I was excited to see Australia announce the creation of a Centre for Disease Control. COVID-19 made it clear that Australia needs an institution of this kind. I'm also glad that Australia has commissioned this Inquiry, including to inform the priorities of the CDC.

There's a long-standing public health adage that "prevention is better than a cure". The same logic applies to pandemics. [redacted] in "The Origin and Prevention of Pandemics" show that the "wait-and-respond approach is not sufficient and that the development of systems to prevent pandemics *before* they are established should be considered imperative to human health."

I think this insight should be foundational to the direction of this Inquiry.

My submission focuses on a select issues, but my overall view is that pandemic prevention should be a key priority of the CDC and that our institutions and leaders should never concede that pandemics are inevitable.

The Inquiry's terms of reference include preventative health measures. The best preventative health measure is likely to be preventing pandemics from occurring. To do this most effectively, we need to have a good understanding of how pandemics might begin.

Historically, zoonoses have been the leading cause of pandemics. This is a significant risk that government policy should address. Looking forward, [redacted] in "Securing Civilisation Against Catastrophic Pandemics" use a range of tools to estimate the likelihood of different future pandemic scenarios. Their estimates show that dangerous pathogens leaking from labs have likely surpassed zoonoses as the key risk. Even more worryingly, they argue that maliciously engineered pandemics could become the overriding risk unless action is taken.

The reason engineered pandemics have become a critical public health concern is rapid progress in biotechnology and the rise of "dual-use" AI products.

"Dual-use risks" refers to the risks generated by AIs intended to perform useful tasks if used by malicious actors. Specifically, biotechnology applications using artificial intelligence have capabilities that could amplify the ability of terrorists to harm Australians.

The US is taking dual-use risks seriously. On 25 July 2023, the US Senate Judiciary Subcommittee on Privacy, Technology and the Law took evidence about the potential risks of AI from [redacted]

Committee Chair, Senator Blumenthal began the hearing by highlighting these "dual-use" risks:

> *The future is not science fiction or fantasy — it's not even the future, it's here and now. And a number of you* [redacted] *have put the timeline at 2 years before we see some of the most severe biological dangers. It may be shorter because the pace of development is not only stunningly fast, it is also accelerating at a stunning pace.*

The hearings painted a concerning picture where frontier models will soon have the ability to combine with advances in biotechnology to supercharge the ability of malicious actors to do harm. [redacted] Anthropic, agreed with these concerns and called on Government to take action:

> *Anthropic is concerned that AI could empower a much larger set of actors to misuse biology… Today, certain steps in bioweapons production involve knowledge that can't be found on Google or in textbooks… We found that today's AI tools can fill in some of these steps… a straightforward extrapolation of today's systems to those we expect to see in 2 to 3 years suggests a substantial risk that AI systems will be able to fill in all the missing pieces, enabling many more actors to carry out large-scale biological attacks…*
>
> *We have instituted mitigations against these risks in our own deployed models, briefed a number of US government officials—all of whom found the results disquieting, and are piloting a responsible disclosure process with other AI companies to share information on this and similar risks. However, private action is not enough—this risk and many others like it requires a systemic policy response.*

In response to these hearings, on 30 October 2023, President Biden made an executive order that does two main things. First, it put a timeline on US agencies to develop a framework to ensure the proper screening of synthetic DNA. With or without the additional risks of AI, synthetic DNA is likely the essential input that any malicious or negligent actor would need to engineer a pandemic. Second, it put a range of requirements on AI labs designed to ensure future AI models don't have these "dual-use risks" that could contribute to a future pandemic.

While I appreciate that this issue may feel outside the scope of a preventative public health measure – the same was said of clean drinking water, the work of Florence Nightingale or many other advances in public health that came from leaders realising that a vast range of social and technological factors feed into public health. Indeed, the history of innovation in public health is a history of tackling cutting-edge problems that others neglected. AI and synthetic biology are today's versions of those historic problems.

Citations

Recent Senate Hearing Discussing AI X-Risk | Medium

AI suggested 40,000 new possible chemical weapons in just six hours - The Verge

Dual use of artificial-intelligence-powered drug discovery | Nature Machine Intelligence

The diagnostic and wastewater infrastructure and talent built up over COVID-19 response should not be wound down but proactively pivoted for public health. Clinical metagenomics, wastewater testing and the testing of airports, cruises and other ports of entry could provide

welcome data to improve the National Notifiable Diseases Surveillance System (NNDSS) and provide a volume of samples to test routinely with metagenomic sequencing for novel pathogens. Keeping this diagnostic infrastructure 'warm' would also mean that in the next pandemic, diagnostic capability could expand more easily, which we know first-hand is essential to halting community transmission of a pathogen. [redacted] in a testimony to the U.S. House Hearing on "Biosecurity for the Future: Strengthening Deterrence and Detection" said:

> *"Sustainably financed systems for early detection and robust response can stop outbreaks at the source before they evolve into global pandemics"*

Any early detection system must be robustly financed into perpetuity and resistant to funding cuts, and one way to do this is to have a public health monitoring system that is consciously set up to be useful both in "peace-time" and health emergencies.

I think the inquiry should familiarise itself with the diagnostics of different sampling types like:

- Clinical diagnostics
- Wastewater monitoring and,
- Airports, cruises and other ports of entry.

It should also familiarise itself with technology developments around:

- Metagenomics (both clinical and wastewater)
- CRISPR-based diagnostics
- Improvements to and multiplexing of PCR and LAMP

It should also familiarise itself with the many emerging cost-effectiveness and effectiveness models, as well as obstacles on such systems in literature to inform the design of an early detection system. For example:

- Sharma et al (2023) Threat Net: A Metagenomic Surveillance, Health Security estimates that for $400-800 mil dollars it would have a 95% change of detecting a novel SARS-CoV-2 like respiratory pathogen after 10 emergency department presentations and 79 infections across the US
- The pre-print by Liu et al (2023) Quantitatively assessing early detection strategies for mitigating COVID-19 and future pandemics estimates that hospital monitoring could have detected COVID-19 ~1000 cases earlier. Wastewater surveillance could provide an early warning for pandemics with long incubation periods. Different pathogens would suit different early detection sampling and platforms.
- Wegryzyn et al (2022) Early Detection of Severe Acute Respiratory Syndrome Coronavirus 2 Variants Using Traveler-based Genomic Surveillance at 4 US Airports, September 2021–January 2022, Clinical Infectious Diseases provided early-warning variant detection, reporting the first US Omicron BA.2 and BA.3 in North America.
- Liang et al (2023) Managing the Transition to Widespread Metagenomic Monitoring: Policy Considerations for Future Biosurveillance, Health Security outlines a number of policy obstacles that need to be overcome for a public health monitoring system with sequencing as it's backbone to be successful over the next decades

- Research by SecureBio and MIT's Sculpting Evolution group https://naobservatory.org/ on monitoring for exponentially increasing nucleic acid sequences since viral nucleic acids that have pandemic potential also increase exponentially
- Ghouneimy et al (2023) CRISPR-Based Diagnostics: Challenges and Potential Solutions toward Point-of-Care Applications, ACS Synth Biol explores costs associated with CRISPR based diagnostic and what this might look like in resource-poor settings.

How well we handle the next pandemic will largely be a function of how quickly we can detect and understand it. Every element of the terms of reference hangs off this. On that basis, early pathogen-agnostic detection systems need to be invested in now to get ahead of the next pandemic. With how necessary PCR diagnostics were in controlling case numbers before vaccine uptake was high, in my opinion, it would border on negligence if we don't improve our diagnostics ability before the next pandemic pathogen outbreak. I recommend the Inquiry direct the new CDC to explore the benefits of a pathogen-agnostic early detection system for both the near-term public health benefits and the long-term early detection pandemic warning system.

I think pandemics are one of the most important issues of our time, and expert assessments that the risk of pandemics is increasing are alarming. I think this inquiry should carefully consider how future pandemics could start and ensure it makes specific recommendations to reduce their likelihood. This should include the known mechanisms that have been with humans since time immemorial, such as zoonoses, as well as more recent risks, such as lab leaks, and emerging threats, such as engineered pathogens.