Editing Humanity: The Halachos of Germ-Line Engineering

By Esther Butler

Discussions of medical ethics precede the implementation of advances in genetic engineering. Genetic mutations occur in various ways, such as when a segment of DNA is repeated or deleted or one of the four nitrogenous base pairs is incorrectly matched. Scientific research is rapidly advancing in the area of gene-editing technology to repair deadly genetic defects and enable parents to select specific genes for their designer babies. Germ line therapy alters an embryo’s DNA and affects the genetic code in all of the embryo’s future descendants. Scientists have not yet refined the technique to safely alter the DNA of an embryo; however, Rabbanim already began discussing theoretical ethical issues that may arise by exploring the halachos (Jewish laws) pertaining to permissible, obligatory, and forbidden procedures.

Before delving into the halachik ramifications, it is important to have a preliminary understanding of the technology under discussion. There are assorted methods to genetically engineer an embryo’s DNA. One method is based upon a bacterial defense system to destroy invasive viral DNA. This mechanism contains Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) which are identical segments of DNA separated by spacers. The spacers contain the history of previous viruses that have attacked this bacterium or one of its ancestors. If the same virus enters the bacterium or one of its descendents, then a CRISPR Associated (Cas) protein cleaves and inactivates the viral DNA. Researchers adapted this mechanism to gene-edit any organism’s DNA. A common method uses the CRISPR system and the Cas9 protein. This mechanism contains guiding RNA (gRNA) which locates the specific target site on the DNA. Once the gRNA is in-line with the target site, the Cas9 protein unwinds and cleaves the double helix. At this point the scientist can alter the DNA by inserting or removing a gene or by repairing a mutation. However, the gRNA can mistakenly locate a different gene on the DNA, and as a result, a vital segment of DNA can be removed from or altered in the genome. Due to ethical concerns, the United States does not currently fund germ-line engineering [1].

This past November, He Jiankui, a Chinese researcher, claimed to have utilized CRISPR technology to edit the DNA of twin embryos. His goal was to lessen the possibility of these babies developing HIV later in life [2]. Currently, Dieter Egli, a developmental biologist at Columbia University, is researching the effects of CRISPR technology on embryos. Egli assures that the genetically modified embryos are only for research purposes and will not be implanted to develop into a baby [3].

Additionally, it is necessary to understand how balacha uses the following principles to determine one’s obligations in medical care. There is a biblical commandment to heal one’s body, “and he shall heal” (Shemos, 21:19). Rabbi Dr. Tatz, in his book, Dangerous Disease, discusses medical halachos and ethics. He explains that within balacha there are three categories that determine one’s autonomy in medical care. The first category consists of medical situations that afford the patient the decision to undergo or refuse treatments. The second category includes conditions for which the patient is obligated by balacha to undergo treatment or therapy; however, if the illness is not life-threatening, a fellow Jew cannot force the patient to undergo the treatment or therapy. The final category consists of life-threatening emergencies where, despite a patient’s refusal, one is required to perform the operation or administer the treatment. Rabbi Dr. Tatz showed how balacha considers the potential risk factors connected to any medical intervention; these are general guidelines based upon the principle that Judaism “sees life itself as the primary value” [4].

Dr. Loike and Rabbi Dr. Tendler discuss the life status of an embryo within the first forty days after conception. Some opinions in balacha hold that immediately upon conception the embryo has the status of a living human, while others hold that it is not considered a living being until it has developed in the womb for forty days. The results of the divergent opinions affect multiple rulings connected to the obligation of saving a life [5]. Whether an embryo has the full status of a living human or whether it is on a relatively lower level, the ethical discussion maintains its significance regarding the value of human life. Rabbinic leaders weigh a myriad of factors before
determining if a given act is permissible, obligatory, or forbidden. Dr. Loike and Rabbi Dr. Tendler assert, “Aside from as-yet undefined side effects, gene-editing procedures do not involve any prohibited acts” [6]. This ruling will be analyzed in the context of germ-line engineering.

Judaism emphasizes the importance of saving a life, even that of an embryo. Dr. Loike and Rabbi Dr. Tendler, citing the biblical commandment “to love your neighbor as yourself” (Leviticus 19:18), extend this to include parents’ obligation to provide medical care for their children. Therefore, according to this approach, religiously observant Jewish parents can utilize gene-editing technology on an embryo to prevent a severe illness lacking an alternate cure. Dr. Loike and Rabbi Dr. Tendler broaden this ruling to include late-onset diseases, because Judaism follows the principle that a healthy person would take action to avert the illness. For instance, an embryo identified to develop Huntington’s disease can be gene-edited even though the illness may not manifest for another forty years. However, halacha forbids gene-editing an embryo for non-medical purposes. Therefore, halacha prohibits creating designer babies [6].

The actual price to edit an embryo has not yet been established, but medical ethicists have already discussed the issue presuming it is an expensive procedure. Halacha requires individuals to expend all their money to save their own life, as well as the life of their spouse and children. There is a halachik dispute if individuals are required to spend all their money or up to 20 percent of their wealth to save another’s life [4]. These rulings show that even one life is worth more than all of their possessions. Rabbi Taub, author of book, The Laws of Tzedakah and Maaser, explains that halacha recognizes that there are many people who need financial assistance, so there is a biblical commandment to give charity, tzedakah. The minimal halachic requirement, even for those who receive charity donations, is to give approximately two dollars and 50 cents to charity each year. However, one is generally expected to donate at least ten percent of his/her annual income to tzedakah. Charities that conform to halacha and focus on paying medical expenses will likely include financial assistance for germ-line engineering that is performed according to the halachik parameters. In addition to the obligation to give charity, halacha delineates a hierarchy to which organizations one should prioritize his/her donations. The top three categories are charities connected to saving lives, Torah study, and paying a poor person’s medical needs [7].

Halacha prohibits editing the genome of an embryo that may produce an uncertain outcome; however, it is permissible to edit the genome for single gene mutations. Individual genes code for the synthesis of one or more proteins. Approximately 6,000 diseases may be controlled by a single gene. For example, a single mutation in DNA can result in Tay-Sachs disease. This fatal disease can be prevented by replacing the mutation with the correct nucleotide base. However, many genetic diseases, intelligence, and behavioral characteristics are controlled by the interaction of multiple genes. Current scientific knowledge cannot confidently predict the result of altering single genes that control several outcomes or behavioral characteristics and complex diseases which are determined by the interaction of multiple genes. Therefore, halacha does not allow editing a gene that will have multiple effects or altering a gene of a polygenic disease. Halacha considers potential risks connected to the procedure, such as the possibility to mistakenly alter the wrong segment of DNA or to activate a cancer-causing gene [6].

Another ethical question is in the arena of researchers altering DNA and “playing G-d.” While some oppose genetic engineering because it negates the natural predetermination chosen by G-d, halacha recognizes that people are G-d’s partners in creation. A story in the Midrash Tanchuma (Tazriah 19) relates that people are allowed to change nature. Rabbi Akiva explained to the Roman general, Turnus Rufus, that the permission of humans to grind wheat into flour to bake bread shows that people are meant to improve upon the natural world. Using this story, Dr. Loike and Rabbi Dr. Tendler conclude that there are occasions when one is allowed to alter the human genome to save a life. However, as discussed previously, one does not have exclusive permission to alter the genome for physical traits. Therefore, for medical purposes it is permissible to alter an embryo’s DNA, without worrying that this medical procedure is outside of humankind’s domain and “playing G-d” [6].

A final consideration is the ethical concern of human experimentation. Halacha outlines specific parameters that determine if one is allowed to partake in clinical trials. Two of the many requirements are whether the procedure has a low risk of causing harm to the
patient and whether there needs to be evidence that the treatment will yield the desired outcome [4]. Carriers of embryos with life-threatening diseases are encouraged to volunteer for these initial clinical trials. However, based upon the outlined parameters, one should only partake in studies in a licensed clinic [6].

As genetic engineering technology advances, the possibility to eradicate diseases may become a reality. CRISPR technology demonstrates the wisdom Hashem has granted to scientists to prevent fatal diseases. Rabbanim review and determine when it is permissible to utilize this wondrous technology. It is incumbent upon individuals to consider the halachos and ethical implications of any technology before it is incorporated into standard medical care.

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References


