

HALACHIC AND HASHKAFIC ISSUES IN CONTEMPORARY SOCIETY

59 - JUDAISM AND THE UNBORN CHILD **GENETIC MODIFICATION AND SELECTION OF EMBRYOS** **OU ISRAEL CENTER - SUMMER 2017**

In Breakthrough, Scientists Edit a Dangerous Mutation From Genes in Human Embryos

By PAM BELLUCK AUG. 2, 2017

Scientists for the first time have successfully edited genes in human embryos to repair a common and serious disease-causing mutation, producing apparently healthy embryos, according to a study published on Wednesday.

The research marks a major milestone and, while a long way from clinical use, it raises the prospect that gene editing may one day protect babies from a variety of hereditary conditions.

But the achievement is also an example of human genetic engineering, once feared and unthinkable, and is sure to renew ethical concerns that some might try to design babies with certain traits, like greater intelligence or athleticism.

Scientists have long feared the unforeseen medical consequences of making inherited changes to human DNA. The cultural implications may be just as disturbing: Some experts have warned that unregulated genetic engineering may lead to a new form of eugenics, in which people with means pay to have children with enhanced traits even as those with disabilities are devalued.

The study, published in the journal *Nature*, comes just months after a national scientific committee recommended new guidelines for modifying embryos, easing blanket proscriptions but urging the technique be used only for dire medical problems.

"We've always said in the past gene editing shouldn't be done, mostly because it couldn't be done safely," said Richard Hynes, a cancer researcher at the Massachusetts Institute of Technology who co-led the committee. "That's still true, but now it looks like it's going to be done safely soon," he said, adding that the research is "a big breakthrough."

"What our report said was, once the technical hurdles are cleared, then there will be societal issues that have to be considered and discussions that are going to have to happen. Now's the time."

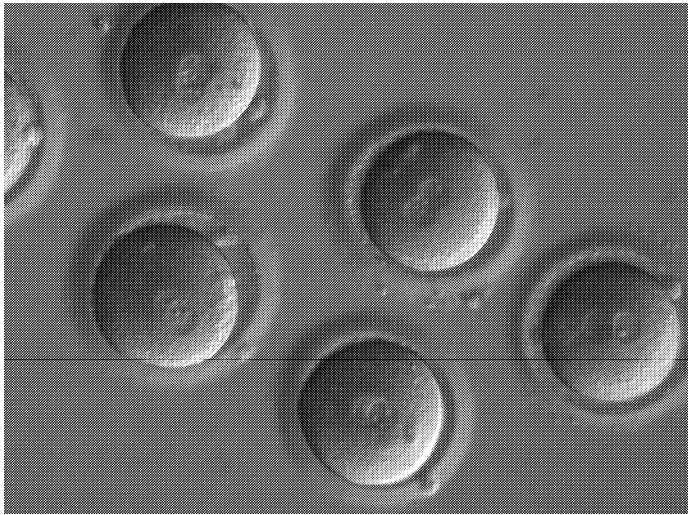
Scientists at Oregon Health and Science University, with colleagues in California, China and South Korea, reported that they repaired dozens of embryos, fixing a mutation that causes a common heart condition that can lead to sudden death later in life.

If embryos with the repaired mutation were allowed to develop into babies, they would not only be disease-free but also would not transmit the disease to descendants.

The researchers averted two important safety problems: They produced embryos in which all cells — not just some — were mutation-free, and they avoided creating unwanted extra mutations.

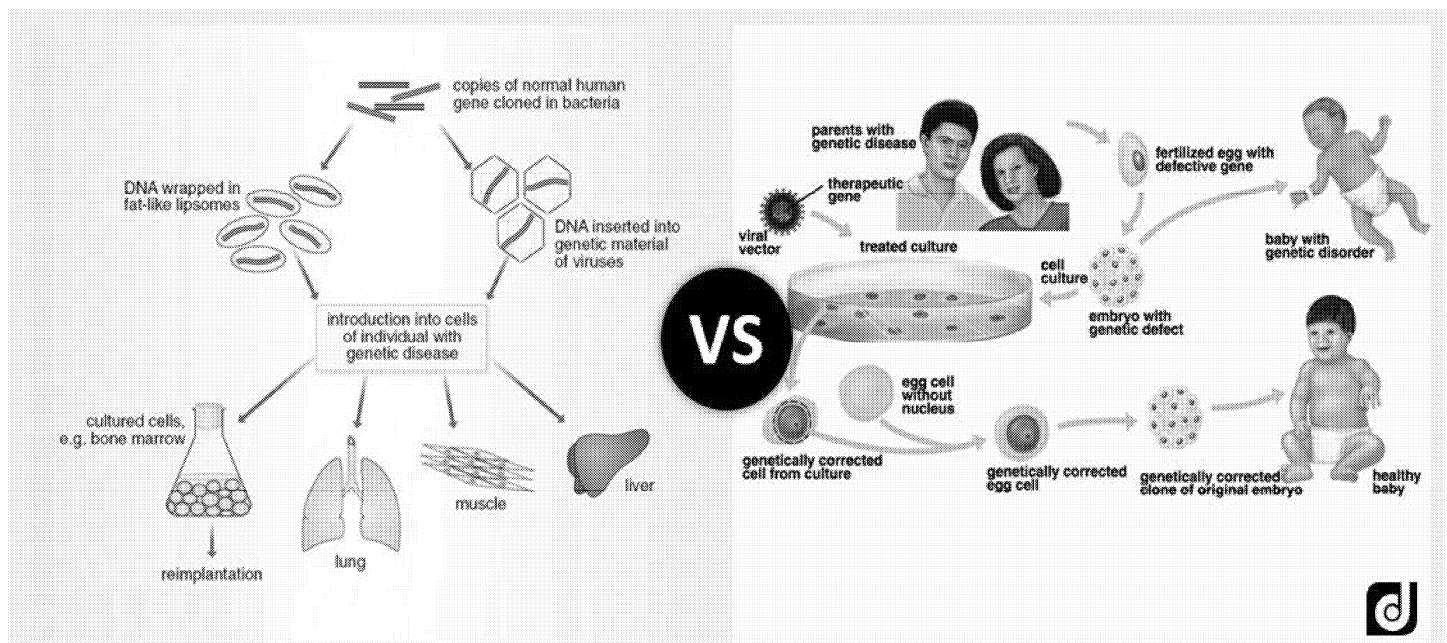
"It feels a bit like a 'one small step for (hu)mans, one giant leap for (hu)mankind' moment," Jennifer Doudna, a biochemist who helped discover the gene-editing method used, called CRISPR-Cas9, said in an email.

The New York Times
2 August 2017



Left: Newly fertilized eggs before gene editing. Right: Embryos after gene editing and a few rounds of cell division¹

A] WHAT IS GERMLINE GENE THERAPY?



Somatic Gene Therapy vs. Germline Gene Therapy

Gene therapy is technique in which nucleic acid polymers are delivered into a patient's cell. This technique is used to treat diseases just like drugs, which is why genes used in gene therapy are called 'drug genes'. Gene therapy can be either somatic gene therapy or germline gene therapy. In somatic gene therapy, the drug genes are introduced in the somatic cells of the body. When drug genes are introduced in the germ cell or zygotes it is called germline gene therapy. Changes in somatic gene therapy are not heritable while in germline gene therapy changes are heritable.²

1. Credit Shoukhrat Mitalipov

2. See <http://www.differencebtw.com/difference-between-somatic-gene-therapy-and-germline-gene-therapy/>

B] ETHICAL AND RELIGIOUS ISSUES

Ethical Issues are often raised, including the following:

- How can 'good' and 'bad' uses of gene therapy be distinguished?
- Who decides which traits are 'normal' and which constitute a 'disability' or 'disorder'?
- Will the high costs of gene therapy make it available only to the wealthy?
- Could the widespread use of gene therapy make society less accepting of people who are different?
- Should people be allowed to use gene therapy to enhance basic human traits such as height, intelligence, or athletic ability?
- Should people be allowed to select male or female embryos on the basis of sex?
- Is this a next step to human cloning?

In wider society, Religious Issues are often raised, including the following:

- Are human beings 'Playing God'? Is there a limit to how much humans can interfere with nature?
- How do hubris and humility play out in radical technological developments?
- What is the status of fertilized eggs? Are they human in any way? Are there limits to what we can do with them?
- What is the role of religious leaders in this area?

C] META-HALACHIC PERSPECTIVES

1. א"ר ישמעאל אלעזר בן עזריה עליך ראייה ללמד שאתה מחמיר שכל המחמיר עליו ראייה ללמד (תפארת ישראל - שכל דבר שלא נדע טעם לאסרו, מותר הוא בלי טעם, דלא בזכירה התורה דברים המותרים כולן, רק דברים האסורים)

משנה ידים פרק ד משנה ג ותפארת ישראל שם ס"ק כז

The Torah specifies what is NOT permitted. In the absence of such a prohibition, the assumption will be that the act in question is permitted!

D] HASHKAFIC PERSPECTIVES

D1] GENERAL PERSPECTIVES ON INNOVATION

2. וכך יפה לנו שלא להבעית את ישראל בחדשות שלא שער אבותינו, ומלתי כבר אמורה החדש אסור מן התורה בכל מקום שו"ת חתם סופר חלק א (אורח חיים) סימן קפא

The Chatam Sofer was famous for a more conservative position on many issues - trying to avoid new innovations in Jewish practice. However, that does NOT mean that the Chatam Sofer was opposed to addressing the impact of new technology on halacha.³ His concerns were more with the gradual encroachment on Minhag Yisrael.

3. הישן יתחדש והחדש יתקדש, ויחדו יהיו לאבוקות אורים על ציון

אגרות ראייה א' קסד (עמ' ריד)

Rav Kook famously saw innovation as an opportunity for increasing kedusha in the world⁴.

3. In fact, he was famously in favor of using the innovation of the long slow-burning fuse on Shabbat, so that a fuse could be lit before Shabbat, slowly burn, and then kindle wood which would heat up food on Shabbat morning.

4. This statement was made about cultural innovation. It does not of course mean that Rav Kook was necessarily in favour of halachic leniency in areas of technological innovation. For more on Rav Kook's approach see below and also Orot Hakodesh 2, Hamegama Haelyona 33, page 563 and Orot Hatechiya sections 16 and 30.

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D2] THE ROLE OF MANKIND IN TECHNOLOGICAL INNOVATION

4. וזו שאלה שאל טורנוסרופוס הרשע את ר"ע: אם אלקיכם אוהב עניים הוא, מפני מה אינו מפרנסם? א"ל: כדי שניצול אנו בהן מדינה של גיהנם. א"ל: אדרבה, זו שמחייבתן לגיהנם! אמשול לך משל, למה הדבר דומה? למלך בשר ודם שכעס על עבדו וחבשו בבית האסורין, וצוה עליו שלא להאכילו ושלא להשקותו, והלך אדם אחד והאכילו והשקהו, כששמע המלך לא כועס עליו? ואתם קרוין עבדים, שנאמר: (ויקרא כ"ה) **כִּי לִי בְנֵי יִשְׂרָאֵל עֲבָדִים**! אמר לו ר"ע: אמשול לך משל, למה הדבר דומה? למלך בשר ודם שכעס על בנו וחבשו בבית האסורין, וצוה עליו שלא להאכילו ושלא להשקותו, והלך אדם אחד והאכילו והשקהו, כששמע המלך לא דורון משגר לו? ואנן קרוין בנים, דכתיב: (דברים י"ד) **בָּנִים אַתֶּם לַה' אֱלֹהֵיכֶם**

בבא בתרא י.

R' Akiva and the Roman, Turnus Rufus are presented as debating a major philosophical issue: if God has decreed that a person be poor, who are we to interfere and give them tzedaka?! Similarly, if people are ill or unable to have children, who are we to intervene and enable them to have children?! R' Akiva answers that, as His children, God wants us to be actively involved in helping one another.

5. פילוסופוס אחד שאל את רבי הושעיה, א"ל אם חביבה היא המילה מפני מה לא נתנה לאדם הראשון, א"ל ... כל מה שנברא בששת ימי בראשית צריכין עשייה, כגון החרדל צריך למתוק, התורמוסים צריך למתוק, החיטין צריכין להטחון, אפילו אדם צריך תיקון

בראשית רבה פרשה יאו

More fundamentally, God put us in this world for the purposes of 'tikun olam' - perfecting His creation. Thus He left us to carry out brit mila. So too, we are required to be involved in helping to cure infertility.

6. וַיִּבְרָךְ אֱתֶם אֱלֹהִים וַיֹּאמֶר לָהֶם אֱלֹהִים פְּרוּ וּרְבוּ וּמְלֵאוּ אֶת-הָאָרֶץ וּבְשָׁהּ וּרְדּוּ בְּדִגְתַּת הַיָּם וּבְעוֹף הַשָּׁמַיִם וּבְכָל-חַיַּה הָרִמָּה עַל-הָאָרֶץ

בראשית א-כח

Mankind is created with a mandate to fill, conquer and subdue the natural world.

7. לשון 'מלאו' הוא על השלמת חסרון בדבר וכו'. והנה האדם שהיה האחרון בבריאה, אף שהיה מוצא הכל מוכן לפניו כל מיני דשאים תבואות ופירות האילן, מכל מקום היה קשה עליו ליהנות מהם כי היה חסר מכל מיני כלים וכו'. לכן היתה הברכה ממנו ית' לתת לו דעת ותבונה להמציא לעצמו תחבולות אשר באמצעותם יוכל להשלים כל חסרונותיו אלה וכו'. ... הנה על השלמת חסרונותיו אלה אמר 'ומלאו את הארץ', השלימו לעצמכם דברים החסרים לכם בעולם וכו'. ברכה זו היא גדולה מאד שיוכל להמציא לו כלים מכלים שונים להקל באמצעותם עבודתו ... אמנם טובה זו היא גדולה מצד גופו, אמנם מצד נפשו יש בזה צד רע

הכתב והקבלה שם

R' Yaakov Mecklenburg (19C Germany) understood that mankind was instructed to innovate and create in the world so as to enable him to fully benefit from it. However, this physical achievement can come at a spiritual price!

D3] THE BOUNDARIES OF 'HEALING'

8. וְכִי יִרְיֶב אֲנָשִׁים וְהָיָה אִישׁ אֶת רֵעֵהוּ בְּאֶבֶן אוּ בְּאֶגְרֹף וְלֹא יָמוּת וְנָפַל לְמִשְׁכָּב: אִם יָקוּם וְהִתְהַלֵּךְ: בְּחוּץ עַל מִשְׁעָנָתוֹ וְנָקָה הַמָּקֶה רַק שְׁבִתּוֹ יִתֵּן וְרָפָא יִרְפָּא

שמות כא-יח-יט

The Torah includes an imperative to heal a person who has been injured

9. דבי ר' ישמעאל אומר: (שמות כ"א) וּרְפָא יִרְפָּא - מכאן שניתן רשות לרופא לרפאות (רש"י - ולא אמרינן רחמנא מחי ואיכו מסי)

בבא קמא פה.

Chazal saw this as 'permission' to heal. Rashi explains that a person may have thought to adopt a theological position that God made this person sick and thus will heal them if He wishes. The Torah is negating this position. We must heal where we can. Nevertheless, our permission to intervene depends on such intervention being an act of 'refuah'.⁵

5. R' Moshe Feinstein refused to allow a healthy person to have an IV drip on Yom Kippur to enable them to fast. Such an intervention went beyond the remit of 'refuah'. (Igrot Moshe O.C. 3:90)

D4] THE BOUNDARIES OF 'NATURE'

10. וענין הכישוף הוא לפי דעתי כן, שהשם ברוך הוא שם בתחילת הבריאה לכל דבר ודבר מדברי העולם טבע לפעול פעולתו טובה וישרה לטובת בני העולם אשר ברא, וציוה כל אחד לפעול פעלו למינהו ובמלאכת התערבות יש בה צדדין שלא הורשו בני אדם להשתמש בהן, כי יודע אלהים שסוף המעשה היוצא לבני אדם באותן צדדין רע להן ומפני זה מנעם מהם.

ספר החינוך מצוה סב

The mitzvah prohibiting witchcraft has at its heart a warning that mankind must not cross the boundaries of the natural world. Any attempt to do so will only lead us into negativity.

However, according to many of the rationalists in the Rishonim - lead by the Rambam - witchcraft is not a 'real' expression of a 'dark side'. It is a fake smokescreen for idolatry used to beguile gullible followers. Modern technology is not connected with idolatry. And even according to those Rishonim - lead by the Ramban - who DO accept the reality of a 'dark side' and the occult, it is accepted that this means invoking powers of negativity and destruction, not healing.

11. אביי ורבא דאמרי תרוייהו: כל דבר שיש בו משום רפואה - אין בו משום דרכי האמורי.

שבת סו.

We are not concerned with the occult if the focus of a procedure is healing.

12. כל שהוא נעשה בפעולה טבעית אינו בכלל כשפים אפילו ידעו לברא בריות יפות שלא מזווג המין כמו שנודע בספרי הטבע שאין הדבר נמנע רשאים לעשות שכל שהוא טבעי אינו בכלל הכשף ודומה לזה שיש בו משום רפואה אין בו משום דרכי האמורי

בית הבחירה (מאירי) סנהדרין סז:

The Meiri (13/14C Provence) writes that even the creation of life through natural means, but without normal human reproduction, will not be prohibited as 'kishuf'

13. כי השם ברוך הוא ברא עולמו בחכמה בתבונה ובדעת ... ובהיות יודע אלהים כי כל אשר עשה הוא מכוון בשלימות לענינו שהוא צריך בעולמו, צוה לכל מין ומין להיות עושה פירותיו למינהו, כמו שכתוב בסדר בראשית, ולא יתערבו המינים פן יחסר שלימותן ולא יצוה עליהן ברכתו

ספר החינוך מצוה רמד

God, in His wisdom, created the world with full potential with its species. We are not allowed to mix these - 'kilayim' - as this detracts from the perfection and blessing of Creation.

14. הטבע הוא משובח מאד במקומו הראוי לו, וכשהמלאכותיות נכנסת במקום הטבע, היא מקלקלת אותו. והנה אע"פ שהש"י ברא את העולם לעשות, לשכלל ולתקן, מכל מקום צריך האדם בוהירות יתירה לעיין שרק ישכלל את הטבע, שהיא מתנת ... אבל כשמהרס אל מקום שהטבע צריך לעשות את שלו ומקלקלו, ע"י מה שעוצר בעדו, אז הוא גומל לנפשו רעה. על כן הגבילה תורה את יכולת האדם בשינוי הדברים הטבעיים, ואמרה: 'בהמתן לא תרביע כלאים', שדך לא תזרע כלאים, ובגד כלאים שעטנו לא יעלה עליך, 'לא תזרע כרמך כלאים', כל זה להשריש בלב האדם את החיוב להיזהר שלא להרס את הטבע ...

אצרות הראיה ח"ב עמ' 901

Rav Kook stresses the importance of defining the boundary between enhancing nature and undermining nature.

However, other Rishonim understand kilayim in very different ways⁶. Also, do these sensitivities apply to humankind as a whole?

15. דתניא, רבי יוסי אומר: שני דברים עלו במחשבה ליבראות בערב שבת ולא נבראו עד מוצאי שבת, ובמוצאי שבת נתן הקדוש ברוך הוא דיעה באדם הראשון מעין דוגמא של מעלה, והביא שני אבנים וטחןן זו בזו ויצא מהן אור. והביא שתי בהמות והרכיב זו בזו ויצא מהן פרד.

פסחים נד.

God held back from some aspects of Creation, which he left for humankind's technological achievement. This is expressed as Adam inventing fire and cross-breeding animals at the beginning of the first 'working week'.

6. For the Rambam, it is intended to distance us from Avoda Zara.

16. וְאֵלֶּה בְּנֵי-צִבְעוֹן וְאֵינָהּ הָיָה עֲנָה אֲשֶׁר מָצָא אֶת-הַיִּמִּים בְּמִדְבָּר בְּרֵעֲתוֹ אֶת-הַחֲמָרִים לְצִבְעוֹן אָבִיו:

בראשית לו:כד

In the account of the generations of Seir at the end of Parashat Vayishlach, there is a strange account of how Ana discovered the 'Yeimim' in the desert, when he was looking after his father's donkeys.

17. האש והכלאים אף על פי שלא נבראו מששת ימי בראשית אבל עלו במחשבה מששת ימי בראשית. הכלאים (בראשית לו:כד) ונבני צבעון איה וענה הוא ענה אשר מצא את היימים במדבר. מהו יימים? ... חציו סוס וחציו חמור. מה עשה צבעון וענה? זימן חמורה והעלה עליה סוס זכר ויצא מהן פרדה. אמר הקדוש ברוך הוא להם אתם הבאתם לעולם דבר שהוא מזיקן אף אני מביא על אותו האיש דבר שהוא מזיקו. מה עשה הקדוש ברוך הוא? זימן חכינה והעלה עליה חרדון⁷ ויצא ממנה חברבר⁸

תלמוד ירושלמי (וילנא) מסכת ברכות פרק ח

The Yerushalmi sees this as a warning against cross-breeding and the inadvertant creation of a more dangerous world.

- According to the Yerushalmi, the possibility of cross-breeding was built into the natural order of Creation in potential from the six days of Creation - עלו במחשבה. Yet Ana was still culpable for releasing this into the world. Evidently, the fact that something is possible within the laws of nature, does not mean that it should be done.
- The unexpected consequence of Ana's experimentation is the creation of an entirely new and dangerous lizard. Could this be a mashal for the dangers of tampering with some elements of nature and the risks of dangerous inadvertant side-effects?
- How is this Midrash to be harmonized with that dealing with Adam on Motzei Shabbat? Chazal in Pesachim 54a comment that Ana produced a negative result because he himself was coming from an illegitimate and negative background. Is the Gemara communicating that ones motivation and background⁹ is critical in assessing whether technological innovation is legitimate?

D5] WHO CREATES A CHILD?

18. תנו רבנן: שלשה שותפין יש באדם, הקדוש ברוך הוא ואביו ואמו. אביו מזריע הלובן, שממנו עצמות וגידים וצפרנים, ומוח שבראשו, ולובן שבעין. אמו מזרעת אודם, שממנו עור ובשר ושערות, ושחור שבעין. והקב"ה נותן בו רוח ונשמה וקלסתר פנים, וראיית העין, ושמיעת האוזן, ודבור פה, והלוח רגלים, ובינה והשכל

נדה לא.

Three partners produce a child - mother, father and God. Humankind must recognize the boundaries of their role in reproduction.

E] THE STATUS OF UNIMPLANTED EMBRYOS

19. אמר רב חסדא: ... עד ארבעים מיה בעלמא היא

יבמות סט:

Chazal explain that, until 40 days gestation, the embryo is considered halachically as mere 'bodily fluids' of the mother. Nevertheless, since it is a potential life, it may not be terminated without strong halachic justification.

20. (בראשית טו:) שִׁפְךָ זֶם הָאֲדָם בְּאֲדָם דְּמִי יִשְׁפֹךְ פִּי בְּצִלָּם אֱלֹקִים עֲשֶׂה אֶת-הָאֲדָם, איזהו אדם שהוא באדם - הוי אומר זה עובר שבמעו אמו.

סנהדרין נ:

A fertilized embryo which is still in a lab and has not yet been implanted in the uterus, is not yet considered to be an אדם שהוא באדם. In this sense it is even less of a potential life, as it could never develop in the lab into a viable fetus. As such, most poskim are lenient in allowing such embryos to be discarded where there is a real medical need, especially if the discarded embryo is itself defective.

7. A female snake and a male toad.

8. A highly poisonous lizard.

9. Rav Dessler (Michtav Me'Eliyahu Vol 1 p 270) write the Tuval Kayin (see Bereishit 4:22) is blamed not for the development of new metals technology but for his unwillingness to safeguard that technology which resulted in weapons development.

F] PGD AND SELECTION OF EMBRYOS

- Pre-implantation Genetic Diagnosis (PGD) can be medically undertaken in conjunction with In Vitro Fertilization (IVF) for various reasons. A cell is removed from the embryo around day 4 or 5 (which is not harmful to the embryo¹⁰) and tested. Based on the PGD (which is highly accurate), some embryos can be selected for implantation and others can be either frozen for possible future use¹¹, or discarded.
- Most poskim are against elective PGD¹² but will permit it in specific circumstances - medical, halachic and regarding shalom bayit. Rav Eliyashiv ruled that PGD is acceptable for Medical but not for 'Cosmetic' reasons. How is that to be defined.

F1] SELECTION TO AVOID GENETIC DEFECTS

- PGD to identify genetic abnormalities is accepted by most poskim¹³. Healthy embryos will be implanted and the defective embryo may be discarded.
- What is considered to be an 'abnormality'? Cases which will inevitably result in an illness such as Tay Sachs¹⁴ are clear. What about Downs Syndrome¹⁵, which is not life-threatening in the same way as Tay Sachs?
- But other cases are less clear. Sometimes the doctors are not sure if the abnormality will indeed be present if the embryo develops.
- What about PGS - Pre-implantation Genetic Screening? Here, the embryo may be screened to see if carries certain genetic markers. Although these do not necessarily indicate a disease in the embryo, these markers indicate an increased statistical likelihood of diseases (eg certain cancers) developing later in life¹⁶. Would it be legitimate to discard embryos simply because they may (but may not) go on to develop diseases later in life. Even if they develop those diseases, what might be the treatment available at that future time? Are we eradicating a real problem? Is this considered to be 'Refua'? What about the concept of 'Shomer Petaim Hashem' - that we must have bitachon in life and trust in God in situations of normal life risk.
- What if the couple want PGD in order to have a child WITH an abnormality. Eg two deaf parents want a child who is deaf or two dwarf parents want a child who is also a dwarf. In such scenarios whose interests are halachically paramount - the parents' or the child's?
- We want to avoid 'unhealthy' offspring - hence genetic screening programs such as Dor Yeshorim.¹⁷ Nevertheless, even if person is sick, they could have a major purpose in the world. Consider how certain individuals have been energized by their illness to bring great things to the world. We can never know the critical role that such people may have in the grand plan for the world.¹⁸
- Could there be a downside to eradicating sickness? Do certain illnesses produce immunity in society as a whole, even if individuals die? Are there unexpected side effects which we could not anticipate?
- Could there be a halachic OBLIGATION to have PGD or can one decide to bring sick children into the world? Could the mitzva of לא תעמוד על דם רעך - not to stand by when others may suffer - apply to the unborn child?

10. As far as we are aware!

11. Cryopreservation suspends fetal development and allows a fertilized egg to be kept almost indefinitely for future use - either for stem cell research or pregnancy.

12. See also <http://www.jewishfertility.org/pgd.php> and also <https://www.ou.org/torah/halacha/torah-in-the-city-halacha/edited-embryos-pgd-halacha/>

13. Ashkenazim have the highest number of genetic abnormalities (93) of any minority in the world!

14. Which can be picked up in PGD as an abnormality in the 15th chromosome.

15. Which can be picked up as an abnormality of a set of 3 chromosomes in the 21st 'pair'.

16. As with people who have the BRCA genetic mutation, which is much higher for women in the Ashkenazi community.

17. Which is of great help for Ashkenazi families, but less so for marriages outside the Ashkenazi community. (Sefardim have their own common genetic disorders) Also, Dor Yeshorim is effective only for recessive abnormalities (which can only be passed on if both parents are carriers) but not for dominant abnormalities (which can be passed on if even one parent is a carrier).

18. Consider the Gemara in Berachot 10a which sets out the conversation between Chizkiyahu and Yeshayahu concerning Chizkiyahu's unwillingness to marry and have a child - Menashe - whom he knew would be evil.

F2] SELECTION TO CHOSE SEX

- Is it ever justifiable to select and discard embryos on the bases of sex¹⁹?
- Consider the following (real) halachic scenarios²⁰:
 - (i) Where the father is a Cohen and produces no sperm. The only way they can have a child is through AID - Artificial Insemination by Donor. The child will be Jewish but will NOT be a Cohen. The family therefore want a girl to avoid public embarrassment.
 - (ii) Where the father has no sperm and AID is necessary. If that family follows a psak that yichud and negiah is only permitted with a blood relative²¹, the father will have major domestic problems if they have a girl. Thus they want to have a boy.²²
 - (iii) The family have many children of one sex and one of the parents has become severely depressed because of this.
 - (iv) The family have many children of one sex and want to fulfil the mitzva of peru u'revu by having a girl and a boy.²³
- What if the family have an 'unbalanced' mix of boys and girls and want to 'balance' the family.
- Some societies favor boys for social reasons. Can that ever be condoned?
- Are we worried about producing a society with a very skewed ratio of boys and girls.

F3] THE SLIPPERY SLOPE - ARE WE HEADING FOR A NIGHTMARE FUTURE?

- Is there a real concern of 'designer babies'? Is it problem if people want babies with blue eyes or curly hair, or who are more sporty or more musical? Halachically there will be more of a concern at discarding the embryos. Why would the secular world have an issue with this when abortion at will is often permitted.
- Some are concerned that the ability to produce 'superhumans' will be available only to the rich and is thus unethical. How is this different to other lifestyle, health or education options which are currently only available to the wealthy?
- Some are fearful of eugenics - that superhumans may be produced who will be able to dominate others, or super-armies of people who will win wars. Are these real medical possibilities in the foreseeable future?

21. אכן, אף כי באופן עקרוני אמנם מותרת ההתערבות בבריאה אך הדבר מותר דווקא אם מתקיימים שלשה תנאים הברורים: (א) אין איסור הלכתי מהותי בעצם פעולת השכלול; (ב) אין לפעולת השכלול תוצאה הכרחית אסורה שאיננה ניתנת למניעה ו/או לתיקון; (ג) יש תועלת לבני אדם בפעולת השכלול, ובלבד שהתועלת עולה על הנוק.

הרב דר. אברהם שטיינברג - היחס העקרוני האמוני/השקפתי, מוסרי/התנהגותי והלכתי/משפטי לחידושים מדעיים²⁴

Rav Avraham Steinberg sets out a three-part test for defining the limits of legitimate medical intervention: (i) it must not be halachically prohibited; (ii) it must not have any secondary consequences (which cannot be avoided or ameliorated) which are halachically prohibited; (iii) there is a overall human benefit to the activity, which is not outweighed by any consequent damage.

19. Note that Chazal give various suggestions for people who wish to have a boy eg being careful about Havdala (Shavuot 18b), giving generously to tzedaka (Bava Batra 10b) and others. Leaving aside whether these are medically effective, it seems that gender selection is acceptable to some degree.

20. For a selection of Rabbinic responses on this see

(a) <http://www.yutorah.org/download.cfm?materialID=522530>

(b) <http://www.yutorah.org/lectures/lecture.cfm/847270/rabbi-dr-kenneth-brander-dr-lawrence-grunfeld/pgd-for-optimizing-chances-for-success-in-ivf-playing-god-can-i-choose-my-child-/>

(c) Sex Selection and Halachic Ethics - Tradition 40:1 (2007) p45

(d) A Boy or Girl? The Ethics of Preconception, Rabbi Joshua Flug, The Journal of Halacha and Contemporary Society XLVIII (Fall 2004) p5.

21. Rav Moshe Feinstein was lenient if the 'adopted' child came into the family at an early enough age to relate to the parents as parents. However others, notably the Lubavitcher Rebbe, were strict on this.

22. R' Yigal Shafran, Director of the Jerusalem Rabbanut's Department of Medicine and Halacha felt that PGD was justified in this case and that it would come under the rubric of cases permitted by R' Shlomo Zalman Auerbach.

23. R' Ovadia Yosef permitted PGD after 6 same-sex children. R' Mordechai Eliyahu permitted it after 5.

24. Available at <http://98.131.138.124/articles/tora/subject2.asp>