

Do you want to be
genetically engineered?

Definitions:

- Genetics
- Genomics
- Epigenetics/epigenomics
- Genomic editing

What are genome editing and CRISPR-Cas9?

Genome editing (also called gene editing) is a group of technologies that give scientists the *ability to change an organism's DNA*. These technologies allow genetic material to be added, removed, or altered at particular locations in the genome. *Several approaches to genome editing have been developed. A recent one is known as CRISPR-Cas9, which is short for clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9. The CRISPR-Cas9 system has generated a lot of excitement in the scientific community because it is faster, cheaper, more accurate, and more efficient than other existing genome editing methods.*

<https://ghr.nlm.nih.gov/primer/genomicresearch/genomeediting>

Problem of “off-target” edits

- Good gene = “assist breathing” gene (CF)
- Bad gene = “assist brathing” (e is deleted)
- Editing = change “brathing” to “breathing”
- Off target edit = editing complex sees the good gene for nerve repair, “assist branching” and mistakenly edits it to “assist breathing” which does not work for nerve repairs and so causes another problem

What in your genome
shall we edit and to
what will we change it?

Enhance your hearing or memory?

Enhance your health?

Enough to just protect your health
as it is?

Therapy vs Enhancement And Somatic vs Germline

Most in bioethics support
somatic, therapeutic engineering
if it is safe enough.

Delineating Genomic Good Health

- What is healthy and who decides?!
- Deafness – disease or different culture?
- Redheads (MC1R mutants)?!



A genetic link between red hair, freckles and skin cancer

- Among people who carry an allele, or gene variant, associated with red hair and freckles, cancer-causing genetic mutations occur at a rate 42 percent greater than they do for people who don't carry that gene variant.



The CRISPR Baby Scandal Gets Worse by the Day

The alleged creation of the world's first gene-edited infants was full of technical errors and ethical blunders.

ED YONG *Atlantic Monthly*

DEC 3, 2018

[e.g. CCR5 mutation can protect against HIV but also make one more susceptible to other Diseases!]



He Jiankui attends the International Summit on Human Genome Editing at the University of Hong Kong. REUTERS

(http://www.nationalacademies.org/gene-editing/2nd_summit/index.htm)

On Human Genome Editing II

Statement by the Organizing Committee of the Second International Summit on Human Genome Editing

November 29, 2018

Even if the modifications are verified, the procedure was irresponsible and failed to conform with international norms. The organizing committee calls for an ongoing international forum to foster broad public dialogue, develop strategies for increasing equitable access to meet the *needs of underserved populations*....

GOOD Genomic Editing?

- Discussion of the goods/goals of gene editing medicine requires input from all who might benefit, especially the underserved and marginalized.
- Technological advance will be slowed, but healthcare will be more effective and humane. Which goal do we want—better technology or better health*care*?!

South African saying:
if you want to go fast,
go alone; if you want
to go far, go together.