Interventions in the Human Germline: To be Allowed or Prohibited?

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A Rationale Case for Pursuing Germline Editing Research

I begin by briefly advancing some arguments for and against germline editing to emphasize the issue that germline editing just like other scientific procedures such as blood transfusion, plastic surgery, and many others will soon become standard practice in medicine. This is due to new therapeutic and curative potentials that genome editing technologies offer to cure previously incurable debilitating genetic disorders and to eradicate infectious diseases which are the most common cause of death on earth and for developing better drugs. Currently, genome editing holds tremendous potentials for understanding, predicting, treating, preventing many debilitating complex diseases such as HIV, cancer, diabetes, heart disease and for improving treatment of many other disorders which no therapy currently exists. Past approaches at using gene-editing technologies led to high levels of off-target, low efficiency and unpredictable specificity. The past existing techniques for germline genetic modification were too inefficient, imprecise and impractical to justify their use in human beings. But today, CRISPR technology is rapidly becoming the most powerful tool with enormous potentials to treat or prevent hard to-cure fatal single genetic diseases such as sickle cell anemia, hemophilia, cystic fibrosis and other incurable debilitating disorders of genetic origin.

Recently, it is becoming evident that the next breakthroughs in therapeutic and preventive medicine will have their roots in genome editing. We are getting to a phase where genome editing enables us to trigger more mutations and is offering possibilities to correct everything that is hereditary diseases. Germline editing currently offers enormous potentials for maximum human health optimization, the longevity of life and improvement of lifespan, wellbeing, welfare and beneficial traits of our future children. Nevertheless, Crispr-Cas9 is a powerful genome editing tool that alters the DNA of embryos in a way that any future offspring would inherit, and potentially capable of changing who we are at our genetic core. Meanwhile, current ethical and legal regulations surrounding the status of embryonic life are still vague and inconsistent, and not constituting reliable mechanisms as they leave the door open for unethical embryo research. This requires the elaboration of more reliable rules and practical details offering more clarity about the circumstances under which embryo editing would be acceptable. Other new possibilities include potentials for redesigning human nature now a malleable reality, remodeling human beings and irrevocable alterations to human identity with significant implications for our common humanity, and with unforeseeable consequences to future generations. Nowadays, human germline editing raises serious ethical, regulatory, policy concerns, as well as questions about its potential risks and social implications of proceeding to alter the human genome for future generations. Does that imply germline editing should be allowed or prohibited?

A few years back, editing the genome of human gametes or embryos was considered a disruptive unactualized technology and continues to be the subject of a wide range of concerns. The chief concerns still remain the safety and efficacy of such an intervention and the unintended errors that it might cause for future generations through the modified germline (ie, the gametes through which the genome is passed on to future generations) (Lancet, 2018). The consensus was that we must not use genome editing tools, like CRISPR, to modify the human germline – that is, eggs, sperm or fertilized eggs. Such a change to gametes and embryos is heritable or would be permanent, affecting all future generations. Today, scientists advance claims that editing genes that are passed to the next generation is a huge challenge and requires higher standards and requirements than for somatic manipulations (Lewis R, 2019). However, germline modification seems inevitable as many scientists have recently progressed from a position whereby heritable gene editing was seen as feasible to that which it is considered as very potentially safe for the treatment of certain life-threatening genetically heritable diseases. Many studies found different societies in favor of editing the germline to treat or prevent incurable diseases, especially fatal conditions with a strong, clear-cut genetic contribution. Some public surveys often find support for heritable genome editing — if it is shown to be safe and used to treat genetic diseases. And soon, we may want to use it to make permanent heritable changes to the human species to eradicate intractable diseases. We shall also be using genome editing technologies to heal and guide lines of research by reducing rates of infectious disease; saving millions of children's lives; changing the odds of serious life-threatening conditions affecting millions around the world; tailoring treatments to individuals to minimize health risks and side effects; creating therapeutic possibilities to eradicate infertility; creating more precise tools for disease detection; and combating serious illnesses. With this shift, instead of imposing a moratorium on germline editing (Lander E. *et al*., 2019), is a strong call for

redesigning rigorous ethical oversights, crafting stringent and reliable regulation, engaging well informed inclusive societal discussion and broad education, and dramatic ethical debate regarding the issue if we can do it, should we or ought we? Further challenging questions include: Do people want to live in a society where embryos' DNA is edited to improve the lives of the next generation? Can we draw a bright line between editing for disease prevention and editing for enhancement?

The Medical and Moral Rationales

Furthermore, gene editing technologies such as CRISPR technique raises serious ethical controversies regarding the moral boundaries between acceptable and unacceptable technologies, and acceptable and unacceptable uses of the technology. This entails providing justifiable reasons for engaging into such activity or practice and making a distinction between therapeutic heritable genome editing, aim to correct disease-causing genes and heritable genome editing intended for cognitive or physical enhancement, aim to augment stature or other attributes. The rationale or justification for the use of CRISPR technology is that, everyone deserves freedom from genetic diseases and deserves the same rights to be healthy. Whether rich or poor we all deserve the same right to be healthy and the right to use CRISPR technology equitably to treat and prevent devastating genetic diseases. Genome editing should be used to help people and society and we should make CRISPR technology to be available to all people, whether rich or poor and use to alleviate human suffering. Developing cures for genetic diseases have a deep moral obligation to serve families and people of every background without discrimination. As such, every human society and communities need to take steps to demonstrate that this new tool can be applied with competence, integrity, and benevolence (Dzau, McNutt & Bai, 2018). Otherwise, having the technologies offering new treatments for debilitating diseases and intentionally refrain from engaging in life-saving therapies is to be morally responsible for the foreseeable, avoidable deaths of those who could have benefitted (Singer, 1993).

Thus, the two basic reasons for carrying out such intervention include: For curing and preventing genetic diseases and for enhancement of the person. Curing and preventing fatal genetic diseases is the most sensible rationale and noble goal for engaging in germline editing, and seems to be the morally appropriate reason for the use of CRISPR technology. The rationale for using CRISPR technology for preventing diseases include the issue that it is simpler, less costly, less risky, and less ethically controversial and more dependable method of preventing the birth of a child with severe genetic abnormality. To avoid, prevent, and treat genetic disease: Through correcting genetic defects in early embryos, or via germline cells, hopefully with beneficial consequences for the child born and subsequent generations. For example: correcting dominant mutations (leading to congenital or late onset disease); correcting recessive mutations (including where loss of heterozygosity of a tumor suppressor gene in somatic cells is likely to lead to cancer); correcting infertility due to Y chromosome defects; altering an allele associated with disease risk to one that is protective. However, before we start editing human embryos to try and control disease, we first need to better understand the safety issues involved, and importantly we need to identify the most appropriate disease to target. For now, the only criterion for editing a genome is for a serious disease and should be restricted to editing genes that have been convincingly demonstrated to cause or strongly predispose to a serious disease or condition.

In contradistinction, the only sensible rational for engaging in genetic modification in the fertilized egg for enhancement includes: conferring resistance to diseases such as cancer, HIV, infectious disease and many others, longevity, intelligence, greater height, muscle strength, appealing personnel and appearance. This could lead to designer babies with the following advantages: Reduces risk of genetic diseases; Reduces risk of inherited medical conditions; Keep pace with others doing it; Better chance the child will succeed in life; A better understanding of genetics; Increased life span; A completely new gene can be given to the child (non-hereditary); Preventing the next generation from having any hereditary disease. And these disadvantages: Termination of embryos; Could create a gap in society; The possibility of damage to the gene pool; Baby has no choice in the matter; Genes often have more than one use; Geneticists are not perfect; Loss of Individuality; Other children in the family could be affected by the parent's decision; Only the rich can afford it. Today, the strongest issue for equivocation against the use of human germline editing remains the case of genetic enhancement, where genome editing may be used for the selection of certain traits or dispositions perceived as beneficial. Genetic enhancement is where there is a greatest moral pitfall or drawbacks and where there is a great responsibility to make medicine to be more ethical. There is need to focus much more on the use of this technology to enhance negatives and erect stringent regulatory oversights. At this moment, treatment of diseases and only to cure or prevent serious diseases represents the critical priority for germline editing. Gene surgery is a serious medical procedure that should be used for treating or curing only serious diseases and not for designing a child for aesthetics, enhancement, or sex selection purposes, and or, in any way that may compromise a child's welfare or freewill. Despite controversial debates, no one has a right to determine a child's genetics except to prevent disease. Gene surgery can expose a child to potential safety risks that can be permanent and should be pursued with caution. Gene surgery is only permissible when the risks of the

procedure are outweighed by a serious medical need and an absence of alternatives.

References

.....The Lancet, Editing the human genome: balancing safety and regulation, *Lancet*, Vol. 391 February 3, 2018. www.thelancet.com.

…….. Singer P., Practical ethics. 2, Cambridge: *Cambridge University Press*, 1993.

…Dzau Victor J, McNutt Marcia, & Bai Chunli, Wake-up call from Hong Kong, *Science*, Vol. 362, Issue 6420, pp. 1215:14 Dec 2018. DOI: 10.1126/science.aaw3127

…..Lewis Ricki, 'We simply don't yet know enough': International commission urges caution with human germline editing, *Genetic Literacy Project*, August 20, 2019.

…..Lander E, Baylis F, Zhang F, Charpentier E, Berg P *et al.,* Adopt a moratorium on heritable genome editing, *Nature*, 165, V. 567, March 14, 2019.