

ETHICS AND GENOME EDITING

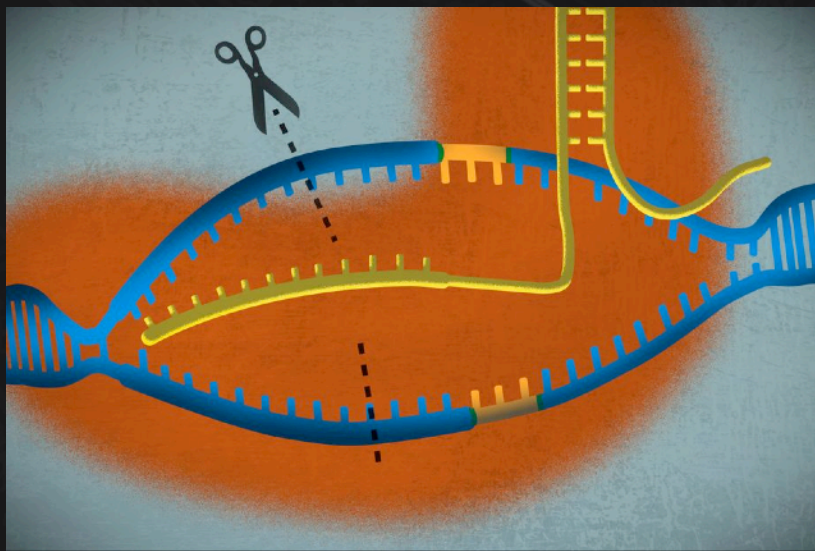
September 26, 2020

What can CRISPR do?

Brief History of Eugenics

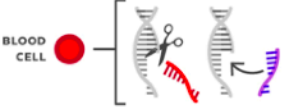
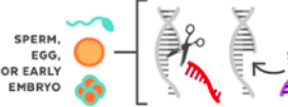

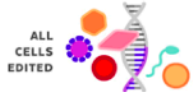
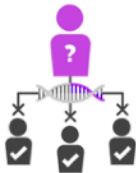
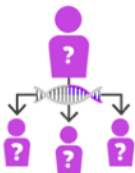




Modern Credos and Examples

What do you think?



Only breaks DNA and then cell repair machinery “fix” but usually in a mutated way

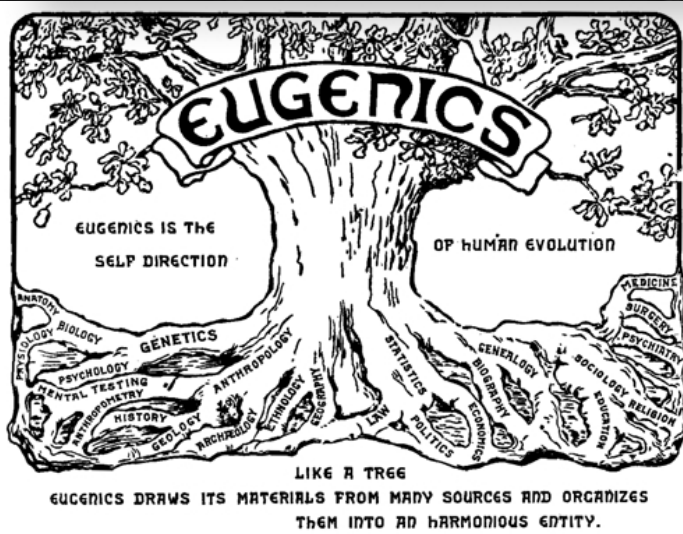
Within next 10 years, can functionally think of making ANY directed change efficiently that we wish

	SOMATIC GENE EDITING	VS.	GERMLINE GENE EDITING
EDIT	 <p>BLOOD CELL</p> <p>Somatic therapies target genes in specific types of cells (blood cells, for example).</p>		 <p>SPERM, EGG, OR EARLY EMBRYO</p> <p>Germline modifications are made so early in development that any change is copied into all of the new cells.</p>
COPY	 <p>EDITED BLOOD CELL</p> <p>UNAFFECTED CELLS</p> <p>The edited gene is contained only in the target cell type. No other types of cells are affected.</p>		 <p>ALL CELLS EDITED</p> <p>The edited gene is copied in every cell, including sperm or eggs.</p>
RISKS	 <p>Any changes, including potential off-target effects, are limited to the treated individual.</p>		 <p>If the person has children, the edited gene is passed on to future generations.</p>
NEXT GENERATION	 <p>The edited gene is not passed down to future generations.</p>		
CONSENSUS	 <p>Somatic cell therapies have been researched and tested for more than 20 years and are highly regulated.</p>		 <p>Human germline editing is new. Heritability of germline changes presents new legal and societal considerations.</p>

BRIEF HISTORY OF EUGENICS

Eugenics was (is?) a movement that is aimed at improving the genetic composition of the human race.

- *Historically, advocated selective breeding
- *Today recombinant DNA and genome editing



1883, Sir Francis Galton, first used the term eugenics, meaning “well-born.”

Galton believed ... (in) selectively breeding individuals who have “desired” traits. This idea was based on Galton’s study of Galton concluded that an elite position in society was due to a good genetic makeup.

U.S. in the late 19th century--stop the transmission of negative or “undesirable” traits from generation to generation

1911 establishment of The Eugenics Records Office (ERO) in Cold Spring Harbor, New York. The ERO spent time tracking family histories and concluded that people deemed to be unfit more often came from families that were poor, low in social standing, immigrant, and/or minority.

Logo of the Second International Congress of Eugenics, 1921.
Image courtesy of Wikimedia Commons

BRIEF HISTORY OF EUGENICS

In 1927, the U.S. Supreme Court decided, by a vote of 8 to 1, to uphold a state's right to forcibly sterilize a person considered unfit to procreate. The case, known as *Buck v. Bell*, centered on a young woman named Carrie Buck, whom the state of Virginia had deemed to be "feebleminded."



"The Most Unkindest Cut of All"
By Gould, Stephen Jay

Nuremberg Laws (1935-1939)
The Law for the Protection of German Blood
and German Honor and The Reich
Citizenship Law.

Wannsee Protocol, January 20, 1942
— discussion about the final solution of the
Jewish question which took place in Berlin,
am Grossen Wannsee No. 56/58 on 20
January 1942.

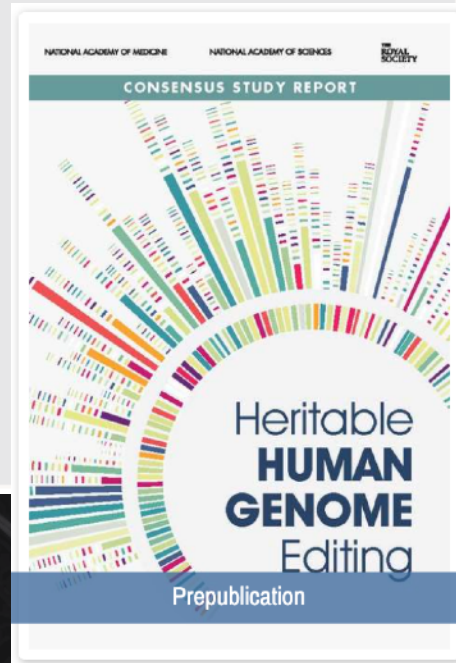
EUGENICS TODAY

National Academies of Science, Engineering and Medicine
Committee on Human Gene Editing:
Scientific, Medical, and Ethical Considerations

Overarching Principles for Research on and Clinical Applications of Human Gene Editing

Genome editing holds great promise for deepening understanding of biology and for preventing, ameliorating, or eliminating many human diseases and conditions. Along with this promise comes the need for responsible and ethically appropriate approaches to research and clinical use. The following general principles are essential foundations for those approaches:

1. Promoting well-being
2. Transparency
3. Due care
4. Responsible science
5. Respect for persons
6. Fairness
7. Transnational cooperation



National Academy of Medicine, National Academy of Sciences, and the Royal Society. 2020. *Heritable Human Genome Editing*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25665>

EUGENICS TODAY

What are the Tiers?

Somatic Manipulation

- therapy of genetic diseases/pre-emptive resistances

Somatic Manipulation

- enhancement from baseline (strength, cognitive abilities, anti-aging, ...)

Germline Manipulation

- correction of genetic diseases/pre-emptive resistances

Germline Manipulation

- enhancement from baseline (strength, cognitive abilities, anti-aging, ...)

Is any widespread and routine somatic functionally different than germline (how many times collectively we have to pay for it)

LET'S DISCUSS

RESOURCES AND MORE

<https://news.harvard.edu/gazette/story/2019/01/perspectives-on-gene-editing>

<https://knowgenetics.org/history-of-eugenics/>

<https://www.npr.org/sections/health-shots/2016/03/07/469478098/the-supreme-court-ruling-that-led-to-70-000-forced-sterilizations>
(Adam Cohen's new book about the Buck case, *Imbeciles*)

<https://www.questia.com/magazine/1P3-8741666/the-most-unkindest-cut-of-all>

<https://www.sciencenews-org.cdn.ampproject.org/c/s/www.sciencenews.org/article/human-germline-gene-editing-crispr-strict-new-guidelines/amp>

<https://www.nap.edu/catalog/25665/heritable-human-genome-editing>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2757926/>