

# Noach and the Tayva

## Some Torah, Some Biology

Everyone is familiar with the story of Noach and the tayva. The intent of this article is not to review the entire incident in depth, but to focus on those aspects that have biological overtones. However, for continuity in thought, the entire story is briefly summarized. Furthermore, it is understood that

all the events in the story of the tayva were orchestrated and directed by HaShem. Any mention of a biological explanation for a specific event is not meant to suggest that it occurred by the laws of nature without Divine intervention. As Rabbi David Brown<sup>1</sup> states, "It is recognized that the laws of nature were created by G-d at ma'ase b'royshis and, in effect, represent His will. Even nissim are not completely contrary to the forces of nature. We find that when G-d performs nissim He still works through the mechanisms of nature."

In the year 1056 (2705 B.C.E.) (MeAm Loez, Genesis 7:4) a son was born to Lemech. This boy, named Noach, was unusual from birth. First, Noach was born circumcised (Torah Sheleimah 5:78). This

was the first such birth since the creation of Adam HaRishon. Second, this was the first baby to be born with clearly defined, separated fingers. Up until this period all people had hands with nonseparated (or, webbed) fingers. Noach, known as "the man of the earth," was born with hands suitable for husbandry and tilling the soil (Torah Sheleimah 5:79). He was credited as the inventor of farm tools, such as the plow, scythe, and axe (Torah Sheleimah 5:78). Interestingly, there is a present-day remembrance ("zechar") to the fact that antediluvian man had webbed hands. Today, during early human embryological development, every fetus has webbed fingers. By the process of programmed cell death, or apoptosis, lysosomal activity in the cells comprising the web

cause that tissue to gradually disappear, so that when born, the baby has distinct fingers.<sup>2</sup>

Noach was a righteous person, wholehearted in his generation (Genesis 6:9). In his time, civilization was steeped in sins including idolatry, theft, embezzlement, immorality, and in particular, bestiality. Animals mimicked human sexual misbehavior and interspecific cohabitation between animals was the norm. As noted in B'rayshis Rabbah (28:8) dogs would seek out she-wolves and peacocks would mate with hens. Most commentaries do not mention that such interspecific matings resulted in hybrid offspring. The N'tziv, however, does suggest that interspecific matings between animals resulted in hybrid offspring (HaEmek Davar, Genesis 7:23). Many pre- and post-zygotic isolation mechanisms hinder the formation of hybrid zygotes and it is rare in the animal kingdom that interspecific matings yield viable, strong hybrid offspring. The most notable exceptions are the mule (horse x donkey) and the zebroid (horse x zebra). But, owing to chro-

mosomal differences between the parents, mules and zebroids are sterile.<sup>3</sup>

At the age of 480, in the year 1536 (2225 B.C.E.), Noah was commanded to build a *toyva*. The *toyva* would serve as a refuge for Noah and his family, as well as for selected representatives amongst the animals during the subsequent *mabbul*. The *MeAm Loez* (Genesis 6:9) notes that the task of building the *toyva* took 120 years as, essentially, Noah started from scratch: he planted cedar trees, tended for them, cut them into boards, planed them, and finally constructed the *toyva*. The *toyva* was to house Noah, his wife, their three sons and their wives, and a male and female of each *min* of nonkosher animal and seven pairs of males and females of every kosher *min* of animal. The dimensions of the *toyva* were approximately 180 yards in length, 30 yards in width, and 18 yards in height. The obvious question is how all the animals were able to fit into this limited space. For example, there are over 800,000 species of insects, 35,000 species of spiders, 8,600 species of birds, 6,000 species of reptiles, and 2,200 species of frogs and toads.<sup>4</sup>

The *Ramban* (Genesis 6:19) is troubled by this problem, which is compounded when also considering the large size of specific mammals (such as elephants and giraffes). The *Ramban* concludes that fitting the animals into the *toyva* was itself a miracle.

*Rebbe* Brown<sup>5</sup> has a different and unique theory regarding the numbers of animals brought aboard the *toyva*. Before explaining *Rebbe* Brown's theory, some initial background information is needed. First, whereas a zoologist classifies animals according to phyla, the Torah's classification is simply *behaymos*, *choios*, *shrotzim*, and *dagim*.

There is no correlation between the zoologists' classification and the Torah's classification of animals. For example, the Torah's category *shrotzim* includes insects, reptiles, and some mammals (e.g., weasel and mouse). According to a zoologist, these animals are categorized in three different phyla. Second, the zoologists' terms, genus and species, have no equivalent in Torah terminology. Instead, the Torah uses the term *min* to identify discrete groups of animals. At *mo'ase* *B'rayshis* *HoShem* created distinct *minim*, which, after relatively short time periods, diversified to yield different genera and species. *Rebbe* Brown postulates that Noah took aboard the *toyva* two animals of each *min*, rather than all the varieties that developed from each *min* since *mo'ase* *B'rayshis*. This interpretation fits very well with the verses: "Of all living creatures, of all flesh, two of each you shall bring to the *toyva* to keep alive with you, a male and a female. Of the birds to their *minim*, of the beasts to their *minim*, of all the creepers on the ground to their *minim*, two of each will come to you to maintain life." Based on this interpretation, the number of creatures brought on the *toyva* is greatly reduced. *Rebbe* Brown cites the *sefer*, *Biur HoRadol*, on *Pirkoy d'Robbi Eliezer* which states that there are 365 *minim* of birds, 365 *behaymos* and *choios*, and 365 *minim* of *sh'kotzim*. Apparently, these specific *minim* contained all the necessary genetic information, so that postdiluvian diversification yielded the different genera and species of animals recognized by today's zoologists.

In this *parsha* there is some discussion amongst the commentaries of fossils and of dinosaurs and other giant creatures. One thought, championed by the *Tiferes Yisroel* (in his *sefer*, *Drush*

*Ohr HoChayim*), is that dinosaurs, as well as the other fossilized animals, were not creatures from our world, but lived in some of the prior 974 generations created on this planet. *Rebbe* Brown<sup>6</sup> interprets these "974 generations" as "974 distinct worlds;" this interpretation will be followed throughout this article. These prior worlds were literally and figuratively overturned because of the refusal of their intelligent life forms to accept the Torah. Creatures on any of these prior 974 worlds were distinct and unique and were not descendants from creatures of any other world.<sup>1</sup>

The *N'tziv* and the *Malbim*, however, suggest that dinosaurs were contemporaries of Noah. According to the *N'tziv*, the dinosaurs were the hybrid offspring of interspecies matings, similar to mules (horse x donkey). As these creatures arose from forbidden sexual relationships, they were destroyed in the *mabbul* (*HoEmek Dovor*, Genesis 7:23). The *Malbim* does not mention that dinosaurs and other large creatures resulted from forbidden matings between species, but rather that they were part of the natural fauna in a world that had rich topsoil and an overabundance of food and solar energy (Genesis 7:23; 8:21). To quote from the *Malbim* (Genesis 8:21): "The ground was then still in the days of its youth, very potent and providing for great longevity. It caused creatures to arise that were imbued with immense body strength, powerful and of giant stature. And today, deep within the earth, are being uncovered giant skeletons of these strange colossi who perished during the *mabbul*, leaving no survivors. Creatures that lived for a long time and who, our Sages tell us, could uproot cedars. In comparison with them, lions

and leopards were as small as ants." In ecological terms, the dinosaurs were a natural reflection of the high carrying capacity of the antediluvian environment. An environment can support no more than a certain number of individuals of any particular species. This number, termed the environmental carrying capacity, is determined by the availability of resources – food, energy, shelter – as well as disease, predators, and social interactions.<sup>5</sup> In the antediluvian period, soil productivity and solar energy were in over-abundance and, thus, the environment was capable of sustaining dinosaurs. In the postdiluvian period, HaShem weakened nature by changing the atmosphere, by decreasing the solar radiation which, in turn, reduced primary productivity (i.e., lessened photosynthesis), and by removing the top soil (hence, reducing soil productivity). According to this approach, the dinosaurs were destroyed, not as a result of their being hybrid offspring, but of their being a life form that could no longer be sustained in the new post-mabbul environment.

According to the Tiferes Yisroel's thoughts concerning dinosaurs, radiocarbon dating of their skeletal remains at an age much earlier than the 5,761 years since ma'ase B'rayshis is not problematic. In fact, it is supportive of the 974 worlds that were created prior to our world.<sup>6</sup> An obvious problem exists with the theories of the N'tziv and Malbim, who suggest that dinosaurs were contemporaries of Noah. The most commonly used test to date organic matter is based on the ratio of radioactive carbon 14 (C14) to non-radioactive carbon 12 (C12). This technique assumes that the ratio of C14 to C12 is constant and has not changed over the period for which any particular

object is being dated. C14 is unstable and disintegrates slowly, with a half-life of 5730 years. It is formed in the outer atmosphere surrounding the Earth through nuclear reactions utilizing energy from cosmic radiation. Apparently, cosmic rays form energetic neutrons, which react with nitrogen 14 (N14) in the atmosphere to form C14, which then reacts with oxygen to form carbon dioxide. Most of the carbon dioxide in the biosphere consists of nonradioactive carbon (C12); the total amount of C14 in carbon dioxide is small (less than 1%) compared to C12. Radioactive carbon dioxide along with nonradioactive carbon dioxide distributes itself throughout the Earth's atmosphere and eventually is absorbed by living plants and animals. When an organism dies, it no longer takes in carbon dioxide. Thus, by measuring the amount of C14 relative to the amount of C12 in a formerly living organism, and knowing the decay rate of C14, it is possible to extrapolate back in time, and calculate how many years ago this particular organism lived. Radioactive dating assumes that the intensity of cosmic radiation striking the Earth is uniform all over the Earth and at all times.<sup>7</sup> According to the Malbim and the S'forno, today's radiation strikes the Earth at a different angle from radiation during the antediluvian period. As noted in Genesis [8:22], when HaShem assures Noah that the world will never be destroyed again, it states: "As long as the Earth endures, seedtime and harvest, cold and heat, summer and winter, day and night, they shall not cease."<sup>8</sup> Most commentaries interpret this to mean that prior to the mabbul the Earth was in continual springtime (B'rayshis Rabboh 34: 11); the changes in seasons were a postdiluvian innovation. The four seasons or a

result of the 23° tilt of the Earth as it revolves around the sun. As noted by the Malbim (Genesis 8:22), prior to the mabbul the Earth's ecliptic revolution around the sun was coplanar with the terrestrial equator. Thus, in the antediluvian period the amount of radiation striking the Earth was not similar to that of today's world. Furthermore, many commentaries note other major changes in cosmology immediately before, during and after the mabbul (Midrash Rabboh 34:11; Berachos 59a), Rabbi Brown<sup>9</sup> expands (see pages 146 to 149 in his sefer) the Malbim's theory and lists the many different time periods since ma'ase B'rayshis when the amount of cosmic radiation striking the Earth was modified. The C14 test is reliable to date organic matter if one makes the assumption that the amount of radiation the Earth received in the past was identical to the amount of radiation the Earth receives today. However, if one acknowledges the various cosmological changes noted by Chozal and if these modifications in the relationship of our Earth to the universe resulted in changes in the intensity of cosmic radiation striking the Earth's atmosphere, then the utility of radioisotope techniques to date fossils of dinosaurs is questionable.

The toyva had three floors; the top level in which Noah, his family, and selected animals (i.e., kosher domesticated birds) dwelled; the middle level in which the other animals were housed; and a basement level which functioned as a repository for waste, primarily animal excreta. Noah built a trapdoor in the second level, through which he shoveled the excreta to the third level (B'rayshis Rabboh 31:11). An obvious question is why Noah needed to keep the animal excreta aboard the toyva,

especially since it must have generated a strong odor! Why could not the third level have a built-in trap door to be used as an exit passageway for removal of the foul-smelling excreta? Apparently, keeping the animal refuse must have served a purpose. There are several possible answers. First, Noach, by profession, was a farmer and he understood the dynamics of plant life. Animals play a key role in the dispersal of seeds from many varieties of plants. For example, fleshy fruits, such as berries, provide food for mammals and birds; their seeds travel safely through the animal's digestive tract, being deposited in environments usually some distance from the parent plant. Perhaps, the excreta of the animals were saved as it was a vast reservoir for spores and seeds needed to replenish the vegetation in the post-mabbul world. Second, as a farmer, Noach understood the connection between soil fertility and crop production. The mabbul that HaShem brought not only eradicated all terrestrial life but also ruined the top layer of the earth. Rashi comments on Genesis 6:13, HaShem said, "I will destroy them with the land," for the topsoil to the depth of one foot was washed away. Noach may have wanted to save the animal excreta to use as fertilizer. Third, animal excreta is teeming with various microbiota - bacteria, fungi and yeasts, protozoa - and other simple life forms needed for maintaining the ecology of terrestrial and aquatic ecosystems. As these simpler life forms do not exist as male and female, but rather as asexual forms that reproduce by such mechanisms as binary fission, Noach would not have been commanded to take them into the tayvo (i.e., only a male and female of each "min" was taken into the tayvo). The Meshech Chochmah notes

that life forms which do not reproduce sexually were not brought aboard the tayvo. Fourth, the excreta may have been used to create the proper habitat for some of the simpler creatures. For example, decaying organic matter when mixed with soil is a suitable environment for some invertebrates, such as earthworms.

Before Noach, his family, and the animals entered the tayvo, Noach was commanded to stock the tayvo with food provisions, both for the humans and animals. "And as for you, take yourself of every food that is eaten and gather it in to yourself, that it shall be as food for you and them" (Genesis 6:21). Thus, Noach took branches for the elephants and hazubah (a shrubby plant) for the deer, as well as all kinds of seeds and shoots of the vine, fig, and olive for future planting (B'rayshis Rabboh 31:14). An obvious question is: What food did Noach take for the carnivores? Since Noach did not store meat for these animals, on what did they subsist during the 12 months aboard the tayvo? The Ibn Ezra suggests that when faced with a lack of meat, even carnivores - in order to survive - will eat specially prepared vegetarian foods. Although this appears unusual, a visit to a local pet food supply store revealed that one company, Nature's Recipe Company (Newport, KY), manufactures a special vegetarian formula product for dogs who are allergic to meat and meat-byproducts. Apparently, vegetarian food when "packaged properly" can fool carnivores into thinking they are eating meat.

The week before the start of the mabbul Noach took his family, the necessary provisions, the seven pairs of kosher domesticated animals and the one pair of domesticated nonkosher animals

onto the tayvo. At midday of the 17th of Cheshvan, 1656 (equivalent to October 27, 2106 B.C.E.) the mabbul commenced. On that day, the pairs of nonkosher wild animals entered into the tayvo. Only those animals that did not mate outside their min were able to board (MeAm Loez, Genesis 7:7-11; Malbim, Genesis 7:9). Once the provisions, animals, and human families were settled on the tayvo, responsibilities were assigned. Noach cared for the wild animals, Shem for the domesticated animals, Cham for the birds, and Yefes for the reptiles. Care for the other animals was equally shared. On the tayvo the animals retained their natural inclinations, food preferences, and behavioral patterns. An interesting conversation was recorded between Shem and Eliezer, Avraham's servant. Apparently, when they met years of after the mabbul, Eliezer questioned Shem about life aboard the tayvo. Shem replied that it was very hard and that during all 12 months in the tayvo the four men never got to close their eyes; the nocturnal animals required feeding at night, the diurnal animals during the daylight hours, and the crepuscular animals at dawn and nightfall. Shem also noted that the wild animals retained their ferociousness, which was exacerbated by the lack of meat. To calm these animals, HaShem produced a type of radiation, which both dulled the animals' cravings for meat and tranquilized them (MeAm Loez, Genesis 7:24). This tranquilization of the wild animals may be a form of tonic immobility (commonly termed animal hypnosis). Tonic immobility is a state of profound, but reversible, physical immobility and muscle hypertonicity and is characterized by the animal's lack of responsiveness to external stimuli. This general condition

of motor inhibition, or paralysis, may be associated with a cationic-like flexibility. Although there are many theories attempting to explain this phenomenon, the most popular idea is that tonic immobility represents an innate fear response prompted by adverse environmental events.<sup>8</sup> Radiation, or light waves, was used to tranquilize the animals and subdue their cravings for meat. Colored light of different wavelengths has the ability to mediate the functioning of the autonomic nervous system, which in turn regulates breathing, the heart rate, the functioning of the digestive tract, and the stress response.<sup>9</sup>

In addition to the rain, thermal fountains of the Great Deep opened, heating the floodwaters to boiling. Rabbi Avigdor Miller, (cited in Sanhedrin 108b, Artscroll edition), suggests that, in addition, volcanoes scattered around the globe also erupted and expelled molten lava. The opening of the underground hot springs, coupled with the molten lava, caused the water on the land to reach lethal temperatures. "Everything on dry land died" (Genesis 7:22). As the fish and other sea creatures did not mate outside their species, they were not included in the decree of destruction. To escape the elevated water temperatures, the fish escaped to the depths of the seas, where the waters remained cool (Ramban, Genesis 7:23). The rains lasted for 40 days and nights until the 28th of Kislev (December 8th) (MeAm Loez, Genesis 7:23-24), at which time torrents of floodwaters began and lasted for 150 days until the 29th of Iyar (MeAm Loez, Genesis 8:14). The intense heat generated from the thermal springs and the lava pouring from volcanoes increased both the turbulence

and volume of the waters.<sup>11</sup> That heat increases the turbulence of water is obvious from everyday cooking activities in the kitchen. What about the influence of heat on the volume of water? In both the solid (ice) and liquid (aqueous) states, water molecules are hydrogen bonded to each other. Heat energy influences the length of these attractive forces (i.e., the hydrogen bonds) that connect neighboring water molecules to each other. Aqueous water is most dense at 4°C. Increasing the temperature puts a stress on the hydrogen bonds causing them to lengthen or stretch, thereby increasing the volume of the water. When the temperature reaches 100°C, the stress is so great that the hydrogen bonds break liberating individual water molecules into the gaseous phase. The extreme heat generated from the thermal springs and volcanic eruptions supplied the heat energy that increased the turbulence and volume of the waters. During this time the floodwaters lifted the toyvo from the earth and, like any buoyant object, the toyvo floated.

The humans and animals remained on the toyvo for one full year. An interesting debate among the commentaries focuses on the invertebrates whose life span may be less than one year. For example, the life cycle of the fruit fly, *Drosophila melanogaster*, is from 12-14 days, with the adults surviving only several months. Based on Genesis 6:18, "But I will establish My covenant with you, and you shall enter the toyvo - you, your sons, your wife and your sons' wives with you," the Chasom Sofer suggests that HaShem promised that those that enter the toyvo will be the same that leave the toyvo. Thus, the pair of invertebrates that entered the toyvo was the same pair that left the toyvo one

year later. According to this opinion, animals did not die aboard the toyvo and a special miracle was required to increase the life span of the invertebrates. Conversely, there is the opinion (Robbi Y. P'ik) that animals did die aboard the toyvo. The adult invertebrates that entered the toyvo produced offspring, the adults died within the year, and it was their offspring that left the toyvo. Genesis 8:19 states: "Every living being, every creeping thing, every bird, everything that moves on earth, come out of the toyvo by their families." Thus, according to the last opinion, with regard to the invertebrates, the "family" (i.e., the pair) that entered was not necessarily the pair that left the toyvo (Sanhedrin 108b, Artscroll edition).

The floodwaters began to recede and on the 10th of Elul Noach sent the raven from the toyvo. Noach knew that in the short time since the mabbul ended no trees or vegetation could have sprouted on the mountaintops. Thus, rather than sending out a herbivore, Noach selected an omnivore that could survive on the dead carcasses presumably washed atop mountains.<sup>12</sup> Ravens eat anything. Their usual diet contains insects, seeds, berries, the eggs and young of other birds, occasionally small rodents, and carrion (the bodies of animals killed by creatures other than the raven). Legend has it that a raven's favorite food is the body of a dead man or of other dead animals and that a raven will go for the eyes of such a fallen creature. There may be a certain amount of truth in this legend as ravens do have a certain fondness for eating flesh. Dead bodies, however, take some time to decompose before birds, such as ravens, can easily tear the meat from the carcass. By going for softer tissues, like eyes, these

birds are more likely to get a quick meal.<sup>13</sup> Indeed, the raven released by Noah found a human corpse and began to devour it (MeAm Loez, Genesis 8:6-7). The raven returned and seven days later Noah sent out the dove. The commentaries suggest that Noah selected a dove because it would return to bond with its mate for life. There are various species of doves, the rock dove (*Columba livia*), the inca dove (*Columbina inca*), the common ground dove (*Columbina passerina*), the whitewinged dove (*Zenaidura macroura*), and the mourning dove (*Zenaidura macroura*),<sup>14</sup> and it is difficult to ascertain the specific species sent from the *toyva*. Dr. Y. Feliks<sup>15</sup> presents some insight into the behavior of doves and perhaps provides a clue to aid in determining the specific species of dove sent by Noah. He notes that it is usual to regard the family life of doves as being symbolic of loyalty and devotion. This is expressed in Erubin (100b), "If the Torah had not been given we would have learned conjugal chastity from the dove" and Rashi comments: "Because they do not cohabit except with their own mates." Feliks notes that this conjugal fidelity among doves is true of the wild doves, such as the dove of the rock, but not as regards the domestic dove, where conjugal life is not so exemplary. The dove returned, Noah waited another seven days, and the dove was sent out again. This time the dove returned with an olive branch. Doves eat seeds of weeds (e.g., croton, foxtail, smartweed, and ragweed) and of grasses and grains (e.g., corn, wheat, oats, barley, rye, and buckwheat) left on the ground after harvesting, and a few insects, snails, and slugs. Branches are not on the menu of the dove. However, a dove's nest is built of sticks.<sup>14</sup>

Thus, possibly, by carrying a branch the dove was indicating to Noah that the earth was once again inhabitable, as it was now preparing to build a nest. On the first of Tishrei the dove was sent out a third time but did not return, as the water was gone and the Earth was beginning to dry. By the 27th of Cheshvan, the Earth was completely dry (MeAm Loez, Genesis: 8:14).

The animals and humans left the *toyva*. The animals were commanded by HaShem to live "by their families," which has been interpreted to imply that the omnivores and herbivores initially lived separately, thereby allowing the animal kingdom to be repopulated. After one year, however, predator-prey relationships resumed.<sup>12</sup> The world that Noah and his family reentered was not the same world that they left (Genesis 8:22). Air quality was reduced, soil productivity lessened, and weather was altered from continual springtime to four distinct seasons (S'forno, Genesis 6:13; 8:22; Malbim, Genesis 8:22). The Earth was desolate; all trees and plant life were destroyed (Malbim, Genesis 9:1-3). Noah had a passion for agriculture and his initial task was to sow and plant. Hence, he gained the title "man of the earth" (Ramban, Genesis 9:20).

"The three sons of Noah who emerged from the *toyva* were Shem, Cham, and Yefes, and the descendants of these spread over the whole earth" (Genesis 9:18, 19). The human beings that leave the *toyva* are destined to be the progenitors of the human populations that subsequently fill the world. All the different races of human beings, therefore, trace their ancestry to these eight people. According to Jewish tradition, Cham and his wife are the forerunners of the dark-skinned races (B'royshis Rabbah 34:7). Current scientific thought

is that human skin color is a polygenic trait, controlled by between three and six gene pairs. Data are most consistent with a model for human skin color that involves three or four gene pairs. Polygenes control traits that vary continuously, with each gene having a small, but additive, effect on the overall phenotype. Assume that each gene pair consists of a dominant form (P) that controls the synthesis of a certain amount of pigment and of a recessive allelic form (p) that does not allow for pigment synthesis. The intensity of the skin coloration of an individual is a function of the number of P alleles in the genotype. For example, let's assume that human skin color is under the control of four pairs of polygenes. Then an individual with the genotype P1p1P2p2P3p3P4p4 would have darker skin coloration than a person with genotype P1p1P2p2P3p3P4p4. These skin color-determining polygenes are, most probably, on different pairs of homologous chromosomes, so that they segregate independently from each other during gametogenesis. Matings between two tetrahybrids (i.e., P1p1P2p2P3p3P4p4) theoretically could produce offspring ranging from albino (p1p1p2p2p3p3p4) to extremely dark-skinned children (P1P1P2P2P3P3P4P4).<sup>16</sup> Thus, if Cham and his wife were olive-skinned tetrahybrids for the genes that determine skin color, there is a 1/256 (0.4%) chance that a child would be born with the phenotype of extremely dark skin. This does not imply that Cham's descendants were only the dark-skinned races, as when two such tetrahybrids mate, the entire spectrum of skin color shades in their offspring is possible, with the distribution fitting a bell-shaped curve.

The human, animal, and plant populations that left the *toyva* produced

progeny, and the progeny produced progeny, subsequently scattering into various environments and occupying unique niches. Recent studies on the importance of the local environment in shaping how organisms change through time indicate that such changes occur more rapidly than previously thought. Studies with the European fruit fly and the stickleback fish have shown "that natural selection can cause a population to change very quickly and hint that speciation could [occur] very quickly."<sup>17</sup> Apparently, by the process of nat-

ural selection, the specific minim biodiversified – at a relatively rapid rate – to yield different genera and species. This biodiversity was hastened by separation of the continents, according to the principles of plate tectonics. These continental movements occurred at the time of the builders of the Tower.<sup>18</sup> Hints of this are noted in the Targum Yonasson's translation of Chavakuk 3:6: "[HaShem] appeared and shook the Earth and brought a mobbul on the people of the generation who dis-

obeyed Him. Also in a later instance when mankind sinned, He mixed the peoples and dismantled the ancient mountains." The many changes in the Earth and in mankind subsequent to the mobbul are most interesting. The reader is directed to the sefer by Rabbi David Brown,<sup>1</sup> in which these events are explained according to the Pirkey d'Rabbi Eliezer.

H. BABICH, PH.D.  
Department of Biology, SCW

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#### NOTES

1. Brown, D., 1997, *Mysteries of The Creation*, Targum Press, Inc., Southfield, MI.
2. Mader, S., 2000, *Inquiry into Life*, McGraw Hill, NY, NY.
3. Starr, C. and Taggart, R., 1995, *Biology: The Unity and Diversity of life*, Wadsworth Publ. Co., NY, NY.
4. Hickman, C.P., Hickman, C.P. and Hickman, F.M., 1974, *Integrated Principles of Zoology*, 5th edition, Mosby Co, St Louis, MO.
5. Purves, W.K., Orions, G.H., Heller, H.C. and Sadava, D., 1998, *Life The Science of Biology*, 5th edition, Freeman & Co, Salt Lake City, UT.
6. Tendler, M.D., 1993, The Theory of Evolution: Impact on scientific thought and Torah beliefs, *Jewish Action*, 54: 69-71.
7. Hanaka, Y., 1994, Torah, science, and carbon 14, In *Science in the Light of Torah*, Bronover, H. and Arico, I.C. (editors), Jason Aronson, Inc., Northvale, NJ: pp. 197-203.
8. Gallup, G.G., 1974, Animal hypnosis: factual status of a fictional concept, *Psychol. Bull.*, 81:836-853000.
9. Roeder, C., 1996, Environmental design technology: using color & light as medicine, *J. Healthcare Design*, 8:133-136.
10. Cocilovo, A., 1999, Colored light therapy: overview of its history, theory, recent developments and clinical applications combined with acupuncture, *Amer J. Acupunct.*, 27:71-83.
11. Munk, E., 1994, *Call of the Torah*, Volume 1, Mesorah Publ., Ltd., Brooklyn, NY.
12. Soratzkin, Z., 1991, *Insights in the Torah*. Bereishis, Mesorah Publ., Ltd, Brooklyn, NY.
13. The Raven's Ravea Facts, <http://www.shades-of-night.com/aviory/ravendoc.html>
14. Pennsylvania Game Commission, [http://www.state.pa.us/PA\\_Exec/PGC/pubs/w\\_notes/doves.htm](http://www.state.pa.us/PA_Exec/PGC/pubs/w_notes/doves.htm).
15. Feliks, Y., 1981, *Nature and Man in the Bible*, Soncino Press, NY.
16. Cummings, M.R., 1997, *Human Heredity, Principles and Issues*, 4th edition, West/Wadsworth, NY, NY.
17. Pennisi, E., 2000, Nature steers a predictable course, *Science*, 287:207-208.

#### Translations used in preparing the article:

- Artscroll, 1994, *Tractate Sanhedrin*, Mesorah Publ., Ltd., Brooklyn, NY.  
Artscroll, 1995, *Tractate Zevachim*, Mesorah Publ., Ltd., Brooklyn, NY.  
Chavel, C.B., 1971, *Ramban, Commentary on the Torah, Genesis, Volume 1*, Shilo Publ. House, Inc., NY, NY.  
Faier, Z., 1978, *Malbim, Commentary on the Torah, Volume 1*, Hillel Press, Jerusalem, Israel.  
Freedman, H., 1983, *Midrash Rabbah, Genesis, Volume 1*, Soncino Press, NY, NY.  
Koplan, A., 1977, *The Torah Anthology, MeAm Lo'ez, Volume 1*, Maznaim Publ. Corp., NY, NY.  
Pelcovitz, R., 1989, *Sforno Commentary on the Torah, Volume 1*, Mesorah Publ., Ltd., Brooklyn, NY.  
Stern, Y., 1996, *Chasam Solter Commentary on the Torah, Volume 1*, Mesorah Publ., Ltd., Brooklyn, NY.  
Zlotowitz, M., 1989, *Bereishis, Volume 1a*, Mesorah Publ., Ltd., Brooklyn, NY.

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