

# Genetic Engineering - Gene Editing In Humans 2023

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Walter Isaacson's The Code Breaker, 2021 focuses on the biography and gene editing research work of Jennifer Doudna, taking the reader on the adventure in the development of gene editing as it applies to humans. This adventure accounts for the arrival of the latest CRISPER technology and reveals its precursors, various applications, and potential future uses.

When it comes to the application of CRISPER based gene editing to humans, many questions arise regarding when and if such applications are appropriate. Doudna participates in this discussion among bio-engineering researchers, ethicists, and public policy makers. So, her experience serves to illuminate the elements of the debate. Like the majority of her colleagues, Doudna pursues a middle position accepting gene editing in humans but only when an array of conditions are met. And these conditions become more and more stringent as gene editing is proposed that would alter inherited human characteristics – edits that thereby have the potential to affect the entire specie's genome.

What is missing in the Isaacson book is a summary of the conditions that are recommended for the various categories of gene editing in humans before it should be implemented. This core message of the book is left for the reader to assemble. What follows is my assemblage, together with an overall evaluation.

## Phase One - Gene Editing in Non-Humans

Genetic modification in plants and animals [GMOs] has been occurring for more than half a century. This editing has raised substantial concerns in some publics with the greatest objections occurring when proposals arise to insert particular genes from one species into the hereditary genome of another species with the goal of enhancing “desired” capabilities. Commercial agriculture and animal husbandry have driven nearly all developments in this editing category with the result that while labeling may be required, few edits have been excluded. In general, the result of these edits for the overall ecology of the planet has been minimally considered.

## Phase Two - Gene Editing in Humans

A Basic Division Applies in this Category - Non-Germline and Germline Edits

### Non-Germline Edits

Non-germline edits apply only to the benefit of the individual who receives them. They are not inheritable. They are “approved” after considering how satisfactory the answers are to the following questions:

- 1) Is the edit legal? [Do the state and/or national laws support this edit option?]
- 2) Is the edit medically necessary? [To address an existing disease or disability for which there are no satisfactory alternatives]
- 3) Is the edit medically desirable? [To correct a recognized and significant potential disease or disability for which there are no good alternatives]
- 4) Is the edit to be conducted in a controlled and safe setting by appropriate experts and as devoid of potential complications as possible?
- 5) Is the edit an enhancement, not addressing a matter of biological or psychological disease or disability? [To address a desired biological characteristic: height, skin color, strength, intelligence, etc.]
- 6) Is the edit socially approved? [Is the edit socially controversial?]
- 7) How available is the edit to all who need or want it – locally and globally? [This question raises the issue of equity, and it includes the cost issue.]

### Germline Edits

Germline edits alter the basic genetic profile of the individual and are passed on to subsequent offspring having the potential to affect the species as a whole. These edits receive the same considerations as Non-Germline edits, but with much greater weight given to the answers to even the basic questions. Additional questions include:

- 1) At the species level, does the edit promote separation among humans and different human groups in terms of basic capabilities that will or will not be available to all humans and human groups? [This question magnifies the issue of the potential inequity that an edit can cause at the species level.]
- 2) Does the edit promote increased species homogeneity or respect the need for biological/genetic diversity within the species? [Diversity is important for species survival, and all non-homo-sapiens Homo species have already gone extinct.]

Additional germline edit questions not raised in the Code Breaker book:

- 1) Does the edit support the planet's ecology? [Earth's natural resources can not sustainably support the 8 billion humans that now populate it, and climate change reduces the level of support the Earth presently offers for the human species. Edits that promote increased procreation or longevity can further exacerbate this situation.]
- 2) Does the edit promote responsible overall individual, societal and species quality of life? [Edits that promote social cooperation and empathy rather than competition and self-interest can promote improved quality of life in modern complex society. The dangerous extra species predators are gone, leaving excessively aggressive humans to unproductively prey on one another.]

3) Does the edit fall into the special category of promoting the ability of humans to travel to and/or inhabit other parts of the solar or galactic system? [Do these edits create the basis for major competition among different genetically modified human groups occupying other locations in the solar/galactic system?]

### Conclusion

Scientists and Ethicists may identify the variables that need to be evaluated when it comes to deciding what and when proposed non-germline and germline human gene edits are recommended, but these recommendations are of little consequence – especially for germline editing – if they are not codified at the social and political levels. The power of the capitalist based economy to encourage human germline edits for profit will most likely overwhelm whatever recommendations scientists and ethicists make from the periphery. This is demonstrated by the commercial implementation of non-human gene editing in the plethora of minimally examined GMO products. And the extraordinary power and privileges afforded the WTO will encourage this laissez faire approach to editing at the global scale.

Uncontrolled gene editing is just one more example of the need for a truly empowered, global, democratic government, one that is federally organized to respect national diversity but that is able to identify and regulate all human behavior that the collective of nations agrees has the ability to negatively impact humans as societies or as a species. Without such a global governmental structure, the elites in autocratic societies and the wealthy in capitalist, democratic societies will inevitably pursue enhanced germline editing for the benefit of the powerful, privileged few. The consequence of this occurring can be disastrous for humanity as a whole.

Humans in modern complex societies are failing to 1) adequately cooperate at all social scales and 2) recognize the combined negative effects of their many prematurely implemented and inadequately regulated innovations. Genetic engineering is at the top of the list of high-risk human innovations. Inadequately controlled, this editing is many times more dangerous than the currently unregulated digital information revolution, which is predictably reaping havoc at the same time that it provides a spectacular improvement in communication breadth and efficiency.

Homo-sapiens or Homo-hubris?