Covid-19 Response Inquiry Submission

Oscar Delaney, 15/12/23

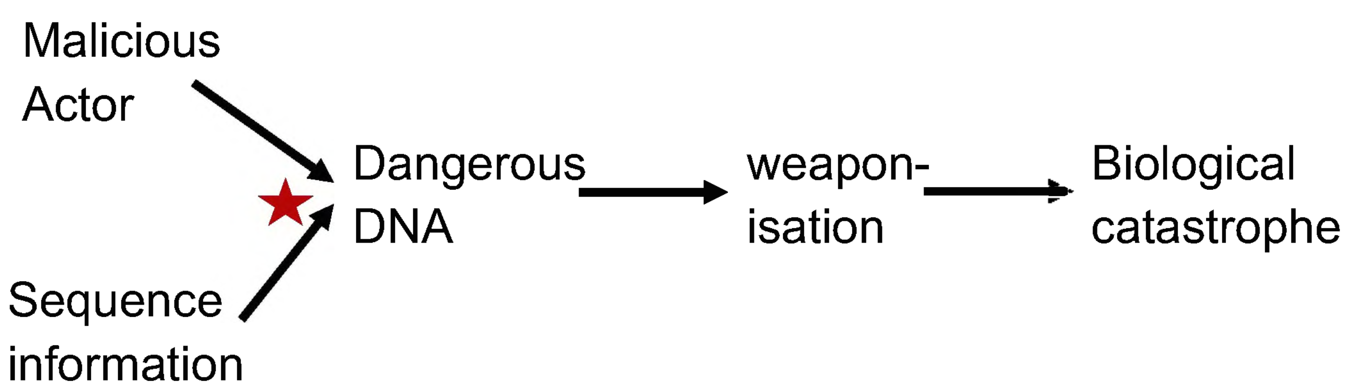
I am a recent graduate of the University of Queensland with a Bachelor of Science (Honours) majoring in biology. Thank you for the opportunity to contribute to this important inquiry.

I have just returned from the Biological Weapons Convention (BWC) meeting held in Geneva 4th-13th December, where I was part of the NTI|Bio Youth Delegation. At those meetings, I was reminded how we need to plan for not just future zoonosis events, but also the possibility of deliberate biological attacks by state or non-state actors. The terms of reference state that the inquiry will present "recommendations to improve response measures in the event of future pandemics". However, prevention is better than cure, and so the best way to respond to future pandemics is to make them not happen in the first place. One of the specific areas of review is how to target responses to the needs of vulnerable populations – here too the best solution is to avoid a future pandemic altogether.

Therefore, the focus of my brief allotted three pages will be on reducing the probability of another pandemic occurring. My research in biosecurity and pandemic preparedness focuses especially on DNA synthesis security, so I will dwell on that.

DNA synthesis refers to a set of rapidly improving technologies that 'print' custom DNA sequences based on a template computer file of A's, C's, G's and T's.

The ongoing democratization of DNA synthesis technology as costs fall is significantly lowering the barrier to creating dangerous biological agents. The sequence information for numerous dangerous pathogens and toxins is readily available in the public domain, so plausibly relatively unsophisticated actors could download a pathogen's genome, order it in pieces from multiple DNA providers, assemble the genome, boot up the pathogen, and deploy it as a bioweapon.



The consequences of misuse could be catastrophic, potentially leading to events surpassing the severity of natural pandemics like COVID-19 if a malicious actor designs a bioweapon that combines the lethality of Ebola and the transmissibility of measles. This scenario underscores the need for effective governance of the digital-to-physical interface of DNA synthesis.

A possible approach to regulating DNA synthesis is to ensure only certain trusted actors can place orders. While this 'customer screening' has some valuable role to play, by itself it is insufficient as malicious actors may be part of a legitimate research institute, or could steal the digital identity of someone who is. Therefore it is also important to screen the DNA sequences themselves that are ordered.

Twenty-five DNA synthesis companies are part of the International Gene Synthesis Consortium (IGSC) and have agreed to meet minimum screening standards to prevent potentially dangerous DNA from being ordered by an unaccredited customer. However, this leaves at least 30 DNA synthesis companies that do not have any public screening protocols. Thus, it remains disconcertingly easy for malicious actors to order from non-screening companies.

President Biden's recent Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence means the US will become the first country in the world to legally require some DNA orders to be screened. However, the national and international regulatory environment remains very weak overall. The Australia Group laudably regulates some exports of DNA synthesis equipment, however most orders of DNA molecules themselves are not checked at international borders.

Currently, DNA synthesis governance relies predominantly on companies' voluntary compliance with screening recommendations. This approach is far from optimal. Specifically, important policy recommendations include:

1. **Minimum screening standards** for all synthetic DNA providers are crucial. This would ensure that all companies adhere to a baseline of biosecurity checks, significantly reducing the risk of dangerous sequences successfully being ordered. To enforce this, a governmental or intergovernmental agency could be tasked with periodically sending deliberately dangerous orders to each synthesis company to check it is indeed blocked. The DNA synthesis industry in Australia is currently nascent, but we should aim to keep regulations ahead of technology.
2. **Government Funded Research:** as well as the above supply-side intervention on DNA companies, Australia should also consider a demand-side intervention whereby all researchers receiving government grants must only order DNA from biosecurity-compliant companies (domestic or international). This would cause compliant companies to receive a higher market share of DNA orders, encouraging more companies to screen effectively.

3. Developing a **cryptographically secure database of hazardous sequences** would provide a robust method for screening DNA orders. This database, established through international consensus, would allow companies to screen orders without direct access to sensitive sequence data. Such a system would protect against the dissemination of high-risk sequences while maintaining confidentiality. If set up effectively, this could also provide a cheap or free centralised system for screening, so that DNA synthesis startups are not overburdened with requiring their own bioinformatics and biosecurity team to analyse each order.

One of the best ways to manage future pandemics is to prevent them from arising at all, and an important though neglected class of possible sources of pandemics is rogue actors using advances in synthetic biology to create and release a bioweapon. Effective regulation of synthetic DNA should safeguard Australia against this risk, without stifling biomedical research and innovation.

Feel free to contact me on [redacted] to discuss matters arising from this submission.

Acknowledgements and References

I thank [redacted] for their invaluable collaboration on this research, and [redacted] and [redacted] for useful advice and mentorship on this project. For a fuller version of this research, with complete referencing, see our paper:

Palya, H., Delaney, O. Deploying Digital Detection of Dangerous DNA. (2023). Journal of Science Policy and Governance. https://doi.org/10.38126/JSPG210306

An abridged reference list with the most important sources is:

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