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Mini Review

Biotechnology Crime In The Future: A Parallel Delphi Research with Unconventional Expert

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INTRODUCTION

As with other disciplines, biotechnology is seeing a change in how science is conducted. As laboratories grow more "connected" and scientific research depends more and more on internet-linked systems, tools, and gadgets, for instance, life science is becoming more and more integrated inside the cyber-domain. Due to the lowering prices of technology and the expanding accessibility of community facilities, broader community groups also operate in the biotechnology sector. In the same manner that computers may be reprogrammed for certain tasks, synthetic biology is the engineering discipline that reimagines organisms for practical purposes by altering them to have new capacities. For instance, using so-called CAR (for chimeric antigen receptor) technology, patients' immune cells can be modified to recognise and target cancer cells (Bethel et al., 2021). Synthetic biology is now conducted outside of the controlled institutional setting and, when it occurs, is referred to as "biohacking." It was once out of the reach of anyone without extensive experience and technical expertise. The word "hacking" is used in this context to refer to the positive act of "discovery [of] unforeseen or ignored uses" and "using them in new and imaginative ways to address an issue, whatever it may be." For instance, biohackers create genetically modified substances (such as the N6 gene to make HIV antibodies and the myostatin gene for muscle growth) that they have evaluated through self-experimentation and created experimentally on their own utilising gene editing technologies like CRISPR/Cas (Hussain 2018). Biohackers have reportedly reverse-engineered proprietary gene medicines in the past, and more recently, they have been looking into the possibility of developing (free and open) vaccinations to fend off the SARS-CoV-2 worldwide pandemic. Although biotechnology is being developed and applied for positive reasons, the speed at which it is developing raises worries about possible abuses, especially since security is frequently disregarded when new products and services are released (Choudhary et al., 2021). One organisation that has been at the vanguard of a resilience plan against this danger scenario is the US National Academies of Science, Engineering, and Medicine (NASEM). For the greater goal of "Safeguarding the Bioeconomy" of the U.S. Department of Defense, NASEM created a methodology for detecting and evaluating synthetic biology risks. Reproduction of harmful viruses was one of the threats of most concern, as were new potential for abuse made possible by improved internet access (Hussain et al., 2017). The findings of these crucial seminars helped to create the field of cyber-biosecurity, which strives to protect sensitive biological data and materials between the cyber-physical realm and thoroughly assessed research on the criminal consequences of biotechnology. The results of the study also revealed the absence of frameworks to handle risks at the nexus of the bio- and cyber-domains. The systematic review's findings demonstrated the necessity for a cyber-bio-infrastructure in the context of criminal justice reform. Without this, the study found that there is a very real chance of a "emerging crime harvest" (crime opportunities) happening because of unrecognised security consequences. Although the review was comprehensive, the results were limited to academic publications, which were found to be both sparse and dispersed (Rayner 2019). For instance, just 15 of the 794 articles that were first identified as having possible relevance actually satisfied the criterion for inclusion. In other words, research openly drew a connection between genetic engineering, synthetic biology, or biotechnology and technological abuse (by describing or displaying threat/attack models). The review also emphasised how, to date, academics only from the biological sciences or computer science have been involved in research and opinion as documented in the academic

literature. Even if predicting crime trends is still difficult, there hasn't been much improvement in this area over time (Attri 2016).

Particularly, there has been little interaction with larger groups and the debate of security issues is restricted to walled experts from established professions. For instance, all of the established persons and/or organisations in "conventional" professions from major institutions (such as the National Defense University) or corporations served on the committee that evaluated the hazards posed by synthetic biology in the NASEM report (Karani 2020). The scope of observed and anticipated misuse of biotechnology is unclear, and it is anticipated that it will become more sophisticated in the future. Therefore, it would be beneficial to obtain data from a larger group of specialists, including those that experiment with these kinds of technology in novel ways. In order to get perspectives on new crime trends that may be aided by biotechnology, we did a Delphi survey (Hoerterer et al., 2020) in the absence of a more established body of research. We use the word "biotechnology" broadly to refer to a variety of developing cyber-biosecurity concerns as well as more focused subdivisions like synthetic biology. The Delphi approach may be used to forecast future occurrences when there is a shortage of empirical evidence, either because the event hasn't happened yet or because it is still undocumented, underreported, or unknown (Bir et al., 2020). Expert advice is required in these circumstances. The Delphi method's ability to prevent "group think," in which group dynamics distort participants' actual opinions, as well as its ability to prevent otherwise vocal participants from slanting other participants' reported opinions, is one of its key features. Participants provide their responses separately and anonymously (Haselkorn 1973).

CONCLUSION

It is still challenging to forecast trends in biotechnology-related crime and security. However, much as with other technologies, biotechnology is developing more quickly than it is becoming secure. Furthermore, there has been minimal interaction with various populations and the debate of security issues is restricted to siloed experts from established professions. This concurrent Delphi investigation yielded predictions and opinions that offer valuable insights into what these potential rising trends may be, what can be done to address them, and by whom. In order to capture a larger danger (and solution) environment, it was decided to include a non-traditional expert group as part of the methodology; this decision was backed up by the extra and varied scenarios produced. We first summarise our findings in this part, starting with the differences in viewpoints between the non-traditional and conventional groups. Then, as the non-traditional group had more polarised views than the conventional group, we summarise the differences in viewpoints within that group. The eight scenarios, which serve as the foundation for a suggested set of multi-sector interventions to address them, are presented in their final form. They were chosen by both traditional and non-traditional specialists. In order to create a multi-sector crime prevention strategy plan in advance of future biotechnology crime, we used data-driven input from important biotechnology and security stakeholders with both traditional and non-traditional expertise that generated opinions and forecasts for emerging crime trends made possible by biotechnology.

To assist foreign governments be ready to make informed judgments about their role in future biotechnology breakthroughs, we recommended interventions spanning sectors of business, academia, government, and policy, including a framework for interacting with the biohacking community. Innovation may be advanced while lowering the possibility of an unintended criminal harvest by making security investments and creating a cyber-biosecurity infrastructure.

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