April 4th, 2024

ARE GENES JEWISH?
ARE GENETICALLY ENGINEERED FOODS KOSHER?

Genetic engineering alters the blueprints of plants and animals to create new varieties of foods and seeds. Today we will explore the Jewish ethics of manipulating the building blocks of life within plants, vegetables and animals, and discuss related issues of halakha and kashrut.

There are two types of holidays in the Jewish tradition. There are the holidays like Sukkot that go "G-d created us, gave us a world full of food, thank you G-d, let's eat!" And there are holidays like Pesach and Chanukah that go "They tried to kill us, we survived, let's eat!" No matter what, we Jews like to eat. But what are most Jews eating, and does modern food technology allow us to live in accordance with Jewish laws and values?
[Naom Dolgin, Treif Tomatoes, Ref#5]

General Outline for Today's Discussion

- Jewish Concepts.
    - L'Meenayhu (of it's own kind), Kilayim (forbidden mixture), Shatnus (cross-breeding)
- Grafting and the Etrog.
- Intro to Genetic Engineering.
- Why GMOs? Pros, Cons.
- Orthodox, Reform stance. Israel Law. Other religions.
- Additional Thoughts.

JEWISH CONCEPTS - A Question: ***In the context of food production, does the artificial transfer of material between species that are naturally prevented from crossbreeding constitute a violation of Halakha (even if both species are kosher)?***

[The following texts to consider were taken from an article by Noam Dolgin, entitled: Treif Tomatoes – Biotechnology, Judaism and the Food We Eat. Ref #5; Ref #20]

1. Ethics of manipulating the building blocks of G-d's world: Jewish text clearly states our role/responsibility in the **stewardship** of Creation. G-d provides us with the ability to use our resources to benefit humanity. We are given permission to manipulate and utilize, but must remember that we are only caretakers of something much larger.

> "G-d said 'Be fruitful and multiply, fill the earth and subdue it [kivshua]'"
> Genesis 1: 28
>
> "G-d said 'behold, I have given you all herbs yielding seed that is on the surface of the earth and every tree that yields fruit; They shall be yours for food.'"
> Genesis 1: 29
>
> "The heavens are G-d's Heavens, but their earth was given to Human Kind."
> Pslam 115

2. Importance of individual species throughout Genesis: "**L'Meenayhu**," according to its kind, is a theme that repeats repeatedly throughout Genesis. Humanity and the other distinct species are celebrated throughout Creation and Noah.

> "And the Earth brought forth vegetation; herbs yielding seeds according to its kind [l'meenayhu], and trees yielding fruit each containing seeds according to its kind." Genesis 1:12
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> On Grafting: "HaShem created species in the world of all animals, plants, and all creatures of movement, and gave them the ability to reproduce as long as HaShem wills the world to existence...as it says (Genesis 1:12, 21 22) "according to their kind" [l'meenayhu]...one who grafts plant species is as if one has denied that the holy one blessed be, perfected the world... …For both these reasons the actions of combining species is disgusting and void! [Nachmonides]
>
> Sefer Ha-Chinuch (ספר החינוך) writes on the prohibition of mixing species: "and all that G-d did is intended for the perfection of that which is needed in His world...and the species should not be mixed, lest it detract from the perfection and there will not be blessing." [Ref #6]

3. Kilayim (forbidden mixture) and **Shatnus** (cross-breeding): There are well defined laws against cross-breading and mixing of species. In the Torah, there's sanctity of boundaries between species. There is a difference between breeding--a natural selection process between like species-- the deliberate manipulation between dissimilar species that would never occur in nature.

They all stem from the following verse:

> Leviticus 19:19 "Don't crossbreed your animals with other species. Do not plant your fields with different species. "You shall not let your cattle mate with a different kind; you shall not sow your field with two kinds of seed."

One could argue that we have been given privilege to reside as caretakers over creatures that evolved through evolution. The collision at the heart of the matter might be summed up as follows:

- Stewardship: Take care of the natural world, respect its integrity and ultimately, to refrain from playing G-d
- Mastery over the world: The injunction at the beginning of Genesis where the world is given to Adam and he is told to subdue it

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GRAFTING

In modern day agriculture, a farmer knows that mixing of one fruit tree with another produces a "sturdier" fruit that can be more disease resistant. This "crossbreeding" is permitted when it is the same type of fruit (think apples-to-apples); all the genes come from the same species. Grafting is more complicated; grafting different fruit bearing trees together is considered a mixing (cross-breeding) of two separate species. Jewish law does not directly permit grafting between different species.

Example: Etrog grafted to a lemon tree. Etrog HaMurkav. **Question: *Is the Etrog kosher?*** Two lines of thought dictate how to halachically handle the resultant fruit:

1. Disqualify the Etrog because we don't know if it is an Etrog or a lemon.
    a. It may be a different (unique) species of fruit.
        i. This might occur if flowers of original tree and grafted branch are cross pollinated. However, modern agriculture only uses trunk of host tree; all branches removed prior to grafting.
    b. Even if it is an Etrog, must subtract the potential for interaction of the host with the graft. There is sustenance from the host to the graft. Must therefore subtract host tree contribution (equal size of a lemon) from the Etrog. In this case, the Etrog would be too small to be used on Sukkot for halachic use (size restrictions for the first day only…).
        i. Note: a counter arguement says the Etrog is indeed kosher: if the identity of the fruit matches that of the expected Etrog, then it is an Etrog.

2. Render the Etrog not kosher to use, based strictly on Jewish law.
    a. Kilayim.
    b. However, modern science says that there is no intermingling of genetic materials from graft to host tree. There is no "blending" of species. Therefore, future generations grown from the Etrog's seeds might be okay to use. [Ref #7]

While the Mishna prohibits plant grafting, it does not say that Jews cannot use or consume hybrid products or species. It is readily accepted that it is permissible to consume the fruit of a grafted plant or tree.

GENETIC ENGINEERING is the practice of altering the genetic blueprints of plants and animals to create new varieties of foods and seeds. Genetically modified (GM) foods are foods derived from genetically modified organisms. Genetically modified organisms have had specific changes introduced into their DNA by genetic engineering techniques which create a stable change in the plant or animal.

In the United States, well over 180 million acres of genetic engineering crops are being cultivated, including species such as corn, cotton, soybeans, canola, sugarbeets, alfalfa, papaya, potatoes and summer squash. In 2020, GMO soybeans made up 94% of all soybeans planted, GMO cotton made up 96% of all cotton planted, and 92% of corn planted was GMO corn. GMO canola was >95%, and sugar beets were 99.9%. Many processed food in American supermarkets contains genetically engineered ingredients (including infant formula, corn chips, margarine, ice cream and ready-made meals). [Ref # 1] [Ref #2] [Ref #3] [Ref #4]

Genetic engineering works as follows: Genes from nonrelated species, such as plants, insect, or mammalian genes, are inserted into plants to enhance growth (size and speed to maturation), or to reduce susceptibility of crops to frost or pest damage. There is incredible potential to improve crop yields and increase nutritional value, or even changing physical properties to make storing and shipping easier.

Though selective breeding has been practiced for generations, genetic engineering allows for crossing the species line in a way nature never could.

Question: ***Do foods that are ordinarily kosher become unkosher when implanted with genes from unkosher animals?***

- Would something such as a vegetable spliced with pig genes remain kosher?

The Union of Orthodox Jewish Congregations of America (UOJCA), ruled in the late 1990's that genetically modified organisms do not violate kashrut [Ref #9]. This is because non-kosher genes are not implanted directly into each plant. **Non-kosher genes serve only as a chemical template.** The template is then reproduced onto materials taken from production vectors (usually in yeast) which are then introduced into plants via bacteria. The reproduced gene that ends up in the edible plant is therefore from a kosher source.

> The process of obtaining the desired gene for use is one that involves copying, and re-copying the gene in various media (such as bacteria), so that the final, resultant gene has NO original DNA in it.
>
> The gene is not placed in each and every tomato, but rather in some seeds or plants which then produce NEW generations of tomatoes that have never come in contact with the original gene. [Is a tomato with a pig gene kosher? [Ref #21]

Since genes are microscopic, they are therefore ***batul***, or nullified, in the new plant.

Kashrut: Laws govern how and what we eat. In some cases, Halakha excuses a non-kosher additive that amounts to less than one part in sixty of the resultant mixture.

Thought: Does the "One in Sixty" Exemption Apply? This is the concept of "Batul", where the item in question is "too small to matter." [Ref #26] [Ref #11]

> This exemption only covers instances in which the non-kosher ingredient was added accidentally. Further, it is inapplicable when the minute ingredient induces a perceptible effect.

Thought: Is There a Difference Between Animal Genes and Their Laboratory Copies? Does the Exemption for Microscopic Phenomena Apply?

> Some rabbis have argued that because the DNA implanted within the target organism was not itself directly extracted from non-kosher animals but is merely a laboratory copy of an animal gene, there is no tissue transfer and no halakhic problem.

Thought: What is the ruling for kashrut regarding animals fed using GMO crops?

> Independent studies show that there is no difference in how GMO and non-GMO foods affect the health and safety of animals. The DNA in the GMO food does not transfer to the animal that eats it. This means that animals that eat GMO food do not turn into GMOs. [GMO Crops, Animal Food, and Beyond [Ref #2]

Thought: Does Matzah made with GMO wheat remain kosher for seder use?

> In 2015 Manischewitz announced a line of non-GMO matzah. This did not render "regular" matzah non-kosher; before 2015 this was not questioned.
>
> Of interest, if a gluten free GMO wheat line were created, would it be kosher for seder use? The answer is a likely "No", since gluten is important in the act of leavening. [Ref #22]

Takeaway Concept: It may be unreasonable to consider the implantation of non-kosher genes as a purely microscopic phenomenon while ignoring both the macroscopic substances they produce and their clearly observable effects.

CURRENT JEWISH STANCE/RULINGS

Orthodox Union: The OU ruled: genetic engineering "does not affect kosher status," because genetic material is "microscopic." While the blending of species (kilayim) is a valid point, it was determined that this only prohibits a complete blending (hybridization) between two different species, and not directly related to enhancement of one particular species by improving/adding/modifying of genetic sequences. The RA concluded that the *Torah*'s ban on *kilayim* "does not extend formally to the modification of gene sequences via the introduction of foreign DNA in order to convey a specific capability in the new organism." While it is not a virtue to tamper with nature, it is not prohibited.
[Ref #17][Ref #9.][Ref #10]

The Responsa Committee of the (Reform) Central Conference of American Rabbis focused on a narrow question, the permissibility of using a specific modified food. Use is valid because of contribution to improving global health and raising the living standards of underserved populations.

Israeli law permits the development and growth of GMOs for research purposes in accordance with requirements established by legislation. Although **GMO growth is not permitted for commercial purposes**, GMO products may be imported, sold, and used in the production of food and pharmaceuticals. Israel's religious *kashrut* authority has determined that the use of GMO ingredients in food does not affect its kosher status because GMOs are only used in "microscopic" proportions.

> Supplying food to a growing population without destroying the world's ecological systems is one of humanity's great challenges. Israel is helping deal with this challenge by developing agricultural technologies. It is a mitzvah to improve the health of another person, and creating a heartier species often does just that. You could even extend this to Pikuach nefesh, which is the principle in Jewish law that the preservation of human life overrides virtually any other religious rule. [Ref #8]

The Muslim world originally said there is no need for genetic modification of food crops because G-d created everything perfectly and man does not have any right to manipulate anything that G-d has created using His divine wisdom. Their stance changed: According to the Islamic Jurisprudence Council (IJC), foods derived from biotechnology-improved (GMO) crops are halal and fit for consumption by Muslims. Are GMO's Halal? [Ref #18]

In Christianity, there is no overarching consensus on permissibility of GMO technology, performing of GMO research, or GMO food consumption. With that said, In 2009, the Pontifical Academy of Sciences, the Vatican's top scientific body, issued a statement in support of the technology when "used appropriately and responsibly." Vatican study endorses GMOs for food security.
[Ref #19]

Other Ethical Issues: Apart from the question of Kashrut, there are additional ethical issues to consider. [Ref #23] [Ref #24]

1. Environmental - Problem of seed spread to neighboring fields: This is a problem of cross-pollination of genetically modified seed into a non-GM field.

   > We are cautioned against causing the loss of benefit to another, even if he has no legal claim to it. The principle "that one should not drain the water of his well when others need it" is found in the Talmud. A Jew is even commanded to prevent damage threatening his neighbor from an outside force" such as wind spread that may result in damaging value to a neighbor's crops.

2. Problem of "terminator" seeds: Many GM seeds are engineered for one time use, with sterilizing seeds produced at harvest. This maximizes profits for the company producing the seed.

   > This appears to be in contradiction with Genesis 1:29 stating: G-d said, "See, I give you every seed-bearing plant that is upon all the earth, and every tree that has seed-bearing fruit; they shall be yours for food."

ADDITIONAL PROS AND CONS

Addressing the issue of genetically modified foods, Rabbi Moshe ben Nachman (also Ramban, Nachmanides c. 1194-1270) argued that these rules teach that humankind should not disturb the fundamental nature of God's creation. Centuries later, the Maharal contended that "any change that human beings introduce into the world already existed in potential when the world was created. All that humans do is bring that potential into actuality." [Ref #13]

Opposition: There are Jews who oppose GM crops, and who purport to do so based on Jewish beliefs and values. [Ref #25] [Ref #26]

Zelig Golden, who now runs the Bay Area nature education nonprofit Wilderness Torah, said: "Just because the Orthodox Union declared them [GMOs] kosher, doesn't mean that they are kosher……The important angle," he said, "is that people think kosher food is safer. But it's not." This was also reported in Sue Fishkoff's 2010 book, "Kosher Nation," where nearly half of Americans believe that food with a kosher label is safer, and 62% believe it is healthier.

Other concerns must be recognized. Why is the GMO produced; who benefits/profits; detrimental effects to other plants/animals/environment; consumer safety; reduction in biodiversity; cannot be done do deceive the consumer; process does not supplant need to treat food supply with respect.

THOUGHTS AND QUESTIONS TO PONDER:

- Is there a specific gene that makes a food “kosher”?
- Salmon have been engineered with an eel gene to make them grow faster. They are deemed to be kosher.
- If a carp is genetically engineered so that it has no scales, is it still kosher; if a catfish is genetically engineered so that it has scales, is it now kosher?
- Cloned food – if pork meat cloned (grown in a vat?) an argument can be made that it is possibly ok (reduce animal suffering, decrease meat industry pollution and environmental stress, end starvation). Meat grown from cells in a lab would have lost its "identity".
- Is there anytime when Jewish law would obligate a person to eat (or use) genetically engineered food?
- Should there be adequate labeling of products so that vegetarians avoid eating vegetables that have been engineered to contain animal genes?

SUMMARY

Although a number of mainstream groups have ruled that genetic engineering foods are, indeed, kosher--due to the genes being so small as to be "trivial" by kosher law, religious objections still persist. Most objections are along ethical lines, or argue that modifications lead to “essential” changes to the recipient food item.

The debate boils down to (1) taking care of the natural world so as to respect its integrity and refrain from playing G-d, versus, (2) mastery over the world: The injunction at the beginning of Genesis where the world is given to Adam and he is told to “fill the earth and subdue it” is a good place to start an open discussion.

It is hoped that you will use this class as a stepping-stone to open a dialog with your Rabbi and community to determine what Judaism's response should be regarding genetically engineered foods and kashrut status.

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