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into the Torah and created the world.

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and, as such, it can never contradict Torah.

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the confluence of Torah and Science.

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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 Psychological Ramifications of Torah Education and the Jewish Child

by Sara Kogan

After Jewish couples get married it is expected that one day they will experience the joy of having children. Children are both the greatest blessing and the hardest job in life. As parents it is their job to take responsibility for their own children. Although it is recognized that both parents play critical roles in the education of the child, this article focuses on the unique role of the mother. After giving birth to a child it is primarily the mother who has the responsibilities of feeding her child, of teaching her child about Judaism, and of raising the child to behave like a Torah-Jew.¹

Rav Sternbuch² cited the sentence, “This is what you shall say to the House of Yaakov and tell *Bnei Yisrael*” (*Shemot* 19:3), as a reference to the greater significance that G-d attached to Jewish women, rather than to men, as the educators of the children. In the above noted verse, Moshe, was preparing the people to receive the Torah. The phrase, “House of Yaakov,” which is noted first in the verse, refers to the Jewish women, whereas “*Bnei Yisrael*” refers to the Jewish men. Moshe, instructed by G-d to speak initially to the women, asked whether they would accept the Torah. As Jewish women are the foundation of the home and are the prime educators of the children, the propagation of the Torah was dependent on them. This idea was echoed by Rav Reisman.³ Whereas the father is obligated to instruct the children in the observance of the *mitzvot* (i.e., the so-called “mechanical” aspect of education), it is the mother who influences the children to want to do the *mitzvot* and to appreciate Torah values. The mother provides the child with the moral basis in which Torah *mitzvot* root, grow and flourish.

The interaction between mother and child begins during pregnancy. Some women cannot realize how active a fetus can be. By the third trimester the fetus does almost everything a newborn baby does. It explores its environment by sucking its thumb, tugs on the umbilical cord,

and walks around the womb by pushing off with its feet. The pregnant mother may experience a sharp, repetitive twinges due to the breathing movements which the fetus practices. In the last trimester of pregnancy the fetus starts to turn and kick as much as fifty times per hour. At other times, the fetus seems to be quietly awake as it is listening to something else.⁴

Once the mother has given birth to her child, she often wonders, when she speaks to her newborn, if the baby can really hear her. Although children’s hearing improves up to the age of adolescence, the newborns’ auditory acuity is actually better than their visual acuity. Researchers have suggested that within the general range of pitch and loudness of the human voice, newborns hear nearly as well as do adults. As they have somewhat more difficulty with high-pitch sounds, such a sound needs to be louder for the newborn to hear it. Another basic skill that accompanies birth, but improves with age, is the ability to determine location of sounds. Because there is a separation from one ear to another, sound waves arrive slightly earlier in one ear than the other. This differential reception allows for one judgement of location. Only if a sound is emitted from a source in the middle of the two ears will the system fail. In this case, the sound waves are detected at the two ears simultaneously. A newborn can judge the location of an emitted sound by turning its head in the direction from where the sound was heard.⁵

It is mentioned in the *Sefer HaChinnuch*, Parshat Bo, Chapter 16: “...And now, my son, if you have understanding hear this: incline your ear and hearken. I will teach you Torah and the percepts for your benefit.” The *Sefer HaChinnuch* noted that it is important for the mother to teach the child about Judaism. She does this by singing songs about Jewish holidays and by playing Jewish music. It is the mother who is the first educator to teach the child the “ropes” of being a Jew. The impact on “Jewish sounds” on the developing infant is illustrated in the following story noted in the Jerusalem Talmud, *Yevamot* (1:6). The mother of Rabbi Joshua placed his carriage by the *Bait Midrash*, so that, even as an infant, he would hear and hopefully absorb the words of Torah. On this story, Rav A.

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Twerski and U. Schwartz⁶ commented that although the mother obviously realized that her infant could not understand the sounds he heard, her intention was that his sensitive, young mind would be imprinted with the sounds of Torah learning.

J.W. Santrock⁷ noted that if the mother or father talks or plays music to the fetus while still in its mother's womb, it would have a preference to the same music and stories after it is born. The fetus can hear sounds in the last few months of pregnancy. If the mother or father reads stories aloud about the Sabbath and play Jewish-oriented songs, then when the child gets older it may be prone to stay on the religious path. This interaction with the infant is actually the parents' first attempt to educate the child about Judaism.

Some people believe that playing certain types of music near a mother's abdomen may boost the baby's IQ. However, this can even be harmful as sound waves are conducted through amniotic fluid and the volume of the music may be uncomfortable to the fetus, causing it to urinate. People also think that playing classical music during pregnancy is better than playing rock music. It is not the type of music that is important, but whether it makes the mother comfortable. Although researchers have noted that when a fetus listens to classical music it becomes quiet, this may result from the relaxed state of the mother who transmits this feeling to the fetus. Other women have reported that their fetuses became very active during loud music, which could reflect the excitement in the mother.⁴

Babies are born with four tastes, bitter, sweet, sour and salty, and with the ability to identify body odors. From the moment of birth the child can recognize its mother by her smell. The perceptual skills of newborns are a great deal better than most parents realize and possibly even better than that recognized by physicians. As more technology is developed, the more we can understand just how skillful a newborn baby really is. Santrock⁷ discussed the different sensory tools a child uses to recognize its mother. Human milk is the baby's source of nutrients and energy. Breast-feeding provides milk that is digestible and immunizes the newborn against disease. According to H. Bee⁵, it is clear that breast-feeding, from a nutritional viewpoint, is substantially superior to bottle-feeding. Women who find it difficult to breast-feed their child may take some comfort from research that has indicated that babies derive protection from as little as one breast-feeding a day. Research has

also shown that babies who are bottle-fed do not psychologically suffer from the lack of such personal social interactions between the mother and child. Bottle-fed babies are cared with the same maternal love as breast-fed babies. Whether or not the baby is breast-fed or bottle-fed, the infant has a built in radar to differentiate between the biological mother and a wet-nurse. A.J. Flashman⁸ noted the importance of the baby's visual recognition of its mother, as was mentioned in Talmud *Ketubot* (59b-60a). The mother-infant dyad is recognized by the baby's capacity to form a discernable visual contact with its mother. Visual interaction between the infant and the mother may begin within the first month of life. For example, an infant as early as two to three weeks of age exhibits distress when its mother presents an unresponsive blank stare.

Flashman supported Santrock's position that a baby can detect and recognize who is feeding it. The child's initial recognition of its mother that reinforces the point that it is the mother who must assume the role of the primary educator in Judaism. Flashman noted that the child is more responsive to its mother's nurturing than to an outside influence. Perhaps this is why a child follows the religion of its mother.⁸

This special bond between the Jewish mother and her child can be traced to the *Chumash*. Spiritual purity can be transmitted to the child even in the most physical ways. For instance, when a G-d fearing, Torah-observant woman breast-feeds her baby, she provides

her baby with spiritual, as well as physical, nourishment. *The Weekly Midrash*, a commentary of Rashi on *Shemot*, discussed the incident of Pharaoh's daughter pulling Moshe out from the river. Moshe's sister, Miriam, had prophesied that her mother would give birth to a son destined to lead *Bnei Yisrael* out of Egypt. Pharaoh's daughter requested many Egyptian wet-nurses to attempt to nurse Moshe. However, Moshe would not take nourishment from them. Moshe, who was destined to speak to G-d, would not take the non-kosher milk from an idol worshipper.⁹ Rashi's¹⁰ explanation for Moshe's refusal was that non-kosher food was consumed by the gentile women. Moshe, who was destined to speak to G-d, needed the spiritual basis of kosher food. Miriam, who followed Moshe down the river, ran to Pharaoh's daughter and suggested that a Jewish woman be brought to nurse the infant. Knowing that Moshe was a Jewish child, the daughter of Pharaoh agreed. Miriam brought Moshe's mother, Yocheved, who not only nursed Moshe, but also was the one who educated and nourished him in Judaism

The mother provides the child with the moral basis in which Torah mitzvot root, grow and flourish.

during the most impressionable years of his life.

This story shows that from the moment of birth a child is most impressionable to things around it and to the different influences of its mother. From the time the child wakes up in the morning to say *brachot* to the time the child recites *Shema* at night, it is the mother who teaches the child how to be a Jew. The mother is the most important educator in an infant's life and continues to teach the child about Judaism throughout adulthood. This idea was expressed by the *Baal Hagada* in "...As for the son who does not know how to ask, you must begin the conversation with him, as it is stated in the Torah, 'and you shall relate to your child on that day saying, 'It is because of this that G-d acted for me when I came out of Egypt' (*Shemot* 13:8).¹¹

In the cited phrase above the Hebrew word "you" is written in the feminine, not masculine, gender. It is the mother's soft and gentle voice that best relates to the child to do the *mitzvot* G-d commanded. It is her voice that encourages her child to continue doing *mitzvot* throughout life. The word "you" in the Hebrew text is composed of two letters. The first letter is *aleph*, which is also the first letter of the Hebrew alphabet. The second letter, *taf*, is the last letter of the alphabet. By using the feminine form of "you", the *Baal Hagada* noted that the mother is

responsible for teaching her child all the concepts of Torah, from *aleph* to *taf*. Perhaps we can surmise that the *Baal Hagada* was comparing the education of a child to Yocheved and her early nurturing and educating of Moshe. We can understand the importance of the modern mother and how to follow the example of Yocheved. This idea was succinctly and beautifully stated by Rav S.R. Hirsch in "The Jewish Women," cited by Rappaport:¹² "On the women of the House of Israel, the mothers of the Jewish people, rests the obligation to take upon themselves the role of education. It is the mother who saves and encourages the spirit and soul of Israel and provides the spiritual preparation for continuing its existence"... "It is she, [the Jewish mother], who educates her sons and daughters to the great and important role common to us all: to be a perfectly faithful Jew."

It is important that the child is educated to be a Torah-Jew during the most critical stages of life. If the child is not properly educated from the moment of birth about its historical background, then the parents will have greater difficulty later explaining the concepts of Judaism and other important morals and values in life, when the child has already received foreign ideas and concepts from outside influences. **DH**

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Teaching Science to the Torah-Observant Student

by H. Babich, Ph.D.

Graduation from an educational institution entails the successful completion of a more-or-less prescribed regimen of course work. As students have varied interests, aptitudes, and career goals, each course does not evoke equivalent intellectual stimulation and appeal. An instructional approach available to the teacher to enliven a “required” course (i.e., a course that the student may perceive as irrelevant) is to focus on existing strengths within the students. When teaching in an Orthodox Jewish educational system it can be assumed that the student body has a working knowledge of the basics of Tanach, Talmud, and Halacha. In teaching a secular course in such an institution, the course can better “hit-home” if, when presenting illustrative examples of a particular topic, the instructor presents topics gleaned from the Torah. For students educated and trained in yeshivas or Orthodox Jewish day schools, the incorporation of Torah-derived illustrative examples into science lectures can make the course material more interesting. The more relevant the subject matter is to the class, the better it will be transmitted to and absorbed by that class. The wealth of available Torah material, i.e., especially if one includes Tanach, Talmud, and Halacha, makes it relatively simple to include some relevant point into any area in biology.

The intent of this article is to demonstrate how a lecture in general biology can be modified to include information that would be of interest to an Orthodox Jewish student body. For demonstrative purposes, this manuscript focuses on the digestive system in human beings; however, any other topic in biology could have been substituted, with equal success. The format of this manuscript is to initially present a specific aspect of the digestive process and then mention a related Torah thought or illustrative example. It is not suggested that a secular course, in which a defined amount of material must be covered in a limited amount of class time, include all the Torah thoughts/illustrations presented herein. However, it is

meant to demonstrate that there is sufficient information in Orthodox Jewish religious literature, especially when all of Tanach, Talmud, and Halacha are available for referencing, to enhance any aspect of a given topic in biology.

Digestion is the process whereby ingested food is physically and chemically broken down to molecules of a size small enough to be absorbed by the body. The digestive tract is visualized as a tube that passes through the body. This tube consists of the following components and in the following sequence: mouth → pharynx → esophagus → stomach → small intestine → large intestine. The salivary glands, liver, gall bladder, and pancreas are accessory organs that play a role in digestion.

Digestion begins in the mouth with the physical breakdown of the ingested food by the teeth. An adult has 32 teeth; the morphology of a tooth is related to its specific function. The chisel-shaped front teeth, termed incisors, are involved in cutting and biting. Next is the canine, a long, pointed tooth involved in tearing; in carnivorous animals the canine is termed the fang. Back further are the fairly flattened premolars and then the well-flattened molars, involved in grinding and crushing, respectively.¹ Distinctions in morphologies and functions among teeth were noted in the Talmud. In discussing the characteristics of a “clean” (i.e., kosher for consumption) animal, the Rabbis observed that all ruminants, except the adult camel, lack upper incisor and canine teeth. The “clean animals” are herbivores and have flattened teeth for grinding and crushing vegetation. (Tractate *Chullin* 59a). Human teeth are referred to in several places in the Talmud. The loss of molars and premolars with advancing age (Tractate *Shabbat* 152a), toothaches (Tractate *Shabbat* 111a), gum disorders (Tractate *Avoda Zara* 28a), and oral hygiene (i.e., cleaning teeth with a twig, forerunner of the toothpick (Yerushalmi, *D'mai* 3, 2)) are but a few citations. Several articles reviewing teeth in the Talmud are available.²⁻⁶

Three pairs of salivary glands release saliva into the mouth. Chemically, saliva consists of water in which are dissolved inorganic salts, mucus, blood proteins, urea, lysozyme, and the enzyme, salivary amylase. Saliva also contains the enzyme, lingual lipase, which is secreted by

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glands in the tongue. The functions of saliva are many. It moistens, lubricates and dissolves food for passage down the esophagus; its mucus holds food particles together; salivary amylase initiates the chemical breakdown of starch, a polysaccharide, to maltose, a disaccharide; lingual lipase starts the chemical digestion of dietary triglycerides (fats) into fatty acids and monoglycerides; and lysozyme is a chemical with antibacterial properties.¹

Chazal have noted several of the above-mentioned properties of saliva. For example, the lubricating ability of saliva was noted in *Shemot Rabbah* (24:1). "If a man ate bread as it is, it would go down into his digestive tract and scratch him, but HaShem created a well in the throat which conducts the bread safely down." The digestion of carbohydrates in the mouth may be hinted in *Bamidbar Rabbah* (18:22), which noted that "the water of the mouth is sweet." The therapeutic efficacy of applying spit to cure an eye infection is noted in the Talmud (Tractate *Bava Batra* 126b; Tractate *Shabbat* 108b). The medicinal value of saliva may be related to lysozyme, an antibacterial agent that inhibits cell wall synthesis, thereby promoting osmotic lysis of bacterial cells. Preuss⁷ however, attributed the antibacterial property of saliva to potassium sulfocyanide, which is most abundant in the saliva of a fasting person.

The reasons presented to explain the six hour time interval that the vast majority of Jews wait between eating meat and milk is related to the enzymes in saliva and to the extracellular enzymes produced by the indigenous oral microbiota. According to Rashi, meat leaves a fatty residue in the palate and throat for a period of six hours. Apparently, during this six hour time interval, lipases, derived from glands in the tongue and from bacteria in the mouth, hydrolyze the meat-derived lipids. According to the Rambam, the emphasis is on meat particles that remain lodged between the teeth. Presumably, after a six hour period such meat particles have decomposed to such an extent that they no longer are considered meat. Here, the emphasis is on the microbial decomposition of meat, which may be enhanced by chemical components in saliva.⁸

The tongue, in addition to having nerve receptors for the detection of touch, temperature, and taste, is a muscular organ and is involved in mashing the softer food particles and in guiding the food particles between the upper and lower teeth. Most references to the tongue in the

Tanach and Talmud focus on speech, specifically on speaking slander and talebearing.⁹ For example, in *Tehillim* (120:4) it is stated: "You (the tongue) are like the sharp arrows of the mighty." The tongue is compared to an arrow, as just as an arrow inflicts damage far from its source, so does the tongue spread slander, attacking its victim at a distance (*Bereishit Rabbah* 98:19). The location of the taste buds only on the tongue has an impact on *halacha*. At the *Pesach seder* there is a *mitzvah* to both taste and eat *maror*, but only to eat *matzah*. One cannot fulfill the *mitzvah* of *maror* by ingesting it in a manner that bypasses the tongue and thereby eliminates experiencing its bitter taste. Conversely, one can fulfill the *mitzvah* of eating *matzah* by swallowing it, even without tasting it (Tractate *Pesachim* 115b).

The tongue is important in the swallowing reflex, that is, the process by which the ingested food (now, termed bolus or a ball of liquids and solid food) is propelled down the esophagus at the same time other pathways of exit (nostrils, mouth, and respiratory tract) are closed. The muscular tongue moves the bolus to the pharynx (throat), in which are embedded nerve receptors that respond to pressure. When the bolus contacts these pressure receptors, the muscles of the pharynx contract and force the bolus into the esophagus. As part of this reflex action, the tongue moves up against the hard palate to prevent exit of the bolus through the mouth, the soft palate is raised to prevent the bolus from entering the nasal cavities; and the larynx (or voice box; the beginning of the respiratory tract) is raised so that its opening, the glottis, is now covered by a flap, termed the epiglottis.¹

The swallowing reflex is mentioned several times in the Talmud. The practical health advice of not talking while eating, so that the ingested food does not enter the respiratory tract and cause choking, is noted in Tractate *Ta'anit* (5b). Rabbi Yochanun stated that "one should not talk during a meal lest one's windpipe (trachea) precedes the esophagus" in receiving the ingested food, "thereby leading to danger." Other references to the swallowing reflex are noted with regard to *Pesach*. In Tractate *Pesachim* (108a) the "reclining" requirement during the *Pesach seder* is discussed. As noted in the Talmud, neither lying on one's back nor reclining on the right side constitute "reclining" and, furthermore, both are considered to be health hazards with regards to eating. As stated by

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Rashi, when lying on one's back the neck is stretched backward, causing the epiglottis to fold back and expose the glottis of the larynx, itself which is thrust forward, thereby allowing food to enter the respiratory tract. The Rashbam suggested that eating while reclining on one's right (but, not on one's left) is also hazardous, as it may result in food entering the respiratory tract.¹⁰

Once in the esophagus, rhythmic peristaltic contractions of the smooth muscles of the esophagus gradually move the bolus towards the stomach. To aid in the movement of the bolus, the innermost layer of the esophagus, consisting of epithelial tissue, secretes a slippery mucus. In discussing the laws of a "clean" versus a "trefah" animal, the differential tissue composition of the esophagus was noted in Tractate *Chullin* (43a). "Rabbah said, the esophagus has two coats, the outer red and the inner white." Further on that page, Rav Ashi noted that the esophagus, being a muscular tissue, contracts and expands when the animal eats or bellows.

The muscular wavelike contractions of the esophagus eventually transport the bolus to the stomach. The stomach is a muscular sac that also undergoes wave-like contractions to macerate the food and to mix the food with the secretions of the stomach. Cells lining the stomach secrete the gastric juices, which consist of hydrochloric acid, pepsinogen and mucus. Hydrochloric acid creates an acidic environment in the stomach (about pH 2). This low pH has the following functions: (a) it kills bacteria and other microbes that were ingested with the food; (b) it denatures and softens proteins, especially tough meat fibers; and (c) it activates pepsinogen to pepsin, an enzyme that starts the digestion of proteins. The partially digested material in the stomach is now termed acid chyme.¹

The focus of the stomach is on the digestion of proteins, in particular, meat proteins. The *Kohanim* serving in the Temple often suffered stomach ailments. One reason, presumably, was their steady diet of large quantities of sacrificial meat. Although the *Kohanim* could cook these meats as they preferred, they were often under pressure to consume certain sacrificial meats within specific time frames (i.e., within the same day as the sacrifice) and within restricted locations, such as the Temple courtyard

(*Shekalim* 5:1). Adding to the difficulties of a high meat diet was the prohibition of drinking wine within the Temple environs. Certain wines facilitate the digestion of meats; in Tractate *Berachot* (51a) it is noted that aged wine was beneficial for the intestines. Wine, apparently, stimulates the secretion of the gastric juices, thereby promoting digestion. Because of the digestive disorders experienced by the *Kohanim*, Ben Achiyah, the "resident gastroenterologist," prescribed herbal medicines to alleviate their ailments.¹¹

From the stomach the acid chyme is transported to the intestines, first the small intestine and then the large intestine. The initial portion of the small intestine, the duodenum, receives bile and pancreatic juices. Bile, which functions in the emulsification of fats, is produced in the liver and stored in the gall bladder until needed.

The pancreatic juices contain bicarbonate, which buffers the intestine from the acidity of the chyme, and pancreatic enzymes needed for the chemical digestion of the food. In addition, the cells lining the small intestine produce enzymes for the final chemical digestion of the foods. Once chemically digested to their smallest subunits, the nutrients pass through the cells lining the small intestine and enter into the blood stream. The large intestine functions in the absorption into the blood stream of water and vitamins. The undigestible material remaining in the large intestine is termed feces. This fecal

material is transported and stored in the rectum, the last 10 inches of the large intestine, until elimination from the body.¹

In *Beha'alotecha* it is noted that *B'nei Yisrael* both craved meat and downplayed the *manna*. "But now, our life is parched, there is nothing; we have nothing to anticipate but *manna* (*Bamidbar* 11:6). The Sifrei explained that as the *manna* was a supernatural food from HaShem, it was totally absorbed in the digestive system; fecal material was not produced. To quote from the Sifre, "They said, 'The *manna* is going to burst in our bellies and kill us. Is there a creature born of woman who does not excrete what it eats, while we do not excrete at all?'" It was asked of Rabbi Simeon, If so, how do you explain the verse (*Devarim* 23:14), 'And you shall have a paddle with weapons' for burying excrement? He said to them, "What

The reasons presented to explain the six hour time interval that the vast majority of Jews wait between eating meat and milk is related to the enzymes in saliva and to the extracellular enzymes produced by the indigenous oral microbiota.

is excreted by them is what the merchants of the nations of the world sell to them, but *manna* was never excreted, as it is said, 'Man ate of the bread of the angels' (*Tehellim* 75:25), bread that is absorbed in the limbs."

Choli me'ayim, or intestinal disorders, and their remedies are mentioned throughout the Talmud (Tractates *Erubin* 41b, 54a; *Shabbat* 11a, 134a; *Sotah* 42b). Furthermore, a reference to rectal cancer may be noted in Tanach. In *Divrei HaYamim* II (21:14-19), Eliyahu conveyed the following threat to King Yehoram. "Behold, HaShem will strike mightily against your people and your children and your wives and all your substance. And you shall have a great sickness - a disease of your bowels, until your bowels fall out from the sickness days upon days." The king was eventually smote with this ailment and "his bowels fell out because of his sickness." Preuss⁷ speculated that this 40-year old king was plagued with rectal cancer, from which pieces broke off from time to time.

Fecal material that is formed in the large intestine consists of undigestible food products (e.g., cellulose) and enteric bacteria. Hygienic practices concerning defecation were noted in the Talmud. Rav Achai said, "If a person holds back his bodily functions," i.e., if he resists his body's strong urge to urinate or defecate, "he thereby transgresses the commandment (*Vayikra* 20:25), 'Do not make yourselves abominable'" (Tractate *Makkot* 16b). Bar Kappara said, "When you are hungry, eat at once; when you are thirsty, drink at once; when your pot is boiling (i.e., when you need to defecate), empty it (i.e., feces) out" (Tractate *Berachot* 62b). Interestingly, this advice is in

accord with concepts of cancer prevention. It is now known that chemical carcinogens are ingested with our foods (e.g., some pesticides) and are produced by metabolic activities of enteric anaerobic bacteria. As such, these chemical carcinogens are part of the fecal material; the shorter their residence time in the intestines, the lesser their potential to interact with intestinal cells and to initiate the formation of tumor.

Thus, it can be seen that there are many Torah-related thoughts/examples that can be incorporated into lectures on the human digestive system. As noted previously, this science/Torah interaction is not limited to discussions on the digestive system. There are a variety of sources in English that are suitable for the science instructor interested in incorporating Torah concepts/illustrative examples into lectures on human physiology.

The books by Rosner^{8, 12} are probably the most informative and that by Finkel⁹ can be used to generate ideas. In addition review articles are available on the following topics: nutrition,^{13, 14} the liver,¹⁵ the spleen,¹⁶ the heart,¹⁷ the kidney,^{18,19} the skeletal,²⁰ reproductive,^{21, 22} and neurological systems,²³ pathology,²⁴ diseases (spiritual - i.e., *tzaraat*;²⁵ genetic - i.e., hemophilia;²⁶ physiological - e.g., gout,²⁷ jaundice,¹⁵ and scurvy²⁸; microbial and viral - e.g., rabies,²⁹ epidemics,³⁰ and communicable diseases;³¹ allergic;³² neurological - e.g., *kordiakos*³³ and epilepsy;³⁴ and psychological³⁵). As noted by Domb,³⁶ the life of a committed Torah Jew does not have to be compartmentalized into its Torah or scientific sections; a harmonious synthesis is feasible. **DH**

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Good Things Come in Small Packages

by Tova Bodoff

After Yaakov worked for Lavan for seven years, he married Leah, and one week later he married Rachel. At this point, the Torah states that Leah conceived and bore a son, Reuven: “*VaYar Hashem ki s’nuah Leah VaYiftach es rachmah ViRachel akarah VaTahar VaTeled ben VaTikrah shemo Reuven.*” (Parshas VaYetzeh, Perek 29, pasuk 32). “And Hashem saw that Leah was hated and He opened up her womb, and Rachel was barren; and Leah conceived and bore a son, and she called him Reuven.”

Rabeinu Bachya comments that in connection with the births of all the *shvatim* except Binyamin, the Torah uses the phrase “*VaTahar VaTeled.*” This terminology indicates the swiftness with which the births took place. All the *shvatim* (except Binyamin) were born in the second set of seven years that Yaakov worked for Lavan. Eleven *shvatim* and Dina were born in those 84 months, allowing each child a gestation period of only seven months. The Beur HaGra explains that each child was born immediately after the other - i.e., there was no break between the pregnancies.

Two questions can be asked on the words of the Rabeinu Bachya. Firstly, he states that the phrase “*VaTahar VaTeled*” was mentioned in connection with all the *shvatim* and so therefore a swiftness in birth took place. However, when Zilpah gave birth, it only says *VaTeled!*? The *Chachamim* explain that Zilpah was very young and so her pregnancy was in itself a *nes*.

Another question is why Rabeinu Bachya felt compelled to explain the pregnancies in this way. If they were all born from one mother, then the reasoning of Rabeinu Bachya could be understood. However, there were four mothers, so why couldn't the pregnancies overlap, therefore giving each baby a full gestation period? Indeed, the Midrash Lekach Tov explains the births of the *shvatim* as simultaneous events. The Midrash explains that Reuven was born in the first year. In the second year, Leah became pregnant with Shimon. At this point, Rachel became jealous of Leah and gave Bilha to Yaakov as a wife. Bilha con-

ceived and bore Dan and so both Shimon and Dan were born in the second year. In the third year, Levi was born to Leah and Naftali to Bilha. In the fourth year, Leah gave birth to Yehuda, then temporarily stopped conceiving, and gave Zilpah to Yaakov as a wife. Zilpah conceived, but Leah also conceived so that Gad and Yisachar were born in the fifth year. In the sixth year, Zevulun and Asher were born and finally, in the seventh year, Yosef and Dina were born.

However, just examining the simple flow of the *pesukim* seems to support Rabeinu Bachya's approach that the pregnancies were in sequence and not simultaneous events: First, Leah gave birth to Reuven, Shimon, Levi and Yehuda and then stopped. Rachel was barren at this time and Bilhah and Zilpah were, as yet, not the wives of Yaakov. The next step in the sequence is that Rachel gave Bilhah to Yaakov because she was jealous of Leah, and so Dan and Naftali were born. When Leah saw that she had stopped bearing children, she gave Zilpah to Yaakov and subsequently Gad and Asher were born. The *pasuk* then says, “Hashem listened to Leah” and she gave birth to Yisachar, Zevulun and Dina. Only now does the *pasuk* tell us that “Hashem remembered Rachel and He opened up her womb.” This sequence would indicate no overlapping pregnancies.

Similarly, the Seder Olam Perek 2 agrees with Rabeinu Bachya and states: “*Nimtze'u kol HaShvatim Noldu B'Zayin shanim, chutz MiBinyamin, kol echad v'echad LZayin chodashim.*” “All the *shvatim* were born in seven years, except for B'nyamin, and each one was born after seven months.

Additionally, Pirkei D'Rabi Eliezer explains that not only were the *shvatim* born after seven months, but they were each born with a twin, except for Yosef and Dina. This idea now is expanded to include twenty-two children, all of whom were, according to these Midrashim, born prematurely!

From a biological viewpoint, this idea with its ramifications must be understood. Term gestation is defined as 37 completed weeks of gestation. Therefore, preterm birth is a birth prior to 37 completed weeks of gestation. The *shvatim*, born after seven months, completed a gestation period of only 28 weeks. And yet, preterm infants are at increased

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risk for complications of the respiratory, renal, gastrointestinal, and neurological systems. Preterm labor affects the survival and well being of an infant and is one of the most important risk factors for the occurrence of long term disabilities.¹

Different labels are used to describe infants with less than optimal weight. All babies below 2500 grams (about 5.5 pounds) are described as “low birth weight.” Those infants that are below 1500 grams (about 3.3 pounds) are usually called “very low birth weight.” Low birth weight infants may have lower levels of responsiveness at birth and in the early months of life. They may also be slower in motor development and are more likely to experience respiratory distress in the early weeks.² The American Lung Association states that Respiratory Distress Syndrome occurs primarily in infants born prematurely and is a result of immature lungs. In 1995, prematurity/low birth weight was the second leading cause of infant mortality.³

The mean value of fetal weight at 28 weeks is 1,150 grams with a range of 750-1,700 grams. In contrast, a fetus at a full 36 weeks has a weight ranging from 2,100-3,350 grams. For infants born between 900-999 grams, their percent mortality is 40%.⁴ There is a 60% chance that a child born within this birth weight range will survive. The product rule of probability states that the probability of two independent events occurring simultaneously is the product of each of their individual probabilities.⁵ Thus, the probability that a child born at this birth weight will survive is .60. The probability that all 11 *shvatim* and Dina survived would be $(0.60)^{12}$, giving a probability of 0.22%. If the *shvatim* were born as twins, then the chance of both babies in the set surviving is 0.6×0.6 which is 0.36 or 36%. The probability that 10 sets of twins (all the tribes except Yosef and Binyamin) plus the two single births of Yosef and Dina could survive prematurely is $(0.36)^{10} \times (0.60)^2$ which is .00132%. Even so, these mortality rates for seven month fetuses **overestimate** the mortality rate that the *shvatim* would have been experiencing. There were no hospitals and no incubators to care for premature, low birth-weight babies. In fact, today most

infants born after 34 completed weeks of gestation survive because of the extraordinary advances in neonatal care provided to preterm infants. Some very small infants do survive, provided they receive prolonged intensive care.⁶ Clearly the *shvatim* were not born at a time of such medical advance. What a miracle - the calculated probability of such an event was based on today's medical technology; to account for the primitive medical care of that time period, the probability of so many premature births remaining viable is even less! Despite all these health risks, the *shvatim* were resilient, both mentally and physically. After all, they were the foundation of *Klal Yisrael!*

Perhaps one could argue the case of *Shinui HaTeva*, that nature existed in a different way at the time of the *shvatim*. Maybe it was normal to give birth after seven months, in which case the birth of the *shvatim*, with the explanation of the Midrash, is showing us the general principle, not the exception!? However, as noted with the birth of Moshe Rabbeinu, a nine month term was natural. Moshe was the exception. In *Parshat Sh'mot*, *Perek 2*, *Pasuk 2* and *3*, the Torah states: “*VaTahar Halshah VaTeled Ben... VaTitzpenehu shloshah Yeraichim...ViLo yuchla Ode Hatzpino.*” “And the woman (Yocheved) became pregnant and she gave birth to a boy; and she hid him for three months and then she could no longer hide him.” Rashi explains that the Egyptians began counting the months of Yocheved's pregnancy from the day that Amram returned to her. Yocheved gave birth at six months and one day. This was an “interrupted” pregnancy, it was cut short and so she had three months to conceal Moshe, but after that point, the Egyptians would check for a baby because nine months had passed.

Why Hashem caused the *shvatim* to be born prematurely we may never know. Maybe it was to show that the *shvatim* were always different and separate from everyone else. Or perhaps this miracle was to indicate their incredible strength, both physically and mentally. Perhaps it is a lesson *l'dorot* of the *bitachon* we should have in Hashem. But one thing is certain: it was clearly a critical part in the development of the Jewish people as Hashem's nation. **DH**

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Benefits of Wine Consumption: Spiritual and Scientific Aspects

by Olga Dynina

Rambam in the second chapter of his great work, the Mishne Torah wrote, “How does one come to love and fear G-d? When a person contemplates G-d’s great and awesome deeds and creations, and sees, thereby, His infinite and incomparable wisdom, immediately one is seized with a feeling of love and praise and great longing to know G-d.”¹ Clearly Rambam indicated that the study of the universe could enhance the study of Torah. Rav Moshe D. Tendler based on the above principal wrote, “G-d fashioned us with the spark of divine intelligence that gives us the ability to perceive the order in nature.” He further added that the Torah is similar to modern science because science, like the Jewish religion, is developed and based on the conviction of the existence of orderly nature.² It therefore makes sense to conclude that all the miracles of the Creator which are described in the Torah are based on natural phenomena.

The alliance of Torah and science is seen from the Talmudic passages related to the beneficial effects of wine. As stated in Talmud *Berachot* 36b: “Rava would drink wine on the eve of Passover in order that he might get an appetite and eat much *matza* (in the evening).” The Talmud further explained that “a large quantity of wine sharpens the appetite, a small quantity satiates.” Wine, moreover, has an advantage over bread. Wine does not only nourishes like bread but also it “gladdens the heart” (Talmud *Berachot* 35a). In the Talmud *Pesachim* 42b it is noted, “Aged wine is good for the entire body.” The Talmud Yerushalmi (*Pesachim* 10:37b) warned, however, that one should only drink wine during the meal, as after or before the meal it intoxicates. In *Nedarim* 9:8 the Rabbis pointed out that aged wine is good for the intestines. As noted in *Bereshit Rabbah* 98:2, wine is good for the bones of a person: “the bones of those who drink

water are black, and those who drink wine, are red.” The passage from Chap. 23 of Proverbs indicated that alcohol decreased blood-clotting ability: “excess of alcohol causes spontaneous bleeding.”³ Talmud *Baba Bathra* 58b states, “Someone who drinks with moderation should avoid illness. When one has no wine (in the house) he is forced to use drugs.” Wine not only has beneficial physiological effects on people, it induces psychological benefits as well. For example, it creates euphoria in depressed people. In Proverbs 31: 6-7 it is indicated, “give wine to drink to one with a bitter soul so that he can forget his affliction and not remember his poverty anymore.” Since Jews are commanded to serve the L-rd with “joyfulness, and with gladness of the heart” (Deuteronomy 28:47) the Zohar *Bamidbar* 189b noted “there is no holiness except with wine, there is no blessing, except with wine, in a place where joy dwells.” The Talmud not only advises to drink wine, it condemns those who abstain. Talmud *Pesachim* 109a noted: “There is no joy without wine.” Weindling³ observed that there are many passages in the Talmud expressing that wine does not only make a person happy, but it also sharpens the mind (Talmud *Eiruvim* 65a). It is also stated in *Pesachim* 111b that at low amounts alcohol improves the eyesight. An excess of wine, on the other hand, leads to decline of the vision. “Rabbi Joseph stated that three things cause defective vision: drinking too much wine from the barrel...” is one of them (*Pesachim* 111b).

Modern scientific literature describes many advantages to drinking wine, many of which parallel the benefits described in the Talmud, which was written in 500 CE. For example, a report in a leading scientific journal confirmed a statement Talmud *Berachot* 36b, where wine is noted both to increase and decrease the appetite. The study reported in *Science* 218 (October 29, 1982): 491 stated that in an investigation with rats:

Glucose, when infused at a low rate, one milliliter per minute, produced a decrease in food intake. When glucose was infused at a rate of three milliliters per

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minute, the rats doubled their food intake.²

In the 20th century, wine was been proven to prevent coronary disease and cancer, and to improve mental, bone, and eye health in the elderly. Modern science therefore confirmed the statement in Talmud *Pesachim* 42b that wine is good for entire body.

Let's now look at each health benefit of wine separately. Platelet aggregation contributes to the pathogenesis of thrombosis and ischemic vascular disease, such as myocardial infarction. Development of thrombosis can be prevented by the inclusion of the phenolic compound, trans-resveratrol, in the diet. This chemical, present in red wine, serves as a powerful inhibitor of human platelet aggregation and serotonin secretion. A recent study suggested that the inhibitory effects of trans-resveratrol on clotting are similar to those of aspirin.⁴ Certainly, this research finding is in agreement with the Proverbs' statement that alcohol decreases the blood's clotting ability. Likewise, according to Klatsky,⁵ a researcher in the area of cardiology, coronary artery disease (CAD), which is due to arterosclerotic narrowing of the major coronary arteries, can be reversed by consumption of moderate amounts of wine. Artherosclerotic lesions are characterized by lipid deposits that develop into plaques with soft cores. Thrombosis in narrowed vessels frequently plays a critical role in major pathological events, such as acute myocardial infarction or sudden death. Klatsky's research has shown that moderate drinking, of two or three standard glasses of wine a day, raises the high-density lipid (HDL) cholesterol level. The HDL proportion of blood cholesterol, also known as the "good" cholesterol, is inversely related to the incidence of coronary atherosclerosis. HDL cholesterol operates protectively in CAD by removing lipid deposits in the blood vessels, thereby, preventing the progression of atherosclerosis. According to Klatsky⁶ the presence of alcohol in wine is responsible for elevating the HDL cholesterol level. Furthermore, a study conducted by a group of French researchers, which excluded participants that had pre-existent conditions potentially related to coronary diseases such as hypertension, diabetes, and gout, supported the hypothesis of an inverse relationship between alcohol consumption and risk of coronary diseases.⁷ In addition, Klatsky⁵ observed that moderate and light drinkers over the age of 60 years had the most dramatic decrease in development of coronary disease and mortal-

Wine not only has beneficial physiological effects on people, it induces psychological benefits as well.

ity rate due to heart attack. An independent study conducted in Spain suggested that the increased cerebrovascular disease mortality (CVD) in the southern and eastern Mediterranean coast provinces in 1975-1979 and again in 1989-1993 was presumably due to lower consumption of fruits, wine, and fish.⁸

Now let's look at how wine can prevent cancer formation. According to Jang and Cai⁹ trans-resveratrol has cancer chemopreventive activity. Trans-resveratrol functions mainly by reducing free radical formation in cells and thereby inhibiting the events associated with tumor initiation, promotion, and progression. Trans-resveratrol acts as an antioxidant, antimutagen, and inhibits cyclooxygenase and hydroperoxidase functions, thus preventing the promotion of cancer. Also trans-resveratrol, was found to decrease human promyelocytic leukemia cell differentiation, and to inhibit the development mammary gland cancer lesions in carcinogen-treated mice.

Another beneficial aspect of wine is that it sharpens the mind of the elderly. Indeed, this effect of wine was recorded in the Talmud in 5th century CE and only rediscovered by French scientists 15 centuries latter. Only at the end of 1990s did the French researchers note the inverse relationship between moderate wine drinking and incident dementia. This decrease of mental health deterioration could not be explained by medical, psychological, or socio-familial factors and they concluded that it was moderate alcohol consumption that lowered the incidence of vascular dementia, a mental function deterioration second only to Alzheimer's disease. Furthermore, mild and moderate wine consumption was reported to reduce the deleterious effects on cognition due to reduction of mental activity at old age.¹⁰ The study conducted by Lemenshow¹¹ moreover showed an association between wine consumption and a decrease in Alzheimer's disease. This finding, however, was only applicable to moderate or heavy wine drinkers.

Bereshit Rabbah 98:2 indicated that wine improved the health of the bones. In the end of 20th century scientists finally confirmed this Talmudic statement. The study by Felson and Zhang¹² revealed that alcohol intake increased bone mineral density in elderly men and women. In particular, women who drank...

At least 7 oz per week of alcohol had higher bone densities at most sites (4.2-13.0% range with 7.7% average differences across all sites) than women in the lighter

category of intake (<1 oz). Men who were heavy drinkers (>14 oz per week) also had higher bone densities than light drinkers, but the difference was less than in women (3.9% average across all sites).

The authors concluded that alcohol intake of at least 7 oz per week increased the bone density in postmenopausal women, presumably due to alcohol augmentation of estrogen levels.

In addition to bone strengthening ability, wine was found to improve eyesight in the elderly. A clinical investigation by Obisesan et al.¹³ showed a negative association between wine consumption and age-related macular degeneration (AMD). This was note worthy as AMD is the leading cause of blindness in adults upon the age of 65 years. Since AMD shares its pathological pathways with cardiovascular diseases, the beneficial effects of wine extend to AMD. The progression of heart disease and AMD was lowered by reducing platelet aggregation and decreasing the levels of serum cholesterol due to consumption of alcohol.

Likewise Perry and Wannamethee¹⁴ confirmed the 1500-year-old statement that wine is good for the intestines. Their research revealed a nonlinear relationship between alcohol intake and diabetes. These scientists observed the lowest risk for development of non-insulin dependant diabetes among moderate drinkers relative to the baseline group of occasional drinkers. More evidence continues to emerge revealing that phenolic antioxidants in wine eradicate those food-borne bacteria causing stomach ailments, such as food poisoning, dysentery and diarrhea, and also aid in digestion.¹⁵ A six-year Harvard study of 45,000 men found that consumption of several beverages, including coffee, tea, beer, and wine, reduced the incidence of kidney stone formation, with wine proving 39% more effective than the other drinks. Other studies have shown that two glasses of wine with meals lowers

blood pressure for up to four hours. And light, dry wines, which are low in alcohol, have a diuretic effect that promotes the elimination of salt, urine, and uric acid for those on salt-restricted diet¹⁶.

Moreover, wine has long been noted to improve the mental well-being of people, as has been stated in Proverbs 31:6-7. As recorded by Klatsky, drinking of wine was associated with a decreased perception of pain. In other studies, wine was found to improve the mood of depressed people making them excellent candidates for moderate wine consumption.⁵

Despite the various benefits of wine one has to be cautious not to abuse it. As noted in various Talmudic sources "wine is one of the eight things, which are beneficial in small amounts but harmful in excess."¹⁷ In fact, the premature death of sons of Aaron was caused by their drunkenness while performing the Temple service (*Vayikra Rabbah* 20:9). The consequences of intoxication are exactly opposite those of the positive aspects of wine consumption. For example, psychic after-effects of excess wine, as described in the Talmud, include hallucinations, impairment of vision, the feeling of seasickness, and apathy. Besides psychological problems, modern science also associates with alcoholism various physical ailments, including cirrhosis, liver cancer, and heart disease.⁵ In addition, driving while intoxicated increases the risk of automobile accidents.

According to one midrashic tradition, excess consumption of alcohol and the origin of the first sin were related: the tree of knowledge of good and evil may have been the grape vine, and partaking from this tree for the first time made Adam intoxicated. According to the same tradition, in the messianic era people will enjoy alcohol without fear of becoming addicted to it.³

So L'chaim - drink to your health but be very cautious. **DH**

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Multiple Births: Defining the Miracle

by Jennie Kirschner

One of the most awesome phenomenon of science that remains unresolved is the aspect of multiple births. This occurrence has existed as far back as biblical times and there are still many issues that are a wonder to modern scientists. How can a mother nurture one child during nine months of gestation let alone two, three, and even seven children? This is one of the questions being asked every day by obstetricians, yet it is still unanswered. An even greater puzzle is how women were able to handle these types of pregnancies without the advances of modern technology? Women, such as our Matriarchs, were not privileged to the use of ultrasound and incubators in order to monitor and maintain their children's health, yet their children still survived.

This issue is touched upon in Exodus Chapter 1, Verse 7. As the Jewish people were suffering at the hands of Pharaoh they experienced one of the most amazing miracles of all times. The Jewish nation was multiplying at an unbelievable rate. The Torah uses six different adjectives to describe their multiplication in this verse. "The children of Israel were fruitful. They teemed, increased and became strong - very, very much so." Rashi commented that part of this miracle was that the women gave birth to six children at a time, corresponding to the six adjectives. However, Rav Samson Raphael Hirsch commented that the miracle was not that there were multiple births, but that all fetuses lived to term and were born healthy. It is quite common in the case of births of two children or more for one of the children to be weaker and, very often, not survive. Thus, such a population, in which multifetal pregnancies are common, may not increase or become strong. Yet, the Torah chose specific words to describe the multiplication: "they increased abundantly and were exceedingly strong." The fetuses from these multiple births all lived and were strong. That was the true miracle.

To many, it may seem difficult to fully appreciate Rashi's commentary of six births per pregnancy. It is widely accept-

ed by commentators that the Jewish people increased at a supernatural rate, as proven by statistical analysis. Jacob entered Egypt with seventy people. After a period of 210 years they should have left with about 1,200 to 1,500 people. But the Torah stated that they left with 600,000 people (Exodus 12: 37), which only represented the men between the ages of twenty and sixty years. Adding the older men and the young boys gives a total of about 1,200,000 males. If women are added to the count one can arrive at a minimum of 2,400,000 people. It is quite obvious that this increase was not in a normal manner.

This event, of six births per pregnancy, was expanded upon by Rav Z. Sorotzkin. It is known that there were 600,000 men between the ages of twenty and sixty years including 22,273 firstborn men (Bamidbar 3: 43). While a modern Jewish family has an average of five children, with one firstborn and four others, a family in the desert had approximately one firstborn per fifty-five other siblings. Because 22,273 women gave birth to these male children - one for every firstborn - then each woman must have had fifty five other children after her firstborn. During the time of Moses, the average human life span was between seventy and eighty years, so no woman could become pregnant more than ten times. Therefore, in order to arrive at an average of fifty-five children per every firstborn, each woman must have given birth to six children at a time.¹

The concept of multifetal pregnancies has become quite controversial during recent years. Unique scientific advancements have evoked a spectrum of moral and ethical issues. With the constant improvements in fertility drugs and treatments, many expectant mothers carrying multiple fetuses have turned towards "fetal reduction" in order to reduce the health risks facing their unborn fetuses. Fetal reduction is a procedure that ultimately results in the abortion of the weaker fetuses so that the remaining healthier ones have a better chance at survival and normal development.²

A strong comparison can be made between multifetal pregnancies then and now in order to emphasize the magnitude of the miracle. Women in Egypt carried their children for the full nine month term, as was already commented on. It is a miracle in itself that a woman had suf-

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ficient anatomical space within her to carry six normal, healthy fetuses. An average baby is born at about seven pounds. Multiplied by six, a woman is carrying forty-two pounds of just babies. In addition to the anatomical miracle, it is almost unheard of for six normally sized babies to be born without the use of a Cesarean section. Once born, a mother had to be able to feed six mouths, which miraculously, she was able to do without the invention of either formula or bottles.

In modern times the circumstances for multifetal pregnancies are different. A woman physically cannot carry six fetuses for nine months. She is faced with a choice. She can either go through with a fetal reduction, allowing herself to carry less fetuses for a longer gestation time or have an early delivery via Cesarean section yielding low birth weight babies that have an abnormally high risk of dying. Regardless of the path she chooses, a mother's options seem less hopeful than they would have years ago.

Multifetal pregnancy reduction and selective termination of a fetus with a known medical disorder are distinct events. The intention of the former is to prevent problems that may arise, while the intention of the latter is to simply avoid giving birth to a sick child. Jewish law states that if a mother's life is in danger then the baby is considered a "rodef" (an aggressor) and in such cases the baby's life may be terminated. But, in the case of a multifetal pregnancy in which each fetus is healthy, each fetus is an aggressor and, at the same time, a

victim. So a question exists whether the life of one fetus may be terminated over that of another. Many rabbinic authorities are of the opinion that if by eliminating one fetus the rest will be saved, then this procedure could be considered a "fetal life saver," rather than a fetal reduction, and the procedure should be allowed. All *halachik* authorities agree that the physician should determine exactly how many fetuses should be aborted. But none of these

halachik authorities permit fetal reduction for purposes of convenience or choice.³

The health-related problems associated with multifetal pregnancy and the accompanying issues of fetal reduction emphasize the miracle that occurred to our foremothers in Egypt. Each pregnancy was multifetal, yet somehow the mothers were able to carry and maintain six normal fetuses in a healthy state. Each pregnancy went to its nine month term, yielding six babies of normal weight. Events such as this, occurring today, would undoubtedly require Cesarean deliveries

probably after seven or eight months of pregnancy, yielding low birth weight babies that require their initial development in a hospital incubator. Low birth weight babies account for a disproportionate number in prenatal mortality and morbidity rates.⁴ Thus the event of a multifetal pregnancy, as emphasized by Rav S. R. Hirsch, was that each such pregnancy went to full term and produced six healthy babies; the concept of "fetal reduction" was never an issue. That was the miracle! **DH**

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However, Rav Samson Raphael Hirsch commented that the miracle was not that there were multiple births, but that all fetuses lived to term and were born healthy.

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Twins - or Maybe Not?

In the days before amniocenteses, ultrasounds, and other prenatal diagnostic tests, women had to rely on the grace of G-d for the hope of a healthy child. Unusual complications in the delivery process often resulted in death of the infant and of the mother as well. Women could only hope for an uneventful pregnancy and delivery. Today medical science has progressed and continues to develop, thus giving mother and fetus a better chance of survival. Still, there is much that science cannot cure or prevent. Even in this modern age of science there are cases in which a baby is born with little chance for survival. It goes unsaid that a thousand years ago it was unheard of for a child born under the same condition to live. However, this is exactly what occurred with the sons of Rabbi Chiya.

Webster's New World Dictionary defines "twin" as "either of two born at the same birth."¹ However, this may not necessarily be true. In Gemara *Yevamot* it states, "Yehudah and Chizkiyah were twins. The features of the one were developed at the end of nine months, and those of the other were developed at the beginning of the seventh month."² One twin was born three months before the other!

This statement seems very puzzling. How is it possible for one twin to be born so early, while the other one remained in the womb for another three months? Gemara *Niddah*³ also discusses this amazing phenomenon, and states, "There was an incident in which a child was delayed in being born three months after its twin. And if you have any doubts as to the veracity of this report, behold [those twins] sit before us in the house of study! And who are they? Yehudah and Chizkiyah. The sons of Rav Chiya."

The Gemara continues with the statement that a woman who is already pregnant cannot become pregnant again. So how can this event be explained? Rav Abaye explains, "There was one drop of semen which divided

into two and developed into separate children. One's formation was completed at the beginning of the seventh month, and one's formation was completed at the end of the ninth month."³ Although a sperm can not split to create two embryos, the fertilized egg can. However, that would mean that they were identical twins and shared a common amniotic sac. This seems problematic since they were born at two separate times. It seems more probable that they were fraternal twins with two different amniotic sacs. The scholars of the Gemara were unable to fully know the details of the egg and sperm development. Regardless, the fact remains that though they were born three months apart, both Yehudah and Chizkiyah survived and were healthy.

In the present day, babies born prematurely have a much greater chance at survival than in prior generations. However, science is not always successful. Woolfson et al.⁴ report an incident in which a baby was born fifty-four days after its twin. An ultrasound informed the doctor of a twin pregnancy with two placentas. At 25 weeks of gestation, the mother was admitted with early labor. The doctors attempted to stop the contractions, but the first baby was born as a breech, and died of respiratory distress after only five days. Fifty-three days later, a healthy girl

was born. The authors conclude that "when a patient with a twin pregnancy gives birth to the first baby before viability can be assured there may be a place for conservative management and delay in the delivery of the second twin." The physicians were unable to save the first child, born during the sixth month of pregnancy. The mother remained under hospital care for most of the remainder of the fifty-three days and the doctors were able to save the second child.⁴

Wittmann et al. report four different cases in which twins are born weeks apart, and they review the literature on this topic. In the four cases that they detail, the first baby was born at 18-24 weeks, stillborn, or died soon after. In each case, the second child was born healthy, but often only after preventive measures, such as ending pre-

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mature contractions, were implemented. Wittmann et al. review all reported cases of similar reports of delayed delivery of the second twin and note that it was a very rare occurrence. There have only been seventeen cases reported (excluding the four that they detail) in the period of time from 1880-1988. The delay interval ranged from 5-131 days, with a mean delay interval between births of 50.3 days. Of these cases, some of which involve triplets pregnancies, only seventeen children “were salvaged and were alive and well at the time of reporting.” The first time such a phenomenon was recorded was in 1880. There were only two cases, one in 1953 and one in 1956, in which both fetuses remained alive.⁵ The phenomenon of a delay between twin births is extremely rare, and the survival of both fetuses is much more infrequent.

In light of these studies, the fact that Yehudah and

Chizkiyah were born three months apart is a very rare event. Furthermore, that they both survived and remained healthy can only be described as amazing and as a G-d directed miracle. It is important to note that neither they nor their mother had the advantages of modern science, yet they all survived. This can only be attributed to the grace of G-d. It is a pure and blatant miracle. G-d, for some reason of which we can only guess, wanted these twins to be born three months apart but also to live. Perhaps G-d performed this miracle to show us, the inhabitants of a modern scientific world, that He determines who lives and who dies. If He wants someone to live, even when science indicates that he must die, then that person will still survive. Science is an important aid for our survival, but G-d decides the ultimate result.

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Acknowledgements:

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Biotechnology and the Resurrection

by Bracha Etengoff

Of all Maimonides' thirteen tenets of belief, the last is often regarded as the most supernatural and inscrutable: "I believe with perfect faith that there will be a Resurrection of the Dead at a time which will please the Creator, and His remembrance will endure for all eternity." Throughout the generations, theologians have attempted to explain this tenet through philosophy and biblical exegesis (e.g., the 1842 "*Derush Or ha-Hayim* sermon of R' Israel Lipschitz, author of the "Tiferes Yisrael" commentary on the Mishnah, as cited by Rav Aryeh Kaplan!). Today, our rapidly advancing biological/cloning technology enables us to further strengthen our belief in the "scientific mechanics" of the Resurrection.

A hint of the "scientific mechanics" of Resurrection is evident from the tremendous strides made in biotechnology. Soon, we may be scientifically capable of cloning the dead. Is it ethically and religiously appropriate for human beings to attempt to bring about this miracle? Despite the initial shock and horror one may feel towards the idea, the answer to these questions seems to be in the affirmative. First, let us examine the technological feasibility of this proposal; second, we will advance some of the biblical and talmudic sources relating to the Resurrection.

To answer the question of the scientific feasibility of cloning the dead, a brief review of the most recent major developments in cloning and related biotechnological fields is required. The most famous recent cloning breakthrough was the creation of the sheep named Dolly by Dr. Ian Wilmut and his colleagues, reported on February 22, 1997. Unlike all other reported animal clones before her that survived past the embryonic stages, Dolly's DNA was provided from an adult, not from a fetal, cell.²

Wilmut and his team chose to work with the mammary cells of an adult ewe. They grew 277 individual cells in tissue culture at a reduced concentration of growth serum. In response to this nutritional deficiency, the cells entered the G0 ("pause") stage of the cell cycle, causing their DNA

to reconfigure into an undifferentiated state, similar to that of the DNA of sperm or unfertilized eggs. Next, by application of an electric current, each mammary cell was fused to an enucleated host egg (one whose nucleus had been removed). This electric current also triggered the nucleated egg to begin cell division and embryogenesis, which was allowed to continue for about six days. At that time, the 30 surviving embryos that reached the blastocyte stage were ready for implantation into the uteri of surrogate female sheep. Only Dolly, however, was carried to full term and developed into a healthy lamb.³ Certain issues still remained unresolved, such as whether Dolly's mitochondrial DNA was from her "donor mammary cell mother" or "donor enucleated host egg mother," and whether Dolly will age faster than normal (because she was born with "older" DNA). The issue of Dolly's ability to become sexually mature and active was conclusively settled when Dolly gave birth through natural processes to a healthy lamb, Bonnie, in 1998.³

But "Dolly, it now seems, is more a beginning than an end."⁴ A much less publicized, but nonetheless extremely important step in the development of cloning techniques, was taken by Dr. Wakayama at the University of Hawaii. Instead of sheep, Wakayama cloned mice; instead of fusing the entire donor cell with an egg cell as Wilmut had done, Wakayama succeeded in transferring only a donor nucleus into an enucleated egg, and used a chemical bath as the mitotic stimulus. His reward: A success rate of 2-3 in 100, as opposed to Wilmut's 1 in 277! The cloned mice were able to "mate and give birth, and their DNA was so robust that they themselves could be cloned, and their clones cloned."⁵

A South Korean medical team has already begun the process of applying Wakayama's technique to cloning humans. Dr. Bo-yeon and his colleagues used a tiny needle to transfer a nucleus from a woman's body cell to her enucleated egg cell. They "cultivated the egg" into a four-celled mass, at which point they were required by South Korean scientific agreements to terminate the experiment.⁶

To clone the dead, however, our current techniques would need to be developed a step further: A way would have to be found to clone not from entire (living) cells or

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even entire (living) nuclei, but from DNA molecules remaining in dead cells. Two questions arise at this point: First, could DNA, a “notoriously unstable molecule” in the environment,⁷ remain intact days, years, and even centuries after an organism’s death? Second, assuming that it could, are we able to reproduce enough of the DNA molecules to actually re-create an entire organism?

First, molecular geneticists have already managed to obtain DNA from human remains, “some dating as far back as 2700 years before present.”⁷ Second, such human DNA could be amplified (artificially replicated), using polymerase chain reaction (PCR) techniques. PCR enables scientists to “create millions of copies of a single gene, or any specific piece of DNA, in a test tube.”⁸ Researchers are currently using PCR to amplify possible dinosaur DNA, in a race to develop the first step of “Jurassic Park cloning techniques.”⁷

In view of these many recent biotechnological developments, it seems credible that we may soon be able to clone humans, including those who have died. Yet the ethical/religious concerns remain: Should we even attempt to “force” this promised miracle? Kolata⁴ asserted that “the horror many feel at the thought of cloning a human is intimately tied to our dread of the sin of pride....It would be the ultimate act of pride — of playing G-d — to recreate yourself.” How much more so would we seemingly be “playing G-d” if we attempted His promised Resurrection!

Rabbi Aryeh Kaplan,¹ however, on the basis of numerous biblical and talmudic sources, conjectured that not only would G-d accept our partnership in bringing about the Resurrection, He has perhaps intended it all along! R’ Kaplan cites a kabbalistic “tradition that the Resurrection will take place through the righteous” (Zohar 2:28b, 3:222a). Obviously, our cloning could only reconstruct a body, only G-d could return one’s soul and memories.¹ But does the actual process of cloning a body reflect the process of Resurrection, as is discussed in traditional Jewish sources? To answer this question, a brief overview of some of the sources which R’ Kaplan presents is in order.

First, while the School of Shammai believed that “man will not be formed in the future world as he is in this world,” the School of Hillel asserted that the process of

Resurrection would indeed mimic the normal birth process. Thus, when the Midrash (*Bereshit Rabbah* 28:3) offered Hillel’s opinion, it stated that “[The person’s] formation will begin with skin and flesh, and end with sinews and bones.” The embryonic development process of cloning thus seems to parallel a major Jewish tradition regarding the process of Resurrection.¹

Second, the physical components from which the Resurrection is supposed to be performed bear similarities to the materials needed for cloning. The two main “materials” mentioned in classical sources are the *luz* and the “dew of resurrection.” The *luz* is identified either as a bone [according to some it is “the coccyx, the lowest bone of the spine” (*Avodat ha-Kodesh* 2:40), while the great kabbalist, the Ari, asserted that it is a bone at the back of the skull],⁹ or as the “scoop of dust” that remains after a body’s decay (*Pirkei de-Rabbi Eliezer* 34). The *luz* could be the receptacle that has preserved the DNA necessary for cloning. Additionally, R’ Kaplan’s concept¹⁰ of the dew as a “nutrient fluid,” perhaps containing enzymes such as DNA and RNA polymerases, which could “extract and reassemble the genetic material from human remains,”¹ reminds one of the current PCR techniques mentioned above.

As mentioned, righteous individuals are supposed to help bring about the Resurrection, and they will even “receive Divine inspiration” for their mission (Sotah 9:15; Pesachim 68a).¹⁰ What role could

righteousness and prophecy play in these biotechnological techniques? First, righteous individuals may be the “lab technicians” needed to locate the graves and/or the DNA of those who are to be resurrected. For this, “we have the precedent where the Ari located... graves...through divine inspiration.” The second and more radical idea put forth by Rav Aryeh Kaplan is that righteous people could prophetically supply the genetic code for those whose manner of death destroyed all genetic material, whereupon “seed molecules of DNA could be produced, and these in turn could be built up into a complete set of artificial genes and chromosomes,” after which cloning could take place.¹⁰

Although we do not, as yet, have all the technology necessary to actually clone the dead, we are many steps closer now than we were at the time when R’ Kaplan initially proposed his ideas (which, it should be emphasized,

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he did see as “entirely conjectural.”)¹ At the very least, however, these ideas serve as yet another example of how

in our day and age, science can help us elucidate and strengthen faith in traditional Jewish beliefs. **DH**

Acknowledgements:

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Tumors in Tanach and Talmud

by Alyssa Reisbaum

Having completed his evil task, the destroyer of the *Beit Hamikdash*, Titus, set out on the sea to return to his homeland. Suddenly, a hurricane threatened to drown his ship, but Titus's reaction was, instead of fear, an arrogant sneer addressed to G-d. "It seems to me that the G-d of the Jews has power only in water; He drowned Par'oh in the *Yam Suf*, He drowned Sisera in *Nachal Kishon* and now He threatens to drown me in the Mediterranean! If He is truly Almighty, let Him wage war against me on dry land!" And so He did: with a puny creature G-d tormented Titus. When he landed, a gnat entered his nose and picked at his brain for seven years. Only listening to the hammering of a blacksmith subdued the knocking of the bug, and even that only lasted thirty days, after which the gnat became accustomed to the hammering sound and took up its pounding once more. This continued until Titus's death, at which time Titus's brain was opened up and a strange growth emerged. According to one *b'raita*, it had a sparrow-like appearance, two *selahs* in weight with a beak made of copper and claws of iron, and according to another, which was also quoted in the Midrash,¹ it had the image of a dove and weighed two *litrim*.²

In attempting to understand this cryptic account in the Midrash and make the ancient documentation of Titus's illness comprehensible to the more modern scientific minds, one finds that the incident is not completely explainable. However, if one removes any agenda of detracting from the magnificence of the event or injecting the Torah with ideas in order to solve its mysteries, one may find it feasible to name certain messengers of G-d in modern scientific terms. One may provide himself with a possible explanation of certain events that seem so foreign, while realizing that the small odds of occurrence of his hypothesis is what makes the event so miraculous.

And so, did a gnat actually kill the evil Titus? Perhaps his untimely death was due to his being afflicted with a brain tumor. Such an interpretation of his illness would account for the growth found after his death; the "copper beak" and "claws of iron" were descriptions of the dried

blood and lime deposits present on the tumor.³ Yeshayah Katz attributed a specific type of cancer which may have killed Titus, who was thirty years of age and overtly appeared to be in good physical health. What afflicted him may have been an acoustic neuroma, a tumor of one of the auditory nerves. Although this type of tumor usually affects those in their fifties to sixties, it sometimes occurs in those of a younger age as well. The tumor generally has an oblong shape, is only a few centimeters long (3.5 on average) and has parts colored a yellow-orange, which may have been the "mouth of copper", and might show hemorrhaging, conceivably the "claws of iron" depicted in the Gemara. Its light weight according to the *b'raita* (two *selah*, which is equivalent to about twenty-nine grams) also attests to the scarcity of significant symptoms mentioned. The gemara only suggested the "knocking in his head" as what plagued Titus. Only a tumor with such a small mass could exist with such small symptomatic evidence.⁴

Aside from the close match to the tumor's physical appearance, acoustic neuroma is a conceivable conjecture due to its similarity in manifestation to Titus's condition. Acoustic neuroma establishes its route of infection from the inner ear canal all the way to the fifth and seventh nerves. Due to its location, a commonplace symptom of the tumor is tinnitus, otherwise known as "ringing in the ears," which could have been what was described as the "knocking" in Titus's brain. In addition, the "knocking" was quieted for a short period of time when listening to the banging of a blacksmith's hammer. This fact parallels evidence that in ten to fifteen percent of those who suffer from tinnitus, the method of camouflaging (listening to background noise or music) helps to decrease the ringing in the sufferers' ears.⁴ The "gnat," which in no way actually metamorphosed into the tumor found, could have been a moral analogy for G-d's ability to destroy the mighty with the seemingly insignificant.³ Thus, perhaps G-d took the life of Titus by striking him with what we now know as acoustic neuroma.

The tumor hypothesis is not unique to the case of the evil Titus. Goliath, a giant of "six cubits and a span" in height, armed with a helmet of brass, a coat of mail, a javelin and spear challenged any one man from *B'nei Yisrael* to a one-on-one battle, clearly assuming that he would have the upper hand, no matter who accepted his dare. The

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young David emerged from the camp of terrified Jews without armor, a slingshot and five stones his only weapons. It was no wonder the mighty Philistine laughed when his eyes caught sight of the pint-sized David. However, in a miraculous turn of events, David pierced Goliath's head with one of his stones, knocking him dead.⁵


It seems unlikely that, what to the colossal Goliath was but a tiny pebble, killed him. Precisely that unlikeliness was the miracle of his defeat! Again, if one assumes that G-d performed this miracle "*b'derech hateva*" he may speculate a natural cause for the stone's having a fatal effect. The "natural cause" of Goliath's demise too may have been a tumor.

Acromegaly, caused by hypersecretion of the growth hormone from the pituitary gland (and therefore a common phenomenon in pituitary giants) is manifested by an enlargement of parts of the skeleton. If Goliath indeed had a pituitary adenoma, or tumor, that could very well have caused the elevation and compression of his optic chiasm and obstructed his foramina of Monro. The results of such problems are commonly hydrocephalus (the dilation of the cerebral ventricles which is typically characterized by an enlargement of the head, a prominent forehead, brain atrophy and mental deterioration), increased intracranial pressure and constriction of the visual fields. In a very small percentage of brain adenoma cases, a shearing force applied to the pituitary produces a massive clotting death of the gland's cells, known as infarction. In the story of David and Goliath, one may postulate that Goliath had a pituitary adenoma that caused his enormity. The constriction of his visual fields may have been the reason for, as *pasuk* 42 tells us, "*vayabeit*"-Goliath had to "look about" for David. The buildup of intracranial pressure, and the hydrocephalus stricken by David's stone began an exploding chain reaction of hemorrhagic infarction, followed by compression and hemorrhaging in other areas of the brain, and then a deadly finale.⁶

According to Drs. David and Pauline Rabin, it was not only Goliath's pituitary tumor that killed him, but the many symptoms produced by a body afflicted with Wermer's syndrome, otherwise known as multiple endocrine neoplasia Type 1. The syndrome's defective conditions include tumors of the pituitary and parathyroid glands and the pancreatic

islet of Langerhans. The huge pituitary tumor accounted for his hemianopia (defective vision), the reason for his having to look around for David. As a result of the parathyroid gland's hyperfunction, he developed osteosis fibrosa, a condition in which the bone becomes inflamed and tender. It was this hyperparathyroidism that killed him, since it was through the tumor on Goliath's forehead that David's stone pierced his brain, causing his demise.⁷ Whether one prefers the view of Rabin and Rabin or that of his having only a pituitary adenoma, it is clear that the rarity of the disease, the small percentage of cases that develop and deteriorate as Goliath's did, and the fact that David's stone hit the giant's forehead in just the exact spot, were all clearly the hand of G-d. Remarkably, it was being a giant, which presumably lent Goliath his strength, which turned out to be his Achilles' heel.

Yet another case of cancer in the Tanach may be found in Chronicles II, 21:12-18. The prophet Eliyahu warned King Yehoram, son of Yehoshaphat of a terrible malady that would befall him as punishment for not following the proper Torah ways as set by David his predecessor. Indeed, "... after all this the L-rd smote him in his bowels with an incurable disease. And it came to pass, that in the process of time after the end of two years, his bowels fell out by reason of his sickness, and he died of severe afflictions." Again, the vague term, "severe afflictions," that plagued the forty-year-old king may refer to what in modern times is known as rectal cancer. What "fell out" were broken off pieces of the tumor and finally, at age forty-two, King Yehoram died. Though ancient commentators had considered this sickness to be dysentery, which is marked by inflammation of the intestines and is attended by pain in the abdomen and frequent stools containing blood, the "falling out of bowels" does not occur in dysentery. Thus, the hypothesis that King Yehoram was killed by G-d by being afflicted with cancer seems most credible.³

The ancient incidents of Titus, Goliath, and King Yehoram may indeed have been illnesses known to us as tumors. In finding a modern scientific definition for these cases one is able to see the intricacy in the natural mode in which Hashem performs miracles. Moreover, all eyes are opened to view the miracle in the nature that is beheld each day. 

Acknowledgements:

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Is it Healthy to be Religious?

by Yedida Goldman

When the Rambam set out to describe the logic behind the *mitzvot* in his work *Sefer HaMitzvot*, the arguments he used to explain certain *mitzvot*, specifically when he posited hygienic motives, were met with a lot of opposition. *Mitzvot*, many people felt, should be observed because God commanded them, not because they do or do not make sense to mankind. Once reasons are assigned, suddenly it seems optional to keep the *mitzvot* if those reasons ever become obsolete, or if one does not think them logical. The aim of this article is not to provide a rational basis for keeping the *mitzvot*. Rather, the goal is to show that many of the *mitzvot*, whether they seem to make sense to us on a theoretical level or not, provide an actual health benefit to those who execute them. The *mitzvot* should not, and indeed, cannot, be kept for these reasons, for as Isaac Abravanel writes, "Heaven forbid that I should believe so [that the reasons for the forbidden foods are hygienic]. For if this were so, the Book of God's Law would be in the category of a brief work among medical books..." Nonetheless, many studies have shown that observance of the *mitzvot*, and leading a religious lifestyle in general, has the ability to confer significant health benefits to the people who observe them. It is with the goal of illustrating some of these health benefits that I write this article.

Historically, the *mitzvot* have helped Jews remain significantly healthier than the people around them, especially in times when personal hygiene was an unknown concept, and medicine was essentially more harmful than helpful. During the Black Plague in Europe, for example, practices such as "regimented hand washing, care of the sick, and the immediate burial of the dead"¹ were all contributors to the lower incidence of the epidemic amongst Jews in contrast to the Christian society around them. In the past several hundred years, washing has become standard amongst all classes of society. This is, however, a relatively recent development; washing had previously been despised as a ritual for the masses, and even amongst the poor, at least in the

middle ages, it was believed that germs were carried in the air and water, and so washing and fresh air were avoided. The Talmud in *Sota* 4b, however, declared the exact opposite. "Whoever eats bread without first washing his hands is as though he had sinned with a harlot. Whoever makes light of the washing of his hands will be uprooted from the world. Whoever eats without scouring his hands is as though he eats unclean bread." There are injunctions concerning the vessels used as well, such as "Rinse the cup before drinking and after drinking" (*Tamid* 27b). The religious practice of immersing oneself in the *mikvah* was another form of washing that Jews performed throughout history, ensuring that all married women, and most men, had a full wash at least once a month. To our society which is obsessed with cleanliness, that does not sound particularly hygienic, but at a time when no one washed, a monthly bath might have been the only consistent cleansing that a person would have.

In addition, the prohibition of eating animals that did not chew their cud and did not have split hooves, which essentially excluded pig meat from the Jewish diet, also conferred an important health benefit, due to the existence of the potentially dangerous parasites, known as trichinae, found in hog meat.² Certainly at a time when meat was usually not properly preserved or cooked, Jewish avoidance of pork was often tantamount to the avoidance of serious medical consequences.

The health benefits of the *mitzvot* are not, however, limited to ancient times when modern science had not yet shone the light of truth and wisdom on the world. Even today, and in some sense perhaps more so today, Jewish religious observance can provide significant health benefits. The laws of *shechita*, for example, governing the appropriate slaughter of animals, have usually been rationalized as the most humane way to kill an animal. Dr. David I. Macht, who taught physiology at Yeshiva College in the 1930's and 1940's, has shown that *shechita* actually makes meat healthier for human consumption. "...Blood obtained after severing the large vessels of the throat of warm-blooded animals, small and large, from the mouse to the ox, was less toxic for seedlings of *Lupinus albus*, than that obtained after slaughter of the same species of animals by cerebral concussion,

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decerebration and other injuries to the brain, electrocution and lethal gases, respectively.”² Another law regarding the consumption of meat, the Biblical prohibition of “Thou shalt not seethe a kid in his mother’s milk,” has also been shown by Macht to provide a medical benefit. When meat and milk mixture combinations were injected into animals, as compared with either meat or milk injections by themselves, the mixtures “exhibited a synergistic or potentiated toxicity,”² and in fact, the rabbinical laws permitting such mixtures in concentrations of one part of either milk or meat in sixty parts of the other were the approximate limits of the effective concentrations Macht found harmful.

In addition, the stomach’s optimal level of acidity, at a pH of about 2, is extremely beneficial because at that pH, the acidity effectively kills most bacteria present in meat.³ The parasites present in animal products, as opposed to those found in plants (which are permitted to be consumed with milk), often have the ability to infect humans as well. Milk is alkaline, and thus raises the pH of the stomach, making the gastric juices less acidic, and so, less effective. Presumably, eating milk and meat together would therefore lessen the antimicrobial efficacy of gastric juices, making one more vulnerable to whatever toxins are present in the meat.

The positive injunction to sanctify the Sabbath and holidays on a glass of wine (it has become the predominant practice to use red wine or grape juice), may also have exciting physical advantages.

Researchers at the University of Illinois in Chicago isolated a compound in grapes, known as resveratrol, which, in addition to having conceivable advantages in decreasing coronary heart disease mortality, also seems to possess potentially significant cancer chemopreventive activity. “Resveratrol inhibits cellular events associated with tumor initiation, promotion, and progression.”⁴ Resveratrol is found in at least 72 different plant species, but an unusually high amount is found in grapes, specifically the skins, and thus in red wine and grape juice, although “appreciable amounts are also found in white and rose wines.”⁴ Although the average American would consume some amount of red wine or grape juice over the course of a typical year, for most people it would not be on a consistent, and therefore substantial, basis. It follows that a dietary supplement of grape-derived liquids, which an observant Jew would con-

sume on, at the very least, a weekly basis, has great potential coronary heart disease and cancer inhibiting possibilities.

The religious practice of praying three times a day, while on the surface having no physical benefits, only perhaps psychological ones, has actually been shown by numerous medical studies to convey a wide range of health benefits. A study reported in the *International Journal of Psychiatry in Medicine* (cited in source 5) showed that people who attended religious prayer services at least once a week have lower levels of an immune system protein, interleukin-6, associated with many age-related diseases. According to Dr. Saul Scheidlinger, an emeritus professor of psychiatry at the Albert Einstein College of Medicine, “[due to] the gratification of affiliative needs [social hunger] and the countering

of loneliness and isolation, this group experience helps its members maintain an intergenerational sense of personal identity and of self-esteem. In the face of marked life stressors such as death in the family, religious institutions such as the *minyán*, with its prescribed ritual steps for grieving...fulfill especially significant preventive and restitutive mental health functions.”⁵ Regular attendance at religious services was shown to be linked with healthier old age and better health for those with moderate disabilities in a study published in the *Journal of Gerontology* (cited in source 5). And according to a Yale University study, “elderly people who attend religious services take better care of themselves in the

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sense of several preventive practices...and they tend to have a more positive outlook on life.”⁵ Thus, what seems to most observant Jews as simply a religious ritual clearly has biomedical and psychological advantages as well.

Regarding the women-specific *mitzvot* of *taharat hamishpacha*, researchers have found that they, too, seem to provide surprising health benefits to those women who observe them. Endometriosis, a condition that occurs in 1-3% of women of reproductive age, occurs when endometrial tissue (the outer layer of tissue lining the uterus that is lost during menstruation), is carried backwards, up the oviduct and into the abdominal cavity. The displaced endometrial tissue often attaches itself to organs in the abdominal cavity, where it acts as if it were still in the uterus, building up an outer lining each month along with the uterus, which eventually breaks down, resulting

in a painful and often dangerous condition. Endometriosis frequently also leads to infertility.³ Endometriosis, however, is markedly rare in the observant Jewish community. A study conducted in Israel, demonstrating this low incidence, suggested a possible explanation. Sperm cells are aided in their journey toward the fallopian tubes by peristaltic movements of the uterus directing movement toward the tubes; these uterine contractions move material backwards and potentially, out to the abdominal cavity as well. In addition, there seems to be a significant correlation between endometriosis and uterine contractility. It is possible that the same contractions that help propel the sperm toward the fallopian tubes also cause endometrial tissue to be pushed out of the uterus and into the abdominal cavity.

It may be suggested that during sexual intercourse at or near the time of the menses, the uterine contractions may enhance the migration of endometrial tissue into the pelvis...The ultra-orthodox population served by our hospital obeys the religious laws of the "Mikvah" — ritual immersion. Sexual relations are forbidden between the couple during the menses and for seven days thereafter — in effect during the first 14 days of the cycle..it may be that avoidance of intercourse during those 14 days reduces the risk of viable endometrial cells passing through the fallopian tubes, thereby reducing the incidence of endometriosis.⁶

Regarding general health, in 1987, a group of scientists in Israel published a study in Preventive Medicine, in which they compared the plasma lipid and lipoprotein levels of 17-year old, secular, traditional and observant Jewish residents of Jerusalem.⁷ This study followed one published two years earlier, in The American Journal of Clinical Nutrition, by the same group of researchers, in which a comparison was made between secular, traditional and observant adults in Jerusalem.⁸ The results obtained in both studies were extremely similar. The more recent study, consistent with the previous one, showed that plasma levels of cholesterol, triglyceride, and low-density lipoprotein, were highest in the secular population, lower in the traditional one, and by far the lowest amongst the

orthodox group. These findings were independent of sex, origin, social class, body mass, and time of year, and were statistically significant. Although high-density lipoprotein cholesterol, (the "good" kind of cholesterol), was consistently highest amongst the orthodox group, it was not in statistically significant amounts. It had previously been thought that a child's environment and the parental phenotype were the most powerful predictors of lipid concentrations in children. However, the association of plasma lipids and lipoproteins with religious observance was independent of the parental phenotype and the environment of the children. The study suggested several possibilities for the varying of plasma lipid and lipoprotein levels by religious observance, among them dietary restrictions, lower incidence of smoking, and the "strong cohesiveness and social support" of traditional and orthodox

communities. Although smoking is more prevalent in the traditional and secular population than amongst the orthodox, there is evidence linking social and behavioral factors to blood lipid levels, even after controlling for the effects of smoking.⁸ This same group of researchers also published a study in the International Journal of Cardiology in 1986, where they found that the risk of myocardial infarction for secular men was four times greater than the risk for the orthodox subjects studied.⁹ Again, the precise reasons for the lower risk amongst the observant subjects was

unknown, and the same basic possibilities for the lower risk factor were suggested in this study as in the studies on blood lipid levels:

Psychological factors could play a protective role in religious groups. Orthodox religious Jews are generally characterized by the social cohesiveness and strong social supports of their traditional culture. The extreme religious community is less exposed to cultural change and their way of life is characterized by a traditional orientation generally unchallenged from within the community. There is evidence for a protective role of the traditional cultural background in reducing risk for coronary heart disease even after controlling for risk variables such as smoking, diet, blood pressure and cholesterol levels. There is some evidence for an inverse association of social support with coronary heart disease as well as with total mortality. It is also possible that the strong belief in a Supreme Being and the role of prayer may in themselves be protective.⁹

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Another study conducted in Israel, over a 16-year period, compared the mortality rates of 11 paired religious and secular *kibbutzim* across the country. Without focusing on the aggregate health status of the population, the study simply studied mortality rates in different age groups, divided into ten-year periods, beginning with 35-44 year olds. The *kibbutzim* were matched as closely as possible, agreeing in geographical location, educational level of the population, standard of living and occupation, economic structure, technological superiority and even use of the same medical facilities. *Kibbutzim*, on the whole, are marked by a strong, stable community and an unusually low death rate in comparison with the regular population. Nonetheless, the mortality rate of the religious *kibbutzim* was significantly lower than that of the secular ones. The number of secular subjects studied was somewhat larger than the number of observant subjects (2111 vs. 1777) but the difference in the number of deaths, 192 vs. 69, was substantial in any case.

[The] distinctly lower mortality rate in religious *kibbutzim* [was] evident in both sexes, evident at all ages, and consistent throughout the 16-year period of observation. The lower mortality persisted, with remarkable overall consistency, across the major categories of underlying cause of death. The magnitude of the protective effect associated with membership in a religious *kibbutz* is exemplified by ablation of the usual female mortality advantage: secular women did not live longer than religious men¹⁰.

The study suggested that perhaps religious life is less stressful than secular life, and lower stress levels contribute to lower rates of mortality. Possible reasons for lower stress levels offered by the study include an overall coherent world view and sense of belonging, the relaxation provided by frequent prayer, belief in God and religious heteronomy (so that authority is set by religion and not by each individual), repetitive ritualistic actions that give structure to daily life and reduce ambiguity, higher incidence of marital stability, and the general sense of well-being resulting from living in a cohesive religious community.¹⁰

The explanations offered in this study of *kibbutzim* revolve around the idea that it is not any specific religious ritual or observance that leads to increased health, but rather the general lifestyle of a religious person. The structure of daily life, and the guidelines provided for making choices, both major and minor, endow an observant person with a sense of stability that is often absent in secular life. Apparently, the absence of this leads to an increase of stress, which in turn leads to decreased immunity. Some of the individual *mitzvot* discussed above *do* seem to have specific health benefits, but it seems that it is the observant lifestyle as a whole that has the potential to yield a longer, healthier life. However, as the Abравanel said, *mitzvot* cannot be dismissed as beneficial health practices, and must be kept whether or not they seem to confer physical advantages. Divine law "did not come to heal bodies and promote their physical health but to seek the health of the soul..." and more than physical well being, that is the ultimate goal. **DH**

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Who Wears the Genes: Hemophilia in the Gemara

by Aviva Sussman

Genetics is often associated with modern biology, as this science was started about a 150 years ago by Gregor Mendel. Known as the father of modern genetics, Mendel is noted as the first to understand how genes segregate during gamete formation. He performed experiments with garden pea plants, crossing different purebred strains and their progeny. Mendel observed the crosses for several generations and concluded that traits were controlled by factors which we now call genes.¹

Looking back into Jewish tradition, however, one can see that although the term genetics had not yet been coined, a complex pattern of inheritance concerning genes was recognized at least as far back as Biblical times. In *Beraishit, Parshat Vayeitzei*, Jacob requested that Laban give him all of his pure white sheep and pure black goats. Jacob's intention was to breed the animals and give Laban any pure colored, or monochrome, offspring, while he would keep only the spotted offspring. Laban assumed that most of the offspring would be monochrome. Thus, Jacob would only acquire the small amount that was born spotted.

Surprisingly, after breeding the livestock for several generations, Jacob attained quite a large flock of speckled animals. Y. Feliks, author of *Nature and Man in the Bible*, proposed, "from the Biblical passage [*Beraishit* 31:12] it emerges that the laws of heredity were revealed to Jacob when the angel of G-d, appearing to him, opened his eyes to a comprehension of the subject." Feliks suggests that although all of the animals that Jacob originally acquired were monochrome in their phenotype, their genotypic constitution was either heterozygotic or homozygotic. The heterozygotic animals, or hybrids, exhibited a condition called hybrid vigor, or heterosis, in which the hybrid has more potency (i.e., is stronger) and was able to conceive before the purebred. It was through Jacob's understanding of the laws of heredity that he was able to increase his flocks of spotted sheep and goats.²

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The laws of heredity that Jacob used to increase his flock apply to those genes located on the chromosomes known as autosomes. Human beings possess 23 different pairs of chromosomes. One chromosome from each pair is inherited paternally, and the other is maternally inherited. Humans possess 22 pairs of autosomes, which are common to both of the sexes. One pair of chromosomes differs between the sexes. These are the sex chromosomes. Human females have two X chromosomes — a matched pair, while males have one X and one Y chromosome — an unmatched pair.^{1,4}

When looking at gene control in autosomes, we see that each type of gene is present in duplicate (one gene on each chromosome of a pair). While both genes are present, different allelic forms of the same gene exist. It is possible that one will exhibit stronger phenotypic expression than the other allelic form. This gene is called the dominant gene. In contrast, a recessive allele is that form of a gene that is not expressed when in the presence of its dominant allelic form. If there are two dominant genes present, the dominant trait will be expressed. If there is one dominant and one recessive allelic form of the gene, then the dominant gene will phenotypically be expressed, but the person will be what is called a "carrier" of the other allelic form of the gene. Offspring that inherit two of the recessive alleles will express the recessive phenotypic trait.¹

Even more complex than the basic laws of heredity, are those governing the genes located on the sex chromosomes. In terms of dominance and recessiveness, the sex chromosomes in a human female function much as the autosomes. The genes on the X chromosome are dissimilar from those on the Y chromosome, which itself carries very few genes. Thus, in a male, any gene on the X chromosome will be expressed, even if it is not recessive. Traits controlled by genes on the X chromosome are called sex-linked or X-linked traits. Therefore, a human female may be a carrier of a recessive X-linked disease, yet will be free of the disease, while a human male can not be a carrier and will express the disease even if he inherits only one copy of the recessive gene.¹

Hemophilia is an example of a disease that is X-linked.

This condition, in which the blood lacks a certain protein cofactor, results in the blood not clotting normally upon causal to bleed. A female carrier for hemophilia may pass the disease to her son. Because males can never carry the gene on a Y chromosome, it is impossible for them to pass this disease to their sons.⁴ Amazingly, it appears that the composers of the Babylonian Talmud had an understanding of this sex-linked trait.

This can be seen from Tractate *Yevamot* (64b):

For it was taught: If she circumcised her first child and he died, and a second one who also died, she must not circumcise her third child; so Rabbi R. Simeon b. Gamaliel, however, said: She circumcises her third, but must not circumcise her fourth child...Come and hear what R. Hiyya b. Abba stated in the name of R. Johanan: It once happened with four sisters at Sepphoris that when the first had circumcised her child he died; when the second [circumcised her child] he also died, and when the third [circumcised her child] he also died. The fourth came before R. Simeon b. Gamaliel who told her, "you must not circumcise [the child]." But is it not possible that if the third sister had come he would also have told her the same! If so, what could have been the purpose of the evidence of R. Hiyya b. Abba ... It is possible that he meant to teach us the following: That sisters also establish a presumption.⁸

Interestingly, children from the same mother (possibly having different fathers), and cousins whose mothers are sisters are discussed here. No mention of children from the same father (who may have different mothers) or children of brothers are mentioned. In fact, the role of the father in transmission of the disease does not appear to be an issue. Although there is disagreement as to how many prior babies must die of circumcisional bleeding before exempting the present baby from the *brit milah*, there is agreement that the cause of death is from a disease that was inherited from the mother.⁹ Discussed in Tractate *Shabbat* (134a) are two specific cases regarding *brit milah*, in which both of the older brothers of the child in question died after circumcision:

For it was taught in a *Baraita*: R. Nassan said: Once I

went to visit the sea towns, and a woman came before me who had circumcised her first son and he died, her second son and he died, and she brought her third son before me, seeking guidance. I saw that [the infant] was red, and I told [the woman]: "Wait for him until his blood is absorbed into [his flesh]," and then she circumcised him, and he lived. And they called [the child] Nassan the Babylonian after me.

The same Gemara continues:

On another occasion I traveled to the province of Cappadocia, and one woman came before me who had circumcised her first son and he died, her second son, and he died, and now she brought her third son before me seeking guidance. I saw that [the infant] was yellow. I looked closely at him, and I did not see in him any covenantal blood. I then said to [the mother]: "Wait for him until he is full blooded, and then circumcise your son." And she waited for him until he became full blooded, and then she circumcised him, and he lived. And she called his name Nassan the Babylonian after me.¹⁰

Although the majority of rabbinical sources agree that the condition discussed in this passage of Gemara is hemophilia, there are differing opinions. Translators

have given other names to this condition, such as neonatal thrombocytopenic purpura, newborn erythema, jaundice, and neonatal anemia.

Whether this Gemara refers to hemophilia or to any other condition that jeopardizes a child's life upon circumcision, it was unanimously agreed either that a *brit milah* should be postponed until the child is well enough to undergo the procedure or that it should not be performed at all, depending on the severity of the condition.

With modern technology, a laser beam procedure has been developed which would allow a hemophiliac to undergo circumcision without endangering his life. Dr. Shlomo Walfisch has been carrying out such laser circumcisions in Israel for the past ten years. Most recently, he performed the operation on a two-month old infant suffering from hemophilia.¹¹

The question arises as to whether circumcision by laser is considered halachically suitable. S. and Y. Walfisch explored this issue by evaluating the criteria needed for a

We forget that the answers were always there, but without the help of G-d they could not have been found.

brit milah to be considered acceptable by Jewish law. Their sources included the Rambam's Mishneh Torah and the Minchat Yitzchak. Their conclusion was that healthy children, who would not be at risk for a traditional *brit milah* with a knife, should not be circumcised with a laser. However, when there is danger posed to the child, such as a blood coagulating disorder, laser circumcision may be permissible. Nevertheless, they have noted that this is not meant to be a *halachic psak* and is an issue that is up for debate.¹²

Unarguably, Mendel's experiments with pea plants set

the modern study of genetics into motion. Since then, a great wealth of knowledge in this field has been uncovered, leading to numerous discoveries and advances in biotechnology. Sometimes however, we attribute our findings solely to ourselves. We forget that the answers were always there, but without the help of G-d they could not have been found. Because our ancestors acknowledged this, they were successful in understanding phenomenon that would not be understood by the general population until centuries later. The knew that truly, "there is nothing new under the sun." **DH**

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