Reproductive CRISPR does not save lives

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Reproductive CRISPR does not cure disease

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Abstract

Given recent advancements in CRISPR-Cas9 powered genetic modification of gametes and embryos, both popular media and scientific articles are hailing CRISPR's life-saving, curative potential for people with serious monogenic diseases. But claims that CRISPR modification of gametes or embryos, a form of germline engineering, has therapeutic value are deeply mistaken. This article explains why reproductive uses of CRISPR, and germline engineering more generally, do not treat or save lives that would otherwise have a genetic disease. Reproductive uses of CRISPR create healthy people whose existence is not inevitable in the first place. Creating healthy lives has distinct and lesser moral value from saving or curing lives that would otherwise have genetic disease. The real value in reproductive uses of CRISPR is in helping a very limited population of people have healthy, genetically related children. This diminished value cannot compete with the concerns in opposition to germline engineering, nor is it worth the investment of research money.

KEYWORDS

CRISPR, gene editing, gene modification, genetic relationship, germline editing

Reproductive CRISPR (*RCRISPR*)

- CRISPR used on human gametes or embryos
- for reproductive purposes, germline modification
- Controversial:
  - Concerns about safety
  - Eugenics
  - Designer Babies
  - Fair access

Movement in favor of rCRISPR

- U.S. National Academies of Sciences and Medicine: genetic modification only permitted in embryos when:
  - 'serious disease or condition'
  - no 'reasonable alternatives' exist
- Proponents of rCRISPR tout its benefits:
  - Cure or Therapy
  - Eliminate disease
  - Prevent pain and suffering
  - Save lives

Curative Claims

- Bioethicist Christopher Gyngell claims of germline engineering, that it:". . . *could provide benefits to individuals who would otherwise be born with genetic disorders – it could cure their disorders.*"
- Scientist Paula Amato: ". . . *I think if you can prevent serious disease in future generations, that makes it worthwhile to pursue this.*"

Christopher Gyngell, Thomas Douglas and Julian Savulescu. The Ethics of Germline Engineering. *Journal of Applied Philosophy* 2016; 34: 498-513, at p. 501.
Rob Stein. Scientists Precisely Edit DNA In Human Embryos To Fix A Disease Gene. 2 August 2017. *NPR*.

CURATIVE CLAIMS

- *National Geographic* writer Erin Blakemore asks: "*What if you could remove a potentially fatal gene mutation from your child's DNA before the baby is even born? In an advance that is as likely to raise eyebrows as it is to save lives, scientists just took a big step toward making that possible.*"
- Bioethicist Shawna Benston states: "*If we allow fear to prevent scientific progress towards the therapeutic application of CRISPR, we will permit otherwise preventable pain and suffering to disrupt and even shorten the lives of those with monogenic disorders.*"

Erin Blakemore. First Human Embryos 'Edited' in U.S.: Get the Facts. 2 August 2017. National Geographic. Available at: http://news.nationalgeographic.com/2017/08/human-embryos-gene-editing-crispr-us-health-science/.

Shawna Benston. Everything in Moderation, Even Hype: Learning from Vaccine Controversies to Strike a Balance with CRISPR. *J Med Ethics* 2017; 43: 819-823.

My argument

- rCRISPR does not cure disease, is not a therapy, and does not save lives
- It is part of an act to create a healthy life, where no life was inevitable
- rCRISPR use does not meet the National Academies' standards of treating a serious disease or condition, with no alternatives
- We should not invest limited research dollars into bringing rCRISPR to market given its low value

What is a cure or therapy?

- Consider a standard therapy:
  - Drug cures cancer- someone lives rather than dies
  - Vaccine prevents infection- a person stays uninfected
  - Drug alleviates pain- a person has less pain than otherwise
  - Treatment prevents disability *in utero*- a baby who would otherwise have a disability is healthy

Counterfactual condition on a therapy:

- For an intervention X to count as a treatment or cure, it is the case that
  1. if X is administered, it will* help soothe, heal, or remedy someone's illness,
  2. if X is not administered, someone will* suffer more or die earlier than if it had been.
- 2 is the counterfactual condition
- *Modify condition for uncertainty/probability

Example: Simplified Cancer Case

- Simplified Cancer Case:
  - A) Take chemotherapy regimen Q
  - B) Not take chemotherapy regimen Q

rCRISPR

- Prospective parents' options:

  A) Create a child with a substantial risk of some genetic disease *X*, not using rCRISPR

  B) Create a child in a genetically modified and healthy state with regard to X, using rCRISPR

  C) Do not create a child at all

rCRISPR Fails to meet the counterfactual condition on what it is to be a cure

RCRISPR, NON URGENT VALUE

- Scenario:
- A. Doctor administers therapy to child with disease
  - Medically and morally valuable action
- B. Doctor first injected child with disease, then administered cure
  - Value of her action is undermined by her being the unnecessary cause of disease in the first place

rCRISPR

- Prospective parents' options:

  A) Create a child with a substantial risk of some genetic disease *X*, not using rCRISPR

  B) Create a child in a genetically modified and healthy state with regard to X, using rCRISPR

  C) Do not create a child at all

Other options

- Prospective parents' options:

  A) Create a child with a substantial risk of some genetic disease *X*, not using rCRISPR

  B) Create a child in a genetically modified and healthy state with regard to X, using rCRISPR

  C) Do not create a child at all

  D) Adopt a child

  E) Use a Healthy Gamete Donor

  F) Use Pre-Implantation Genetic Diagnosis (PGD)

PRESERVING GENETIC RELATEDNESS

- AGAINST ADOPTION AND GAMETE DONATION
- PEOPLE WANT GENETICALLY-RELATED CHILDREN
- THIS IS A PREFERENCE, NOT A MEDICAL NEED
- FURTHER, THESE PEOPLE CAN USE PGD

For more on this: Tina Rulli, "Preferring a Genetically-Related Child," *Journal of Moral Philosophy,* 13 (2016): 669-698

Objection 1: In some cases PGD is not an option

- Homozygous cases: One or both parents carry two copies of a gene for a (monogenic) disease
  - If one parent and a dominant disorder, then all embryos will have disease
  - If both parents, then all embryos will have disease
- Extremely rare*
- preference for genetically-related child not medical need, not urgent

*Lander, E. (2015). Brave new genome. New England Journal of Medicine, 373, 5-7, p. 6

Objection 2: People will procreate anyway if RCRISPR is not available

- Response:
  - This is an empirical claim, and it is speculative. Not obviously true.
  - We should not take as fixed or given matters that people, as moral actors, actually have a choice in.
  - How people choose to reproduce can be greatly impacted by the policies we endorse and the way we frame options.

Summary/Conclusion

- rCRISPR does not meet a plausible counterfactual condition for being a cure/Therapy
- Does not meet medical need, nor an urgent one
- Other options exist for people who want to have healthy children
- rCRISPR cannot meet National Academies' standards: serious condition, with no reasonable alternatives
- Our research dollars would be better spent on actual therapies for affected communities

THANK YOU

FOR MORE INFO:

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