Interface of Halacha and Genetic Engineering

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Genetic engineering, often described as the manipulation of an organism's genetic material to modify the proteins that are synthesized, has allowed mankind to manipulate life in a way our ancestors could never have imagined. Today, it is possible to identify, isolate, and extract genes, the genetic units responsible for expressed traits, from one organism and insert them into a wide array of different species, i.e., process of the creation of transgenic organisms. These newly implanted genes give the developing embryo novel instructions to express physical and chemical characteristics that were never exhibited by that species, but that will now be manifested in all its future generations. The initial task is to isolate the gene from one species and insert it into the fertilized egg of a different species. This foreign gene, now inserted to the nucleus of a fertilized egg, may permanently integrate into a chromosome of the egg. Through growth and division of the fertilized egg, all the daughter cells will also have the added foreign gene. Eventually, the growing embryo, with its new genetic constitution, is implanted into a surrogate mother.

Such scientific technologies have led to biologic innovations, such as anti-freeze strawberries, achieved by isolating the gene from a salmon that prevents it from freezing and inserting that gene into the genome of a strawberry. Other interesting concoctions include glow-in-the-dark houseplants, synthesized by inserting the glow-in-the-dark gene from a jellyfish into the genome of a houseplant. Applications of such technology are in the not so distant future. Currently, in the United States, 45% of the corn crops, 85% of the soy crops and 76% of the cotton crops are genetically modified [1]. Thus, apparently, human consumption of genetically modified produce is quite common, albeit, not publicized to the populace.

Unscrambling and re-scrambling DNA, the blueprint for all life, is what scientists, lawyers, businessmen, and philosophers have been studying, testing, debating, and analyzing for the last 45 years. More recently, rabbis have been concerned of the halachic implications of genetic engineering. Such innovations, as the anti-freeze strawberry have lead to an interesting question: what blessing is required upon consumption of such a fishy fruit, the blessing for a fish or for produce grown from the ground?

If one looks to the future of genetic engineering, this type of question can be taken a step further. Scientists may soon be able to isolate the gene that causes an animal to chew its cud. When this day comes, and someone introduces this gene into a pig's fertilized egg, the resulting animal may express both signs for a kosher species: a chewing of the cud and a splitting of the hoofs. Is this animal kosher?

Answers to such halachic questions depend on many issues, however two of most significant are kilayim and simanim, the prohibition of mixing species and the designation of the physical symbols of the kashrut on animals, respectively. The issue of kilayim, commonly equated with grafting and interbreeding, is explicitly banned by the Bible, "You shall not mate your animal into another species, you shall not plant your field with mix seed" (Leviticus 22:19).

At first glance, it appears that the Bible is directly forbidding interbreeding of animals which would, to say the least, put an abrupt end to halachic issues involved in genetic engineering. However, upon a closer and more informed inspection, the Bible only states that one may not "mate" or "plant" different species. Genetic engineering is initially performed in test tubes and Petri plates and only later involves surrogate motherhood. Hence, as it does not involve the act of sexual reproduction (i.e. "you shall not mate"), it seems that one may be permitted to mix the genes of one species with those of another [2]. However, there are those of note, namely Nachmonides, a 12th century Jewish scholar, and Rabbi Samson Hirsch, a seventeenth century German biblical commentator, who view the above-cited verse differently. They note that the creation of hybrid offspring is inappropriate, because such hybrids modify G-d's original creative intentions and improving the creations of G-d is not the duty of man. Therefore, it is not the methodology of how mixed species are created that is forbidden, rather it is the actual creation of the hybrid offspring that is prohibited. Ergo, the same logic that forbids the mat-

ing or planting of non-synonymous species would equally forbid any other type of genetic manipulation leading to the creation of a transgenic species, as these "creations" alter the original blueprint formulated by G-d. As yet, there is no modern-day resolution to this debate and there are still strong proponents for each opinion. The issue of kilayim is important, not to be trivialized, as it will have major effects on the eventual halachic analysis of genetic engineering.

The other major and extremely interesting issue is the Biblical signs designating an animal to be kosher, i.e., the simanim of kashrut. These laws are outlined in Leviticus 11:9: "Any animal that has true hoofs, with clefts through the hoofs, and chews the cud - such you may eat." Do the simanim, the signs that the Bible predicates kosher animals as having, INDICATE or CAUSE the kosher status of an animal? For example, one can say that a squirrel is inherently a non-kosher species and a cow inherently is a kosher species. Yet, to allow Jews to recognize those species fit for consumption, the Bible gave two specific symbols, i.e. chewing of the cud and a splitting of the hoof. The implication of this definition of simanim is that even if a specific member of a kosher species does not bare the signs of kashrut, it is still considered kosher because its species has been designated as kosher. On the other hand, it can be argued that the actual split hoof and cud chewing is what makes the animal a kosher animal. With this explanation, the simanim are the actual causes of the kashrut status of the animal. This would imply that a pig, a non-kosher species, through some natural mutation or genetic manipulation would possess the simanim of kashrut, it would, in fact, be kosher. Ostensibly, one would be inclined to say that this new transgenic pig is kosher, as it meets all the Bible's specifications. But, with a closer look into the gamut of rabbinic literature one will find many opinions that support the opposite case.

"...[T]hat which issues from the impure is impure and that which issues from the pure is pure" (Berachot 1:2). This statement made by first century Rabbis seems to unequivocally imply that it is status of the mother that defines the kosher status of the offspring. But if one continues to read, the Gemara rules that "one might have an animal that chews its cud and has true hoofs, yet is not to be eaten. And what might that be? A pure animal born of an impure one." This seems to unambiguously tell us that the simanim are merely symbols to delineate kosher status.

One clear distinction must be made. The previous discussions pertained to only non- oviparous mammals. Birds are an entirely different issue, as organisms hatched from eggs are -halachically speaking - are not considered as "coming" from the mother which laid them because the mother did not gestate her young internally. Instead, the instant after an egg is laid, it is considered as dust, not fit to be eaten, and not deemed alive. Only after a period outside the mother's body is life considered to form inside the egg (Temurma 31a)[3]. There are however, other opinions (Rambam, Hilchot Ma'akhalot Assurot 3:11 as explained by the Maggid Mishneh) [2] that hold that since the kashrut status of eggs are determined by the animal that lays them, the same principle can be applied to the kashrut status of birds that hatch from those eggs. But, the latter view, in a sense, detaches the child from the parents, thereby shaking off any status of the parents. Fish also have a different status because the rabbinic liturgy never included them in the ruling of: "what issues from impure is impure," and because some species are hatched from eggs. Thus, one can make an even more convincing argument that a non-kosher animal, which is born by hatching, can be genetically modified with the proper simanim and be considered kosher.

The future is approaching quicker than anyone can keep up with. These theoretical discussions seem to be esoteric and far from practical now, but soon they will be our daily reality. The effects of humanity's recently harnessed genetic powers will be felt in strange but profound ways and Jewish law (halacha) will, as it always has, respond to it. ■

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Acknowledgements:

Firstly, I want to acknowledge and show gratitude to my parents for building the foundations for my deep love of Hashem, Torah, knowledge, and truth. I want to thank my husband, David, for his support. I also want to recognize and thank Dr. Babich and Rav Tabory for editing my article and constantly exciting, motivating, and encouraging me, and all the students that come into contact with them. Their devotion is a true inspiration.

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