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JUDAISM AND GENE DESIGN

INTRODUCTION

Genetics — the study of the mechanisms of heredity — is a well-established branch of biological science. As these mechanisms become better understood, it may become possible to tamper with them and so to alter heredity. For example, hemophilia — inability of the blood to clot properly — is a hereditary condition; a woman who is a carrier of this condition is likely to have sons who are “bleeders” and daughters who are “carriers.” If one could identify the specific genes that transmit hemophilia, it might be possible to remove an ovum from such a woman, operate on it to repair these genes (or perhaps replace them with genes from a normal woman), and return the ovum to her body. A child that she conceived by fertilization of this ovum would then be neither a bleeder nor a carrier.

Modification of genes to correct hereditary defects such as hemophilia would seem to be a desirable goal. However, once such techniques of “genetic engineering” are developed, they will be used for many other purposes and will have enormous social implications. Prospective parents would demand improvements in their potential offspring — they would want their children to be tall, strong, handsome, intelligent. Perhaps demands of this sort are reasonable, but where would we draw the line? It might not be objectionable if a couple wanted a six-foot son, but what if they wanted a seven-foot son who could become a basketball player, or an eight-foot son who could become a circus freak? What if they wanted their son to be a piano virtuoso, and demanded that he be given six fingers on each hand, or two pairs of arms?

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The present article will consider genetic engineering from a halakhic standpoint. Is gene surgery permissible? If so, what sorts of modifications would be allowed? Is it permitted to transplant genes from one person to another? If so, do we regard the resulting child as related to the donor?

GENE SURGERY

In gene surgery an ovum is removed, some of its genes are modified by microsurgical techniques, and the ovum is then replaced in the body. No donor is involved here. One could also consider the possibility of performing gene surgery on a sperm cell. However, this would require artificial insemination of the mother-to-be with the modified sperm; if it were instead somehow replaced in the man's body, there would be odds of millions to one against the particular sperm being involved in fertilization. Those who forbid artificial insemination even with the husband as donor would thus certainly not allow gene surgery on sperms. On the other hand, there seems little reason to object to the removal and replacement procedures that would be required when doing gene surgery on an ovum. Assuming, for the sake of argument, that these procedures could be carried out without rendering the woman ritually unclean, so that after replacement of the ovum (in the Fallopian tube?), normal fertilization would be permissible.

As regards the surgical process itself, we assume that it has been perfected to the point where it is (almost) always successful. Otherwise, it might be regarded as "destruction of the seed," which, according to many authorities, applies to a woman's seed as well as to a man's.¹

Given these assumptions, one could contend that all gene surgery is permissible on the grounds that genes are submicroscopic particles, and perhaps no process invisible to the naked eye could be halakhically forbidden. For example, we recall that the laws of forbidden foods do not apply to microorganisms, even though a visible forbidden creature is prohibited no matter how small it is. As a more pertinent example, surgical procedures that are forbidden on a gross scale may sometimes be

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permitted when done a small scale — autopsies by needle biopsy methods, for example. However, this argument may lead to difficulties if it is applied indiscriminately. Suppose that a woman is artificially inseminated by a single sperm, which is invisible; would the child halakhically have no father?*

Another, and perhaps stronger argument for permitting all gene surgery is that the ovum (or sperm) is not a person, since conception has not yet taken place. Thus in performing gene surgery, we are not tampering with an existing human being, but only with a potential one; we are only “cutting meat,” not doing surgery on a person. One might argue that we are destroying a potential person if we bring about the conception of a sufficiently altered creature, but in fact this is not so — even if there are drastic departures from the normal human form, the child is still halakhically human.² Indeed, even if the surgery involves replacement of natural genes by synthetic genes, the child is still human — even an entirely artificial creature is halakhically human as long as it has human-level intelligence.³

Whether or not one accepts the arguments just given, the following principle seems indisputable: Any surgery that is permitted on a person must certainly be permitted on an ovum or sperm before conception. If a surgical cure for hemophilia were possible, it would surely be permissible; thus it would certainly be permissible to cure hemophilia by gene surgery. Cosmetic plastic surgery is permitted by many authorities; they should thus also permit achieving cosmetic effects through gene surgery — assuming, of course, that the surgical procedures are safe and reliable.

Our sages recognize, and perhaps even encourage, the use of prenatal (or better: pre-conceptual) influences to improve one's offspring:

R. Yohanan used to go and sit at the gates of the place of immersion, saying: “When the daughters of Israel come out from their required

* There are, of course, cases where a child would in fact have no halakhic father — in particular, when the child is conceived by parthenogenesis (stimulation of the ovum to begin dividing without being fertilized by a sperm, a procedure which has already been used successfully in animals).

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immersion, they look at me and may have sons who are as handsome as I, and as accomplished in Torah as I."⁴

This concept might well be extended to allow the use of gene-surgical techniques to produce physically and mentally superior children.

On the other hand, turning a person into a monster by surgical means would very likely be forbidden, unless it were necessary to save his life; and creating monsters through gene surgery might thus also be forbidden. Borderline cases — unusual height, extra fingers — would probably have to be decided on an individual basis.⁵

GENE TRANSPLANTS

We now consider the case where the gene surgery involves transplanting genes from another person into the ovum or sperm. Would this be forbidden, perhaps as constituting some sort of perverted sex act between the gene donor and the recipient? Would it be forbidden, in particular, if they were close relatives? Would a child conceived from that ovum or sperm be regarded as related to the gene donor?

One could argue here too that since the genes are submicroscopic, their transplantation could not constitute a forbidden act, and they could not be halakhically recognized as a heredity mechanism. However, we have already discussed the weakness of this argument; let us therefore look into other possible lines of reasoning.

Regarding the question of permissibility, an important point should be made: The transplanted genes need not come from a reproductive cell (sperm or ovum) of the donor; they can come from any cell of his or her body. On the recipient's side too, it should be noted that the sex organs are not immediately involved, since the transplanting is done outside the body. In view of this, it seems very unlikely that the transplantation process could, by any stretch of the imagination, be regarded as a sex act.

The problem of the child's relationship to the donor, on the other hand, seems at first glance to be more complicated. Our

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sages recognize the concept of a heredity mechanism in which different parts of the body are formed out of different parts of the reproductive material:

R. Hanina B. Papa taught: "What is the meaning of the Scriptural 'You have winnowed my going and my lying' (Psalms 139:3)? It teaches that man is not formed from the entire drop, but only from its clearest part" (*Niddah* 31a).

R. Yohanan said: "The Holy One, blessed be He, forms man from a mere drop of white matter; 'You have winnowed' — like a man who winnows and puts the straw by itself, the stubble by itself, until he has purified the grain."

R. Shimon b. Lakish said: "Nor does He waste the drop; rather, he winnows out part of the drop for the brain, part of the drop for the bones, and part of the drop for the sinews."⁶

True, the parts of the "drop" are not normally regarded as having separate origins. Here, however, where we know that parts of the "drop" have come from a donor, is it possible that we might regard the child as having been generated in part by the donor?

Before discussing these problems further, let us consider an analog of gene transplantation on a much grosser scale. Suppose that ovaries are transplanted from one woman to another, or testicles from one man to another. Would this be forbidden from the recipient's standpoint? (If done from a living donor, it would surely be forbidden from the donor's standpoint, since it constitutes "castration";⁸ but this problem should not arise if the organs are removed from the donor posthumously.) Would we regard a child conceived after such a transplant as being related to the donor? If we could answer these questions in the negative, we could then certainly give negative answers to our analogous questions about gene transplants. It is impossible that transplanting submicroscopic parts of a single sperm or ovum could be more objectionable, or could have more effect on the status of a child, than transplanting entire testicles or ovaries.

SEX ORGAN TRANSPLANTS

Remarkably, the problem of sex organ transplants was actu-

ally raised in the halakhic literature during the early 20th century. (It is possible that this discussion was stimulated by the then current interest in "monkey gland" transplants for men.) A series of responsa on the subject was published in the halakhic periodical *Va-Yelaket Yosef*, edited by R. Yosef Schwartz of Bonyhad, Hungary, Vol. 10, Nos. 3, 4, 6, and 9 (5668).*

* The help of the Harvard University Library in providing photostats of these responsa is gratefully acknowledged.

The following quotations are taken from these responsa:

[From R. Yaakov Gordon of Southport (?), England]: I present here a problem about which I am in doubt as to the halakhah. The doctors here have developed a method of putting a woman's generative organs in a barren woman, so that she should be able to have children. Are we permitted to take the generative organs from a mother and put them in a daughter? And if you say that it is permitted, what is the law regarding the first born, which depends on being first to emerge from the womb, and here the womb is another woman's? And in general, who is the mother in this case, the first woman or the second?

[Answer by R. Eliezer Deutsch, head of the rabbinical court of Bonyhad]: It seems obvious to me that a prohibited sex act (*ervah*) is certainly not involved here. Indeed, even with an entire body, when dead, the laws of prohibited sex acts do not apply (*Yevamot* 25b) . . . And although it seems at first glance that [in that case], while there is no punishment, there is still a prohibition; nevertheless, one can say that this is only for a dead person, where the body is complete, and it is reasonable to rule [that sex acts are forbidden] . . . But for a single organ, such a ruling is not appropriate, and there should not even be any prohibition.

And one can convince oneself that sex act prohibitions surely apply only to a living body, not to the sex organs. For if we say that these prohibitions refer to the sex organs, then if they took generative organs from a woman who is not forbidden [to someone], and put them in a woman who is forbidden [to him], and he had sexual relations with her, he would be exempt from punishment. But if so, how could there ever be a death penalty for sexual offense? . . . If we follow the sex organs, then in any case of prohibited sex, it is possible that they have put [in the woman] generative organs from a woman who is not prohibited, and the witnesses [to the sex act] could not know this. *The Torah surely prohibited [only] the woman herself, and it makes no difference where the generative organs are from. For once the generative organs have been joined to her body, they are like*

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her body itself. And the same for a woman who is permitted to him — there too we follow only the vitality [*hiyut*] and body of the woman, and we do not care about the generative organs, for once they have been joined to her body, they are like her body.

Aside from this, sex act prohibitions do not apply to an organ, which has no life of its own, and is like a mere piece of meat; there is not even a rabbinical prohibition . . . The story of the Arab who bought a haunch in the market, made a hole in it and performed a sex act with it (*Avodah Zarah* 22a) . . . is cited only to show that they are so bound up in sexual lust that he performed a sex act with a mere haunch . . . But it is obvious that sexual prohibitions do not apply to a piece of meat. If so, in our case there is no possibility of a sexual prohibition; this is obvious, in my humble opinion . . . And similarly regarding generative organs from a woman who is sexually prohibited [that are put] into another woman, it is obvious that there is no sexual prohibition here, for it is like mere meat; there is no need to enlarge on this . . .⁹

To tell the truth, however, it is difficult for me to believe that a naturally barren woman could be helped by generative organs from another woman. It is explicit in tractate *Yevamot* (64b), on the verse "And Sarah was barren" — She did not even have a place for a child. But if we say that generative organs from another woman can help, then the Holy One, blessed be He, did not have to perform a miracle for her!

Surely the doctors are lying; if not out of respect for the questioner, I would not have replied at all. I have written on the basis of limited thought, in the time available, and only as regards the [theoretical] halakhah, not for practical application.

[Answer by R. Binyamin Aryeh ha-Kohen Weiss, chief of the rabbinical court of Tschernowitz and vicinity]:¹⁰ Regarding the method that the doctors have developed to cut generative organs from a living woman and to attach them to the body of a barren woman, so that she should be able to have children, the halakhic question has been asked: Who is the child's mother, the first [woman] or the second? And there are many legal matters that depend on this.

I am far from believing this report; nevertheless, suppose that the story can be verified. It is certainly forbidden to do this in the first place, even if there is no danger involved, because the first woman is being "castrated" . . . But if they transgressed and did it, in my humble opinion *the child is the second woman's in all respects.* And the source from which this halakhah can be derived, in my opinion, is the explicit Talmudic law (*Sotah* 43b) regarding a [branch of a] young tree that has been grafted onto an old tree, in connection with *orlah* [the prohibition of the fruit of a tree during the first three years].

Rabbi Deutsch's responsum begins by stating that the act of sex organ transplantation is not a sex act. His reasoning seems to apply not only to the case at hand, where the donor and recipient are women, but also to the case where they are men — and perhaps even to the case of a sex change operation, where a man's organs are transplanted to a woman or vice versa.¹¹ And surely his arguments hold where only genes are being transplanted.

Rabbi Deutsch further rules that once the donor's sex organs are in the recipient's body, they become part of that body. In particular, the recipient is not forbidden to marry the donor's relatives. This would presumably be true even for sex change operations; although the recipient's sex changes, his/her family relationships do not change. However, Rabbi Deutsch's principle that "we follow only the vitality and body" can lead to complications in the more extreme hypothetical case of a brain transplant. There is much evidence to support the conclusion that when A's brain is put in B's body, the halakhic identity follows the brain — the person is A, not B. But according to Rabbi Deutsch's reasoning, the person should be forbidden to marry B's relatives, not A's.¹²

In Rabbi Deutsch's responsum there is no ruling on whether a child born to the recipient of a sex organ transplant is related to the donor. Rabbi Weiss, however, rules explicitly that the child has no relationship to the donor. This conclusion, incidentally, is compatible with the possibility that in a brain transplant case, where A's brain is in B's body, the child is A's, not B's. In sex organ transplants, the organs become part of the body, and so belong to the recipient; but in a brain transplant, the body itself now belongs to the "donor" of the brain. In any event, this ruling too would surely apply in a gene transplant case.

HEREDITY AND HALAKHAH

As we have seen, genetic mechanisms and their manipulation can be treated from a halakhic standpoint. In doing so, however, let us not forget that besides the physical machinery

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of heredity, there is also a spiritual machinery:

Our sages have taught: There are three partners in a man — the Holy One, blessed be He; his father; and his mother. His father sows the white matter, from which comes bones, sinews, nails, the brain in his head and the white of the eye. His mother sows the red matter, from which come skin, flesh, blood, hair, and the black of the eye. The Holy One, blessed be He, puts into him breath, spirit, facial appearance, sight, hearing, speech, mobility, knowledge, wisdom and understanding.¹³

Moreover, this spiritual heredity is at least as important as the physical:

One who raises an orphan in his house is regarded by Scripture as if he had given birth to him . . . One who teaches his friend's son Torah is regarded by Scripture as if he had given birth to him.¹⁴

A father endows (*zokheh*) a son with beauty, strength, wealth, wisdom, and longevity.¹⁵ But the sages say: Until he comes of age, his father endows him; thereafter, he endows himself.¹⁶

The father's influence on his son is not a mere matter of physical heredity or fiscal inheritance — it is also a matter of spiritual merit (*zekhut*). As we move into an era of genetic engineering, when fathers may be able to choose and control the qualities of their children, let us hope that we do not forget our ultimate dependence on the merit of our forefathers and on our Father in Heaven.

NOTES

1. See commentaries on *Niddah* 13a, particularly Ramban and Rashba.
2. On this point see Responsa *Teshuvah Me-Ahavah*, No. 53 quoted in my article "Religion and the Robot," *TRADITION*, Fall 1966, pp. 15-26.
3. *Ibid.*
4. *Berakhot* 20a; *B.M.* 84a. The Roman notables used to hold beautiful figures while engaging in sexual relations (*Gittin* 58a. See also *Midrash Ba-Midbar Rabbah* 9:34, where the fact that an Ethiopian couple produced a white child is ascribed to their house having white figures in it. On analogous procedures involving animals see *Genesis* 30:37 ff. and *Avodah Zarah* 24a).

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5. See, incidentally, Responsa *Tashbetz* Pt. IV, No. 49: "The doctors have said that when the material [in the womb] becomes abundant, it is a sign of twins or of an extra finger; and if the material is bad, the form of a frog may be added there — may Ha-Shem save us!"

6. *Va Yikra Rabbah* 14.

7. See *Chulin* 69a: R. Yirmiah asked, "Does organ generate organ, or is it the seed mixed?" He later said, "Obviously the seed is mixed; otherwise the blind would have blind children and the lame would have lame children."

8. *Shulchan Arukh Even ha-Ezer* 5:11.

9. In a passage not quoted here, Rabbi Deutsch also discusses the status of the child as regards the law of the firstborn. The Talmud is in doubt (*Chulin* 70a) whether it is contact with the womb or containment within the womb that sanctifies the firstborn. In our case, the child touches only the donor's transplanted womb but is also contained in the recipient's body; thus the child is only a doubtful (*safek*) firstborn.

10. This responsum appears also as No. 29 in Rabbi Weiss' collected responsa *Even Yekarah*, published in 1911.

11. On the possibility that the halakhah would recognize the effectiveness of a functional sex change operation see my article "The Heart, the Head, and the Halakhah," *New York State Journal of Medicine* 70, October 15, 1970, pp. 2615-2619. See also *Yerushalmi Berakhot* 9:3; *Bereshit Rabbah* 72; and especially *Tanchuma Va-Yetze* 8: "It is not difficult for the Holy One, blessed be He, to make females into males and males into females."

12. See my article cited in note 11.

13. *Niddah* 31a; see also *Yerushalmi Kilayim* 8:3.

14. *Sanhedrin* 19b.

15. *Eduyot* 2:9.

16. *Tosefta Eduyot* 1:14.