Improvement of ethical standards for CRISPR research with Catholic Social Teaching Principles

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Introduction

- CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats [1]
- CRISPR-Cas9 has the ability to facilitate RNA-guided site-specific DNA cleavage, allowing geneticists to insert, delete, or modify the cleaved DNA [1]
- Possible solutions to issues such as, food scarcity, diseases such as malaria, and genetic disorders including, but not limited, to spina bifida and cystic fibrosis [2,3]
- Scientists and ethicists are at odds in determining the boundaries for CRISPR-Cas9 research and its applications [4]
- Catholic Social Teaching (CST) principles have previously been applied to ethical questions in marketing for the betterment of humanity [5]
- CST holds high standards for the principles of Life and Dignity of the Human Person, Option for the Poor and Vulnerable, Rights and Responsibilities, and Solidarity
- CST will challenge the current stands in ethics that require honest reporting of results, careful analysis, open sharing of methods, data, and interpretations, and the moral obligations of society to consider the side effects on not only model organisms and humans, but also society's perception of how life should be treated
- The standards outlined in CST provide promise in protecting the dignity of all beings, whilst sustaining the duty to improve medicinal palliative care for all patients [5]
- The research endeavors to use CST to examine ethical dilemmas, as it pertains to CRISPR-Cas9 and de novo scientific research
- We hypothesize that the CST model will effectively determine the appropriate uses of CRISPR-Cas9 research and applications while specifically protecting the lower autonomies

Figure 1 (right). Image of generic target sequence cleaved by CRISPR-cas9

Figure 2 (right). Image of CRISPR-cas9 3D model

Methods

Figure 3. Flowchart of the multistep analysis used as the research methods.

Results

- Benefits of CRISPR [2, 6, 7]:
 - Increased efficiency in gene editing compared to previous genetic engineering techniques like transcription activator-like effector nucleases
 - Investigation into new organisms
 - Functional characterization of key genes and molecular signaling pathways
 - Drug-targeting screens
 - Fortification of crops and livestock
 - Control of pests, invasive species, endangered species and reservoirs
- Risks/Harms of CRISPR [2, 6, 7]:
 - Legality of human embryo testing
 - Privacy of confidentiality breaches
 - Serious injury, disability, and/or death for research
 - Eugenics
 - Difficult law enforcement/ Ability to supervise research
 - Lack of uniformity
 - Possibility of misuse/ misapplications
 - Distinction between therapeutic and enhancement applications
- CRISPR funding is provided by grants from the government, which is actually taxpayers’ money [2]
 - Treatments will be expensive, so the people funding the research may not get the life-saving benefits of the technology
- Rather than underscoring a particular set of religious values, CST models a blended, principle-based social philosophy that provides a scope of pragmatic guidance for ethical values of CRISPR [5]
 - Creates a moral theology that is consistent with various philosophical ethical frameworks such as justice and fairness

Table 1. Table 1 demonstrated the many considerations, backed by CST Principles, aimed to mitigate the aforementioned risks from the study’s results.

<u>Catholic Social Teaching Principle</u>	<u>Consideration</u>
Life and Dignity of the Human Person	Will CRISPR breach the integrity of the unborn or elderly?
Call to Family, Community, and Participation	Will families be able to give informed consent to CRISPR application in the clinical setting?
Rights & Responsibilities	Will CRISPR enhance the life of an individual?
Option for the Poor & Vulnerable	How will CRISPR be tested on humans? Will humans in marginalized populations be targeted?
Dignity of Work and the Rights of Workers	Will CRISPR increase the severity of discrimination for hiring and termination in the workplace?
Solidarity	Will CRISPR research benefit the community as a whole or only certain racial, ethnic, or economic groups?
Care for God’s Creation	Will CRISPR put excessive stress on the Earth by means of population, energy or agricultural enhancement?

Conclusion

- Use of CRISPR-Cas9 revives both social and ethical issues, not only with humans, also other organisms and the environment
 - Need to take into account the non-maleficence principle in risk assessment, safety issues to avoid ecological impairment, or the the possible use of the technique for genetic enhancement
- Moral decision making should evolve as the science of genomic engineering advances
 - National and supranational legislatures should consider CRISPR techniques for the betterment of human health and progress using CST principles
- An understanding of religious norms is necessary to understand the current ethical behaviors around the world [5]
 - Given that most religions agree with the idea of CST principles, there is room for development and collaboration around ethics
- Development of an international interdisciplinary network of scholars for global observatory for gene editing is necessary [2]
- Revise current methods of teaching standards to include CST values
- Adopting CST to the current ethical standards may show conflicting views about the religious issues that seem to separate Church and government or even society

Future Studies

- Create a review board of scholars from various disciplines [2]
- Introduce the CST model to the review board [2]
- Integrate the CST model in the academic setting, particularly the secondary education and undergraduate level

References

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