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Analysis of Ethical Responsability in CRISPR Technology

BLUF

CRISPR gene editing revolutionized biotechnology by offering an increased potential to treat genetic disorders and enhance biological research. When we look at CRISPR gene editing, though, compared with its reliance on technologies and cybersecurity, it uncovers some ethical considerations that must be addressed. The increasing digitization of genetic research introduces significant cybersecurity risks, such as data breaches or manipulation of information. These risks give entry to the argument of the short arm of predictive knowledge by showing the importance of foresight and consideration of possible impacts on the field of study and humanity itself.

Understanding CRISPR technology

(1) CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats and is a way that scientists selectively modify DNA to aid in different research or legal uses (What is CRISPR?, n.d.). CRISPR gene editing can be used to make advancements in many different fields involving biotechnology some of which include the creation of medicine to help fight off new or previously uncured illnesses or diseases (Arshad et al, 2021). Another common use is in the agricultural realm. Many of the foods that we have come to love have been somewhat genetically altered (GMO crops, animal food, and beyond, n.d.). For example, most of the corn in America has been genetically modified to resist pests (GMO crops, animal food, and beyond, n.d). One of the newer and promising uses of CRISPR is in genetic mutations like cancer, neurodegenerative disorders, and infectious diseases, by working to accelerate the development of potential treatments (Zhu, 2022).

(4) There are unfortunately some negative uses for CRISPR gene editing. These can include bioweapons, which are engineered pathogens that have increased virulence and can be drug or bacterial-resistant. Another example is Biohacking. Since DNA is being converted into an online format, hackers can slip into the databases and add or change the genetic code to work for their benefit. CRISPR also has the possibility to incite unintended consequences on the target of genetic manipulation. Gene editing brings up the idea of genetically enhancing babies

(“designer babies”) which besides the ethical concerns brings up the possibility of accidentally altering something that could be vital to the functioning of that person.

Ethical implications of cybersecurity risks in CRISPR

The integration of CRISPR technology with digital infrastructure introduces significant cybersecurity vulnerabilities, raising ethical concerns about the security of genetic data and potential manipulation of it. Every day more and more things are being connected to digital formats and that is no different when it comes to the way that scientists store, analyze, and share genetic information. This introduces quite a few security and privacy concerns for people. Genomic data not only contains information about the individual themself, but also about their family (Arshad et al, 2021). A breach of this type of information could contribute to serious consequences such as a leak of the individual's name, date of birth, or even their address (Arshad et al, 2021).

A really common instance of genomic data leaking is in direct-to-consumer companies (DTC) such as 23andMe and Ancestry which advertise being able to tell you your ancestry or medical background. The problem that arises with these companies is when they aren't fully transparent with what they do with the data they gather. A study found that approximately 67% of DTC companies aren't transparent to consumers about where they use their data (Arshad et al, 2021). A person's genetic information can be highly valuable to the applications it can have in research regarding genetic variations, disease screening, and drug reactions (Arshad et al, 2021). Such information can also be sent to insurance companies which may prompt them to add additional charges because of possible genetic issues (Arshad et al, 2021). Suffice it to say that there are many ways that people can use genetic information against the proprietor of such information, therefore, it is extremely important to ensure that it is kept confidential and only used for purposes that the person consented to.

Hans Jonas’s Framework and CRISPR Cybersecurity

(3) In the essay, Technology and Responsibility: Reflections on the New Task of Ethics by Hans Jonas, he focuses on the importance of combining Kantianism theories with the idea of the short arm of predictive knowledge (Jonas, n.d.). Kantianism is a very popular moral theory that can help us determine the moral standing of an action. Kant's basic theory was that the rightness of an action depends on your reason for acting alone- meaning an action's rightness is independent of the consequences it produces (Jonas, n.d.). If we apply this idea to Technological

innovation, then the moral standing of an innovation depends on the intended use of that innovation. For example, we can look at the creation of dynamite. It was created to aid in demolition (which has an arguable neutral moral standing) however, people decided to take that invention and use it for evil purposes. In the realm of Kantianism, that doesn't make the creation of dynamite wrong because the creator was acting under the maxim of "I shall dedicate my resources to encourage actions and innovations that promote the well-being and peaceful coexistence of humanity." When following such a maxim, the creation of any invention with good intentions that promotes the well-being of others can be said to be morally correct, independent of the consequences that follow.

(2.b) Hans takes the idea of Kantianism in that the rightness of an action depends on the reason for acting, but goes further to say the foreseeable consequences do matter in determining the moral standing of an action, presenting us with his own categorical imperative: “Act so that the effects of your action are compatible with the permanence of genuine human life”(Jonas, n.d.). This is basically saying, “Make sure that your actions or creations don't escalate into something that could harm humanity.” When we look at the maxim under the idea of technological advancement, Jonas is trying to say that for every little invention and innovation, we need to closely examine what impacts it could have on humanity and the field itself (Jonas, n.d.). More specifically, weighing out whether the good that can come of an advancement is worth the possible issues that can arise from it. An example of this is the creation of AI. There are so many things that AI could help us with however, what does it do to the job market, what can it mean for advancement in the ways that hacking can be undergone, and how can it change the everyday systems and interaction between technology and humanity?

Political and Ethical Standpoint

Addressing cybersecurity risks in CRISPR gene editing requires a proactive approach that balances innovation with the responsibility to protect against potential harm, ensuring the technology is developed and used safely. This requires us to look at what something like CRISPR could mean for the future of humanity and what positive and negative impacts could come from it. The precautionary principle is an ethical/policy guideline that emphasizes taking proactive actions to prevent damage or harm to something when there is uncertainty about the risks of that product (Koplin, 2019). In the realm of cybersecurity and emerging technologies, this looks like applying strict scrutiny to technologies like CRISPR gene editing or artificial

intelligence, where the long-term consequences are not fully understood (Koplin, 2019). This principle requires us to find a balance between technological advancement and ethical and humanitarian considerations.

(2.a)One way that we can do this is by using scenario based planning. This helps policy makers to anticipate vulnerabilities and creat plans based on that while also considering the ethical ramifications or consequences of that scenario (Selin, 2023). It is also really important to have multiple experts in different fields to look at the outcomes (Selin, 2023). If a company can have someone specifically looking at the security standpoint, another focusing on the ethical impact, and someone looking as the sustainability, than the product would likely have a much higher societal benofit. When looking at CRISPR gene editing in the realm of ethical policies, they must address both the immediate technical safeguards required to secure CRISPR tools and the broader ethical implications of their use (Selin, 2023). This could be done by requiring a risk assement to identify potential cybersecurity threats, such as unauthorized access to CRISPR design platforms or the illegal alteration of genetic information, while also creating frameworks where decisions are guided not only by technological advancement, but also through considering the equity, safety, and the long-term societal impact of gene editing.

Conclusion

(5) CRISPR gene editing has the potential to be a great tool or a great threat to humanity. It can help us to do many things such as identify genetic illnesses and synthisize cures, determine genetic information in criminal procedings, and aid in agricultural production, however it can also greatly harm humanity in personal and ethical ways. The consecences higlight the importance of foresight in the advancement of technology and in the ways we use it and why it is necessary for us to examine these advancements from multiple standpoints to best understand the effects of such technology. When looking at CRISPR technology this requires us to be proactive in protection measures and thoughtful in how we choose to us it while considering the long-term repercussions. Of course, this requires a lot of thought and cooperation, and there will often be times where situations cannot be foreseen, but if we can but a conscious effort into creating a system where we are constantly considering all of the outcomes of sour actions than we can help to eliminate some of the negative consequences we see in the CRISPR technology today.

References

Arshad , S., Arshad, J., Khan, M. M., & Parkinson, S. (2021, May 20). *Analysis of security and privacy challenges for DNA-genomics applications and databases*. Journal of Biomedical Informatics. https://www.sciencedirect.com/science/article/pii/S1532046421001441

GMO crops, animal food, and beyond. U.S. Food and Drug Administration. (n.d.). https://www.fda.gov/food/agricultural-biotechnology/gmo-crops-animal-food-and-beyond#:~:text=Corn%20is%20the%20most%20commonly,%2C%20livestock%2C%20or%20other%20animals.

Jonas, H. (n.d.). *Technology and responsibility: Reflections on the new tasks of ethics*. Interdisciplinary Encyclopedia of Religion and Science. https://inters.org/jonas-technology-responsability

Koplin, J. J., Gyngell, C., & Savulescu, J. (2019, June 27). *Germline gene editing and the Precautionary Principle*. U.S. National Library of Medicine. https://pmc.ncbi.nlm.nih.gov/articles/PMC6972592/

Selin, C., Lambert, L., Morain, S., Nelson, J. P., Barlevy, D., Farooque, M., Manley, H., & Scott, C. T. (2023, September 21). *Researching the future: Scenarios to explore the future of human genome editing* . BMC Medical Ethics. https://bmcmedethics.biomedcentral.com/articles/10.1186/s12910-023-00951-8

What is CRISPR?. The Jackson Laboratory. (n.d.). https://www.jax.org/personalized-medicine/precision-medicine-and-you/what-is-crispr

Zhu, Y. (2022, September 23). *Advances in CRISPR/Cas9*. U.S. National Library of Medicine. https://pmc.ncbi.nlm.nih.gov/articles/PMC9525763/#:~:text=These%20studies%20prove%20that%20CRISPR,in%20recessive%20alleles%20%5B93%5D.