



Australian Government

Chief Scientist

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SCIENCE ON THE SWAN CONFERENCE

Leveraging our unique strengths

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I'd like to start by acknowledging the Whadjuk Noongar people, the traditional owners of the land on which we meet. Every welcome to country extends my learning and understanding of culture and the land. Thank you for inviting me to Perth to speak with you. And thank you, researchers – being a researcher is not easy but what you do is essential for humanity's existence.

It's hugely important for my work as Australia's Chief Scientist to gather insights from people at the front-line and from communities around the country. My task of advising the Australian Government on matters relating to science depends on the research, and what it tells us about opportunities and solutions to big challenges. It also depends on being able to identify roadblocks to progress – where we need to bring people together, or focus efforts, to shift those roadblocks so we can realise our ambition. This is where I can contribute to greatest effect.

So here I am! And I'm very keen to hear from you today and tomorrow on the things needed in your sector to unlock the potential of the expertise and the excellent science and great ideas that are bundled up in this great nation of ours. You may be aware – I hope you are aware – that I spent much of the past six weeks on a national consultation process on behalf of the Australian Government for the development of a refreshed set of science and research priorities. That process has involved roundtables and other meetings with people in the science and research sector and in government, also with First Nations peoples, school kids, local government, citizen scientists and peak bodies around the country – including meetings here in Perth and in Geraldton in March.

We're working to bring that work together – to inform the development of the new science and research priorities, which is still underway. I have to say, I learn so much from these meetings and my other visits to communities around the country, especially in WA, given so much of Australia's wealth and wellbeing emanates from this state. Just flying into places like Geraldton is a reminder of the natural endowments that make Western Australia so beautiful and such a powerhouse! As always, I tend to see the inside of meeting rooms more than the outside, which in this instance has been beneficial because I heard excellent insights about the challenges you have here in Western Australia – and also the capabilities and where we need to focus attention as we chart a path for the coming years.

Today, I want to share some of my reflections from those and previous visits, especially as they apply to the health sector and to the opportunities here in Western Australia. I also want to show how different disciplines are merging, each contributing to an amplification in impact – a partnering of capabilities, if you will, to solve our greatest challenges. For example, biotech combined with big data and with digital will give us better health.

In March, I visited the Harry Perkins Medical Research Institute. I came away really impressed by its facilities and your vision – the integration of the institute with the university, shifting the dial on precision medicine, and focussing on accelerating the translation of discoveries from bench to bedside in clinical trials. The ability to scale precision medicine is coming together with advances in artificial intelligence to create huge optimism about cancer treatment, and from my perspective it's excellent to see

such a strong emphasis on emerging science and emerging capabilities. Scientific ambition and a strong research focus are hugely important in these fast-moving fields.

One of the areas I'm focussed on at the moment is the opportunities for Australia in the biotechnology sector. As you know, we have significant strengths in biotechnology, and I include health tech here, and a long history of breakthrough discoveries. I've been exploring what I can do to bring the expertise, research projects and initiatives at state level together to really scale and advance the sector. I want to ensure our medical and research excellence is translated to impact. Science has this habit of being a long time in the marinating phase, and then suddenly, we're exploding with new applications. Biotech is like this.

It's 70 years since Leland Clark developed the first oxygen biosensor in the US in the 1950s. And now we've entered a new era in health where biosensors will shift the dial on everything from early indicators of disease to health surveillance, to monitoring the response to candidate drugs at the individual level. Coupled with AI, this has the power to nudge us into good habits and potentially better wellbeing. I'm a physicist and my own career involved making sensors, so I find the advances in sensing especially fascinating. Biosensors have applications well beyond human health. They will be the basis for smart materials that have the ability not only to self-monitor for corrosion or faults, but to self-repair. Sensors will be an ever-increasing aspect of animal husbandry and agriculture. They give us the ability to monitor and test for contaminants in food and water.

This is a huge opportunity, and combined with quantum technologies, will transform capabilities in many sectors. There's also a lot of work underway to build on the mRNA vaccine manufacturing facility that Moderna's establishing in Australia. This is an opportunity to develop an innovative RNA research and development ecosystem in Australia, to really scale up an RNA industry that goes well beyond COVID vaccines. I know you have some exciting work being done in WA on RNA – including advances from PYC Therapeutics that are already seeing important progress on diseases such as Duchenne muscular dystrophy. This is life-changing. RNA vaccines and therapeutics have the potential to treat a long list of human diseases. They've also got potential in agriculture including for animal diseases such as African Swine Fever and Lumpy Skin Disease.

We often hear that biotechnology in Australia is world-class but disconnected, with different groups operating in their own silos. I hear from AusBiotech that the sector includes more than 1400 businesses, all the way from start-ups to multinationals, with much of the industry in that small to medium-size – many pre-revenue and in the process of commercialisation or translation of research. One of the things I'm working on is linking up the different pieces of work so our expertise can be scaled nationally.

But to be honest, I'm already seeing an enormous amount of collaboration and building of those networks on the ground. One example is the SABRE Alliance. The acronym stands for Safeguarding Australia through Biotechnology Response and Engagement. It's a network that spans defence and research sectors, and is

designed to ensure we're prepared for potential biological threats – related to agriculture, water security, human health, animal and bird vector diseases and threats, as well as for defence. This is a fantastic foresighting initiative. It means we have a network of people across the different sectors ready to respond when threats arise. So the messages of collaboration for impact have really taken hold, and it's clear that you're on the same page in the health sector here in WA.

Another important aspect of biotech is that it will offer environmental and climate solutions – and I've been interested to hear about a number of projects on the go here in WA. These include ways to recover metals from e-waste – and other mining-related applications that CSIRO and Murdoch University are working on. This will become all the more pressing as Australia scales up its minerals processing capability. It will be important to use low-emissions and low impact techniques for the extraction of minerals, and their processing up the value chain. But we also need new technologies at the other end of the life cycle, in recycling and reuse. There's no use developing renewable energy technologies if the technologies themselves, the batteries, turbines and solar cells, create environmental problems of their own. I've been told about other projects to create biofuels from microalgae and crops such as corn and sugarcane, and an alternative to plastic that's made from seaweed, right here in Perth.

I applaud these kinds of innovations, because they demonstrate all the characteristics that I believe are so central to the future of our nation:

- Fresh thinking
- The willingness to take risks
- The courage to develop a uniquely Australian solution
- And the preparedness to ask: 'Is there another way to solve this problem?'

It is always easiest and often safest to retreat into the familiar systems and ways of doing things, but it's rarely the best option. I often wonder whether it's environments like the one you have here in Western Australia that might just be the best incubators of fresh ideas.

Any of you who have visited Wellington in New Zealand – or perhaps Coober Pedy or Sorrento – will know that the most innovative architecture emerges from the most challenging of landscapes. Here in Western Australia, your unique landscape creates challenges for communities – and I don't want to underplay them – but it does power innovation. The Square Kilometre Array is a fantastic example of this. When I was here in March, I met with the team that is developing the array, and – like the Harry Perkins Cancer Institute – it brought home the strength of what this part of the country has to offer. It also inspired and reinforced my thinking about the important things we need to focus on at the national level to ensure we get the settings right and enable all parts of Australia to thrive.

The Square Kilometre Array is all about data. Big data. Huge data! It is a standout example of the sheer scale of the datasphere that we have to come to terms with in all parts of society. The SKA telescope in the Murchison outback will transfer an average of 8 terabits per second of data to the processing facility in Perth. That's a

data transfer rate 40,000 times the global average home broadband speed last year. In total, the array will archive 300 petabytes of data per year. This would fill the data storage capacity of about half a million typical laptops every year. This means the Square Kilometre Array will lead the way in helping us understand how to process, store and make the best use of that volume of data. This will be a transferable capability that will have an impact on – surprisingly enough – personalised health.

I love the idea that we'll all be taking our lead from this amazing facility, which is, simultaneously, about as remote as you can get in our remote continent and also at the absolute edge of discoveries about the universe. The Square Kilometre Array demonstrates that state-of-the-art science can be done in remote parts of the country and it was great to see how valued it is locally. It brings personnel, work opportunities and activity to the area. It brings communications infrastructure, which benefits the whole community. I don't want to overstate the transformations to regional WA; I know digital communication can be a struggle in many places. I know you face challenges with economic opportunities in the regions, and with the enormous distances and transport costs that can be prohibitive. You have no regional university in WA, which makes it more difficult for young regional people to find a pathway into the emerging knowledge-based sectors. The distances can also be prohibitive for healthcare, and especially specialist care. But I do want to acknowledge the value of ambitious thinking, international collaboration, and building on our strengths, which are all represented in that incredible project.

I also want to talk a bit more about data today, because how we connect with the digital world will, in many ways, define the future of our society and economy. Data has become so important to the way we live and work. Many of us have become very protective of data in our work and personal lives – and rightly so. We're all well aware of the ways it can be misused or misplaced, and the privacy issues are significant. But, as I have said often, the answer is not in retreat. Rather, it is critical that we develop ways to share data safely and use it well. This is true right from the research laboratory to the health clinic, and it is an intrinsic part of science. The future of science lies in shared data and scaled data. We have so much more to be gained from sharing data than locking it down. A better version of ChatGPT is the least of the things we can look forward to!

The power of machine learning and artificial intelligence to make sense of data, and to find new patterns and connections, is immense. This will lead to new understandings about causes of disease and new possibilities in diagnoses and treatment. All of you in this room will know the contribution of machine learning to the COVID vaccine, for example. Artificial intelligence will help us develop new understandings of the human brain, and may offer new ways to respond to the epidemic of mental health issues, which is such a top-line concern to so many Australians around the country. I am pleased to see the mental health strategy launched today. Congratulations, Peter [Peter McEvoy, Professor of Clinical Psychology at Curtin University]. I loved hearing the words: "research questions and co-design".

Another critical contribution is how quantum technologies will scale this up exponentially. Yes, they will impact all aspects of health research. Quantum computing will bring a much finer understanding of the ways molecules behave and interact and will also open the way to building new molecules, and then being able to test those new molecules in the virtual realm. This will vastly truncate the process of discovery. Science is increasingly complex in the infrastructure that researchers need. Increasingly, science is not a solitary profession. As a PhD student, I pulled out the hammer and screwdriver to build a device to measure the properties of indium nitride and its receptivity to light.

Inventive scientists and researchers still do this, of course, but carrying it through to real-world impact requires teams of people and a multidisciplinary approach. The future of research infrastructure lies in shared equipment and in scaled equipment. It's expensive and highly technical – like the Square Kilometre Array and the Pawsey Supercomputer that supports it. All of these advances – in large-scale science infrastructure, machine learning and AI, and quantum technologies – will rely on coming to grips with how we collect, use, share and protect data. I'm sure this challenge is front of mind for all of you in the medical field and in research, and for those of you in government.

I've spoken today about some of my personal reflections from visits to Western Australia. But the reality is that the things I hear from this state are similar to what I hear all around the country as I speak with audiences and meet with groups from all different sectors of the economy in my work as Australia's Chief Scientist. Australians have a shared interest in preventive health, on issues of mental health, and an ambition to build on our expertise in medical research to scale up in personalised medicine and diagnostics, and manufacturing capability in areas such as vaccines and therapeutics so all Australians can be as healthy as possible. Australians want to know how to stop ourselves from getting sick in the first place.

I've also heard many people talking about sustainability in the way we live our lives – so that the things we've learned from the pandemic, from our First Nations peoples and the transformations that will be brought by the new economy are not simply shaped into economic bonanzas, but help us create a better, healthier way of living. The people I have spoken to want Australia to be ambitious and ethical – prosperous, healthy, egalitarian, fair and wise.

Something else I encounter everywhere I go is broad commitment to a collaborative approach to solving the big challenges; a systems approach that recognises Australia's unique strengths. We sometimes tend to think of Australia as a federation of states and territories that are in constant competition, but what I see is that people in every state and territory are eager for a unified and collaborative approach – a designed solution.

Part of that designed solution is the recognition that the source of much of Australia's wealth comes from the regions, and the regions must get a share in the benefits. Another aspect is recognition that the things that make Australia unique are also the things that give us an edge. The unique knowledge of Australia's First Nations peoples, who have been generously willing to bring their knowledge and knowledge

systems to the table to weave into the country's approaches. The unique biodiversity and the mineral richness of the Australian continent, which are so important in medical research and in the net-zero transition. And the strength of our science and research system, which combines with our international partnerships and our outward-facing, collaborative approach.

These are the things that give us an edge. I am impressed by what I have heard and how Australians, you and me, want what is best for everyone, using evidence to guide and design for a fair and prosperous nation that weathers the storms we are navigating. This is the strength we must leverage.