

# Judaism, Genetic Screening and Genetic Therapy

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**BEGINNING OF REQUIRED READING FOR PART 1 (UNTIL PAGE 4)**

## Abstract

Genetic screening, gene therapy and other applications of genetic engineering are permissible in Judaism when used for the treatment, cure, or prevention of disease. Such genetic manipulation is not considered to be a violation of God's natural law, but a legitimate implementation of the biblical mandate to heal. If Tay-Sachs disease, diabetes, hemophilia, cystic fibrosis, Huntington's disease or other genetic diseases can be cured or prevented by "gene surgery," then it is certainly permitted in Jewish law. Genetic premarital screening is encouraged in Judaism for the purpose of discouraging at-risk marriages for a fatal illness such as Tay-Sachs disease. Neonatal screening for treatable conditions such as phenylketonuria is certainly desirable and perhaps required in Jewish law. Preimplantation screening and the implantation of only "healthy" zygotes into the mother's womb to prevent the birth of an affected child are probably sanctioned in Jewish law. Whether or not these assisted reproduction techniques may be used to choose the sex of one's offspring, to prevent the birth of a child with a sex-linked disease such as hemophilia, has not yet been ruled on by modern rabbinic decisions. Prenatal screening with the specific intent of aborting an affected fetus is not allowed according to most rabbinic authorities, although a minority view permits it "for great need." Not to have children if both parents are carriers of genetic diseases such as Tay-Sachs is not a Jewish option.

Preimplantation screening is preferable. All screening test results must remain confidential. Judaism does not permit the alteration or manipulation of physical traits and characteristics such as height, eye and hair color, facial features and the like, when such change provides no useful benefit to mankind. On the other hand, it is permissible to clone organisms and microorganisms to facilitate the production of insulin, growth hormone, and other agents intended to benefit mankind and to cure and treat diseases.

Key Words: Premarital screening, genetic diseases, Judaism

## Introduction

Genetic information about a person's health and health prospects can be inferred from family history or by direct genetic testing. Such testing can involve sophisticated molecular analysis for the mutant gene (e.g., cystic fibrosis) or simple biochemical (e.g., hypercholesterolemia), enzymatic (e.g., Tay-Sachs disease), hematological (e.g., Sickle cell diseases), or chromosomal (e.g., Down's syndrome) analysis of blood or body fluids or tissues.

Points to consider before embarking on carrier screening programs include the nature and frequency of the disorder and availability and effectiveness of treatment, community perception of the disorder and attitudes to screening, motivation for screening, how the test is done and what the results mean, obtaining informed consent

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and maintaining confidentiality of results, when to screen, education before screening, possible stigmatization and discrimination, and the organization of the screening program (1). The Council on Ethical and Judicial Affairs of the American Medical Association has addressed ethical issues related to prenatal genetic testing (2), genetic testing by employers (3) and insurers (4), and carrier screening for cystic fibrosis and other disorders (5).

How does society control the way genetic information is obtained and used? How does society monitor and review genetic screening programs? What criteria should be set to make maximum use of the potential good that the Human Genome Project offers, without infringing on the ethical and legal principles of privacy, autonomy, beneficence, confidentiality and nondiscrimination? Who owns genetic information? How should genetic information be used? Who decides which people should be screened? Are there or should there be limits to preimplantation, prenatal and neonatal screening? How should employers and insurers receive and use genetic information? Do we have sufficient data to judge the pros and cons of genetic testing and screening? The Orthodox Jewish community relies on the traditional use of biblical and talmudic law and rabbinic responsa to answer such questions. This approach is described in this essay on traditional Jewish views on genetic issues.

The genetic testing and counseling of children and adolescents is associated with special ethical, legal and psychological implications (6). The risks and benefits of testing have to be assessed to determine whether it is in the child's best interests to be tested (7).

**[The following section, in red, is not required reading for the Jerusalem Science Contest]**

## **Specific Examples**

### **Breast Cancer**

About 5 or 10% of all breast cancer cases are hereditary. The breast cancer genes known as BRCA1 and BRCA2 are responsible for most inherited breast cancer, especially in women who develop the disease before the age of 40 years. The BRCA1 mutation known as 185delAG is found in approximately 1% of the Ashkenazi Jewish population (8) and in 20% of Ashkenazi Jewish women who develop breast cancer before 40 (9) or 42 (10) years of age. This gene is also associated with an increased risk of ovarian cancer. These findings and observations are cause for concern (11). Early interventions may be appropriate in high-risk women who test positive (e.g., more frequent breast examination and mammography, prophylactic mastectomy, hormone prophylaxis). There are many other issues of concern, including confidentiality; access; autonomy; and informing the patient about the implications of a positive or negative test, including its technical accuracy and cost.

The availability of a test does not require that it be offered universally. The American Society of Clinical Oncology recommends that cancer predisposition testing be offered only when the person has a strong family history of cancer or very early age of onset of disease, when the test can be interpreted adequately, and when the results will influence the medical management of the patient or family member (12). However, many other prestigious organizations emphasize that BRCA1 testing remains a research activity for the time being (13). The pitfalls of genetic testing (14) and the psychological issues in testing for breast cancer susceptibility (15) should not be minimized. People at risk must fully understand the risks, benefits, and limitations of genetic testing, the risk of psychological harm, and the possibility of insurance discrimination and subsequent loss of health care coverage, before they undergo testing (16).

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## Tay-Sachs Disease

Debates continue about the screening of large populations of Jewish people for the carrier state of Tay-Sachs disease to prevent the inappropriate marriage of two carriers. Also controversial is the performance of amniocentesis for the prenatal detection of the fatal disease, with the subsequent possible abortion of an affected fetus. Selected termination of affected fetuses may not be acceptable in Judaism, although some rabbis might sanction it. Mass screening programs may produce a psychological burden on those young people who screen positive. Should a carrier of the Tay-Sachs gene refuse to marry an individual who has not been tested? Should a couple break up their engagement if they learn that both are carriers? Should a young person inquire about the Tay-Sachs status of a member of the opposite sex prior to meeting that individual on a social level? Must a person who knows he or she is a carrier divulge this fact to an intended spouse? The stigma of being a carrier of the Tay-Sachs gene may not be fully appreciated. Misinformed or uninformed people may shun and ostracize such carriers. Job and insurance discrimination is also possible if confidentiality of testing results is not assured. If the purpose of Tay-Sachs screening is to provide information and genetic counseling about mating and reproductive options, few will oppose screening. If the purpose, however, is to suggest prenatal diagnosis with the specific intent of recommending abortion of affected fetuses, religious and moral objections might be raised. Preimplantation diagnosis of in vitro fertilized eggs, with the discarding of affected zygotes, if any, avoids the issue of pregnancy termination since pregnancy in Judaism does not begin until zygote implantation into the wall of the uterus.

## Genetics and Eugenics in Classic Jewish Sources

Ancient Jewish writings, including the Bible and Talmud, are not devoid of material relating to genetics. One writer describes in some detail how the laws of Mendelian genetics were applied by Jacob in the biblical narrative (Genesis 30:32 ff) of the speckled and spotted sheep (17). Hemophilia and its precise genetic transmission is described in the Talmud (Yebamot 64b). The Sages in the Talmud and subsequent rabbinic authorities had a remarkable knowledge of the genetics of this sex-linked disorder (18). All rabbis recognized that females transmit the disease but do not suffer from it. A few rabbis also considered the possibility of its transmission through males.

Elsewhere (Ketubot 10b), the Talmud portrays a family whose women had hereditary absence of menstruation and no blood of virginity, and were obviously childless. The exact nature of the anatomical or physiological abnormality is not described.

It is prohibited in Jewish law to marry a woman from a family of epileptics or lepers (Yebamot 64b; Maimonides' Mishneh Torah, Issurei Biyah 21:30; Karo's Shulchan Aruch, Even Haezer 2:7) lest the illness be genetically transmitted to future generations. According to Rashi (Yebamot 64b), any hereditary disease is included in this category. This Talmudic ruling (19a) may well represent the first eugenic enactment, and the only legislative bar to the procreation of a diseased progeny, in ancient and even medieval times. On the basis of the higher frequency of defective births resulting from unions among blood relatives, Rabbi Judah the Pious, in his ethical will, prohibited marriages between first cousins and between uncles and nieces. Yet such marriages are sanctioned in the Bible and expressly encouraged in the Talmud (Yebamot 62b and Sanhedrin 76b). Since consanguineous marriage increases the probability of birth defects, some rabbis ban such marriages (20, 21), while others strongly caution against them (22 & 24).

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Genetic disease was recognized by Maimonides, who prescribes a regimen of health for all Jews to remain healthy, since one cannot serve the Lord when one is ill (Mishneh Torah, Deot 4:1). He guarantees that anyone who follows his regimen will be healthy all his life, except for those who were born with hereditary or genetic defects (Ibid. 4:20).

**END REQUIRED READING FOR PART 1**

## The Genome Project and Judaism

Is the genome project an encroachment on the Divine plan for this world by interfering with nature as God created it? Would genetic engineering tamper with the Divine arrangement of Creation? Although one rabbi answers in the affirmative (25), most rabbis consider the acquisition of knowledge for the sake of finding cures for human illnesses to be divinely sanctioned, if not in fact mandated. God blessed mankind with the phrase: replenish the earth and subdue it (Genesis 1:28).

This phrase is interpreted by Nachmanides (Ramban) to mean that God gave man dominion over the world to use animals and insects and all creeping things for the benefit of mankind (Ramban, Genesis 1:28). To subdue the earth, according to Samson Raphael Hirsch (Hirsch, Genesis 1:28), is to master, appropriate, and transform the earth and its products for human purposes. To have dominion over the fish and over the birds and over every living thing on earth (Genesis 1:28) means to use them for the benefit of mankind. The pursuit of scientific knowledge does not constitute prohibited eating from the tree of knowledge (Genesis 2:17). Whatever is good for mankind must be permissible and praiseworthy. However, good often is not pure good, but may contain potentially dangerous elements. Although the genome project is intended to cure diseases, it has raised many concerns.

In the general introduction to his Commentary on the Mishnah (26), Moses Maimonides discusses the existence and purpose of all living and inanimate things in the world. He clearly enunciates the thesis that the purpose of everything that God put on this earth is to serve mankind. Thus, scientific experiments on laboratory animals, during the course of medical research that might find cures for human illnesses, are sanctioned in Jewish law as legitimate utilization of animals for the benefit of mankind (27). However, whenever possible, pain or discomfort should be avoided or minimized in order not to transgress the prohibition in Jewish law against cruelty to animals.

King David said that The heavens are the Lord's heavens but the earth He has given to mankind (Psalms 115:16), further supporting the concept that knowledge and its pursuit are legitimate activities for human beings and not considered an encroachment upon Divine prerogatives. Thus, therapeutic genetic engineering and gene therapy that may result from the knowledge derived from the genome project do not undermine God's creation of the world by manipulating nature (Ramban, Leviticus 19:19). On the contrary, it is a legitimate modification of the natural order. The use of scientific knowledge to benefit mankind is biblically mandated (Ramban, Genesis 1:28). The use of such knowledge to heal illness and cure disease is also allowed biblically, based on the Talmudic interpretation (Baba Kamma 85a) of the phrase and heal he shall heal (Exodus 21:19), or even biblically mandated, based on Maimonides' interpretation (Mishnah Commentary, Nedarim 4:4) of the biblical obligation to restore a lost object (Deuteronomy 22:2) to include the restoration of one's lost health. The healing of illness

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includes the use of genetically engineered medications such as insulin and various antibiotics. The cure of disease by gene therapy, if possible, is also sanctioned in Jewish law.

## Genetic Screening and Judaism

Many years ago, Rabbi Moshe Feinstein (28) was asked whether or not it is advisable for a boy or girl to be screened for Tay-Sachs disease and, if it is proper, at what age the test should be performed. His answer was:

“. . . it is advisable for one preparing to be married, to have himself tested. It is also proper to publicize the fact, via newspapers and other media, that such a test is available. It is clear and certain that absolute secrecy must be maintained to prevent anyone from learning the result of such a test performed on another. The physician must not reveal these to anyone . . . these tests must be performed in private, and, consequently, it is not proper to schedule these tests in large groups as, for example, in Yeshivas, schools, or other similar situations.”

Rabbi Feinstein (29) also points out that most young people are quite susceptible to nervous tension or psychological stress and, therefore, young men (below age 20) and women (below age 18) not yet contemplating marriage should not be screened for Tay-Sachs disease. Finally, Rabbi Feinstein strongly condemns abortion for Tay-Sachs disease and even questions the permissibility of the amniocentesis which proves the presence of a Tay-Sachs fetus, since amniocentesis is not without risk, albeit small.

Rabbi J. David Bleich (30) indicates that the elimination of Tay-Sachs disease is, of course, a goal to which all concerned individuals subscribe. He points out, however, that the obligation with regard to procreation is not suspended simply because of the statistical probability that some children of the union may be deformed or abnormal. While the couple may quite properly be counseled with regard to the risks of having a Tay-Sachs child, according to Jewish law (Halachah) the failure to bear natural children is not a viable alternative. He further voices concern that if the fetus is found to have Tay-Sachs disease by prenatal testing, abortion may not be sanctioned in Jewish law. Rabbi Bleich concludes that screening programs for the detection of carriers of Tay-Sachs disease are certainly to be encouraged. He suggests that the most propitious time for such screening is childhood or early adolescence, since early awareness of a carrier state, particularly as part of a mass screening program, is advantageous. He is critical of Rabbi Waldenberg, pointing out that the latter's permissive ruling on abortion for Tay-Sachs disease is contrary to the decisions of other contemporary rabbinic scholars, including Rabbi Feinstein.

Two methods now exist for totally eliminating the need for prenatal screening for Tay-Sachs disease and thus averting the serious halachic objections to abortion if the fetus should be found to be affected.

The first method is to perform confidential premarital screening and to strongly discourage the marriage of two carriers. This approach, widely utilized in many Orthodox Jewish communities, is sponsored by the Dor Yeshorim organization (160 Wilson Street, Brooklyn, NY 11211, [718] 384-6060), which claims to have tested more than 70,000 people and identified more than 100 at-risk couples, who were advised not to marry. In the United States, the program has significantly reduced the number of Jewish babies born with the disease. And in Israel, a similar screening program has resulted in no Tay-Sachs children being born to newlywed couples in the ultra-Orthodox Ashkenazi Jewish community in over 10 years (31).

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The second method of preventing the birth of a baby with Tay-Sachs disease, hemophilia, or Huntington's disease is to perform preimplantation screening of in vitro fertilized zygotes if both husband and wife are known carriers and to use only the unaffected ones for implantation. Whether one may screen these in vitro fertilized zygotes for genetic diseases has yet to be ruled on decisively by modern rabbinic authorities. However, in vitro fertilization is sanctioned by many rabbis for couples who cannot conceive in the normal way (32). Moreover, the discarding of the affected zygotes would not be considered abortion, since Jewish law considers life to begin only when the living embryo has become implanted in the mother's womb and continues to grow.

It is not clear whether Judaism sanctions genetic screening for diseases for which no effective treatment yet exists. The rabbis are greatly concerned about the emotional burden (*tiruf hadaat*) that such knowledge may place upon a person found to have the gene for Huntington's disease in the presymptomatic stage. Judaism would not sanction amniocentesis or chorionic villi sampling to rule out Huntington's disease if the only purpose is to abort the fetus if it is found to be affected.

However, preimplantation screening of Huntington's disease and choosing only unaffected zygotes for implantation may be permissible, to prevent the birth of an affected child, as described above for the prevention of Tay-Sachs disease. The same permissive view might apply to the prevention of hemophilia births by preimplantation screening.

Newborn screening for treatable diseases such as phenylketonuria and congenital hypothyroidism should certainly be done. Judaism subsumes such testing under the biblical and rabbinic mandates to seek healing from the medical profession.

Judaism requires that confidentiality of test results for all types of genetic screening be maintained. The prohibitions in Judaism against talebearing (Leviticus 19:16) and evil gossip (Psalms 34:14) are discussed at length in the Talmud (Yoma 4b, Sanhedrin 31a) and in the Codes of Jewish law such as Maimonides' *Mishneh Torah* (Deot 7:2). An entire book was written on this subject by Rabbi Israel Meir Hakohen of Radin, popularly known as "Chafetz Chayim" (33).

Whenever the physician obtains confidential medical information, genetic or otherwise, he is forbidden to disclose that information or share it with anyone, including the patient's family and even professional colleagues, if no benefit to the patient would result. However, if keeping confidence might impact adversely on the health of another person, the latter may be informed. In Jewish law, a person who is the carrier of a serious and potentially lethal genetic disorder is obligated to divulge that information to a prospective spouse.

More difficult to resolve is the question as to whether or not an Ashkenazi Jewish woman with the gene for breast cancer BRCA1 or BRCA2 is obligated to tell that to a prospective spouse or to her husband if she is already married. Modern rabbinic authorities have not yet ruled on whether it is even appropriate to test for that gene in all Jewish women. It may be reasonable to do so in women with very strong family histories of breast cancer. But to what end? If they are found not to have the gene, the risk of developing breast cancer is still high. But women found to be positive for the gene may wish to take action such as more frequent mammography, prophylactic

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hormonal treatment, or even prophylactic mastectomies. Current rabbinic authorities need to address how such matters might impact on therapeutic choices within the context of Judaism.

## Gene Therapy and Genetic Engineering

The literature in Jewish law on gene therapy and genetic engineering is very sparse indeed. Two rabbinic articles with genetic engineering in their titles (34, 35) deal primarily with artificial insemination, in vitro fertilization and surrogate motherhood, and only briefly mention cloning. The production of hormones such as insulin and erythropoietin, and antibiotics and other therapeutic substances, by genetic engineering through recombinant DNA technology is certainly permissible in Jewish law, because nature is being used properly by man to his benefit in the treatment and cure of illnesses. Gene therapy, such as the replacement of the missing enzyme in Tay-Sachs disease and the missing hormone in diabetes, and the repair of the defective gene in hemophilia or Huntington's disease, if and when these become scientifically feasible, are also probably sanctioned in Jewish law, because they are done with the intention of restoring health, and preserving and prolonging life. The technical medical problems of modifying the defective gene or genes in an individual sperm, ovum or zygote by gene surgery and implanting the replaced or repaired genes into the mother in order to produce a healthy child have not yet been surmounted. However, assuming such surgery can be performed successfully, gene surgery will probably be sanctioned by rabbinic authorities as a legitimate implementation of the mandate on physicians to heal the sick.

Another argument favoring the permissibility of gene surgery or genetic manipulation is the fact that neither the sperm nor ovum nor even the fertilized zygote is a person. Thus, gene manipulation is not considered to be tampering with an existing or even a potential human being, since that status in Jewish law is only bestowed upon a fetus implanted in the mother's womb. One can also argue that any surgery performed on a live human being must certainly be permitted on a sperm or ovum or fertilized zygote. For example, if a surgical cure for hemophilia, Tay-Sachs disease or Huntington's disease were possible, it would surely be permissible. Hence, it should certainly be permissible to cure or prevent these diseases by gene surgery.

Rabbi Moshe Hershler (25) warns against blinding ourselves to the potential of genetic engineering and gene therapy, which is no longer a dream or a fantasy but becoming a medical and scientific reality. Hershler raises the question of the permissibility (or lack thereof) of experimenting with gene therapy to try to save the life of a child with thalassemia or Tay-Sachs disease if the unsuccessful outcome of the experimentation would be a shortening of the child's life. Hershler is of the opinion that gene therapy and genetic engineering may be prohibited because Ahe who changes the [Divine] arrangement of creation is lacking faith [in the Creator],@ and he cites as support for his view the prohibition against mating diverse kinds of animals, sowing together diverse kinds of seeds, and wearing garments made of wool and linen (Leviticus 19:19). This line of reasoning is rejected by Rabbis Shlomo Zalman Auerbach and Yehoshua J. Neuwirth (36), since genetic engineering does not seem to be comparable to the grafting of diverse types of animals or seed. The main purposes of gene therapy are to cure disease, restore health, and prolong life, all goals within the physician's Divine license to heal. Gene grafting is no different than an Aorgan graft,@ such as a kidney or corneal transplant, which nearly all rabbis consider permissible.

Ethical and halachic problems associated with genetic engineering include "speciation". Does a certain species lose its identity if other genes are introduced into it? Would the citron or ethrog (*Citrus medica* Linn) used on the

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Tabernacles holiday (Sukkot) for religious purposes lose its identity if lemon genes were introduced into it? How many transplanted lemon genes are needed to consider the ethrog to be a lemon? Can the rabbinic concept of nullification (bitul), whereby one part of a prohibited substance becomes nullified if mixed within sixty parts of a permitted substance, be applied to this situation? Another example is the need for fins and scales for fish to be kosher for consumption. If genes introduced in a scaleless catfish induce scalation, does the catfish then become a kosher fish? Yet another example is the conversion by genetic engineering of annual plants into perennials. The latter are not subject to some of the laws of the Sabbatical year. thus, perennial wheat, corn or tomatoes would be permitted in Jewish law even if grown during the Sabbatical year. These problems and issues have not yet been decisively discussed and resolved by current halachic authorities.

It seems clear that genetic engineering and gene therapy can and should be used to promote the human condition and treat, cure and prevent disease. But should these techniques be allowed to alter human traits such as eye color, height, personality, intelligence and facial features?

The Talmud relates (Pesachim 54a) that God inspired Adam with a type of Divine knowledge, and he took two heterogeneous animals and crossed them and created a mule. Elsewhere, the Talmud asks (Chullin 7b) why they are called mules (Hebrew yemim) and answers “because they cast fear [Hebrew emah] upon men.” This inappropriate use of nature by Adam is what Ramban condemns in his biblical commentary (Leviticus 19:19) as “changing and denying the Divine creation of the world”.

There is no specific halachic prohibition against attempting to clone a human being. An example of the creation of an artificial human being or golem is cited in the Talmud (Sanhedrin 65b). The golem, however, was not formed in and born from a woman’s womb. It was therefore not considered to be human and was destroyed without that being considered an act of murder. A cloned human being, on the other hand, has the full status of a human being. Although it is not prohibited in Jewish law to clone a human being, one should be very cautious and not do so indiscriminately. Many potential scientific and Jewish legal problems would first need to be dealt with. The risks of producing serious birth defects through human cloning are not known. In Judaism, paternity is determined by the sperm (37). But in human cloning, no sperm is used; so who is the father? The possible deleterious effects of genetic engineering and gene therapy are not yet fully known. And in addition to the medical and scientific aspects of genetic engineering, DNA recombinant research and human cloning, the spiritual and theological aspects also require exploration. Rabbis must examine these issues from the Jewish viewpoint and offer halachic guidance to the medical and lay communities.

## Conclusion

Genetic screening, gene therapy and other applications of genetic engineering are permissible in Judaism when used for the treatment, cure, and prevention of disease. Such genetic manipulation is not considered to be a violation of God’s natural law but a legitimate implementation of the biblical mandate to heal. According to Jewish law, if Tay-Sachs disease, diabetes, hemophilia, cystic fibrosis, Huntington’s disease or other genetic diseases can be cured or prevented by “gene surgery”, it is certainly permitted.

Genetic premarital screening is encouraged in Judaism for the purpose of discouraging at- risk marriages for a fatal illness such as Tay-Sachs disease. Neonatal screening for treatable conditions such as phenylketonuria is

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certainly desirable and even required under Jewish law. Preimplantation screening and the use of only unaffected zygotes for implantation into the mother's womb to prevent the birth of an affected child is probably sanctioned in Jewish law. Whether or not these assisted reproduction techniques can be used to choose the sex of one's offspring to prevent the birth of a child with a sex-linked disease such as hemophilia has not yet been ruled on by modern rabbinic authorities (38). Prenatal screening with the specific intent of aborting an affected fetus is not allowed according to most rabbinic authorities, although a minority view permits it "for great need".

Not to have children if both parents are carriers of genetic diseases, such as Tay-Sachs, is not a Jewish option. Preimplantation screening is preferable. All screening test results must remain confidential. To improve physical traits and characteristics such as height, eye and hair color, facial features and the like, is frowned upon in Judaism if it serves no useful medical or psychological purpose. The cloning of man is not prohibited as a violation of the Divine arrangement of the world and the creation of man in the image of God. However, Lord Rabbi Immanuel Jakobovits (19) expresses sentiments which we should all take to heart:

"It is indefensible to initiate uncontrolled experiments with incalculable effects on the balance of nature and the preservation of man's incomparable spirituality without the most careful evaluation of the likely consequences beforehand . . . . "Spare part" surgery and "genetic engineering" may open a wonderful chapter in the history of healing. But without prior agreement on restraints and the strictest limitations, such mechanization of human life may also herald irretrievable disaster resulting from man's encroachment upon nature's preserves, from assessing human beings by their potential value as tool-parts, sperm donors or living incubators, and from replacing the matchless destiny of the human personality by test-tubes, syringes and the soulless artificiality of computerized numbers. Man, as the delicately balanced fusion of body, mind and soul, can never be the mere product of laboratory conditions and scientific ingenuity."

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