Australian Government

Chief Scientist

Dr Cathy Foley AO

National Press Club Address

to

Science meets Parliament

Achieving impact from Australian science

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National Press Club
Canberra

Today, we celebrate 21 years of Science Meets Parliament.

I still remember coming here for the first Science Meets Parliament.

It had its beginnings in a very difficult budget for science in 1984.

Barry Jones, the then Science Minister, famously told academics they were "the wimpiest collection of lobbyists you can imagine".

This was a catalysing moment. It resulted in the formation of what is now Science and Technology Australia, with the aim of being a voice for the science community.

Next, Ken Baldwin, from the ANU, took up the challenge and organised the first Science Meets Parliament.

An event funded by the Government for scientists to make their case to Parliamentarians.

And here we are, 21 years later.

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I do believe Science Meets Parliament has changed the dialogue over the past two decades.

Politicians increasingly see themselves as science and technology geeks. As researchers, we get to be in their ear – sharing the latest science and its possibilities for Australia

The Prime Minister has given me instructions to "drive collaboration between industry, and the science and research community" to support the COVID-19 recovery.

And Science Minister Karen Andrews has asked me to pursue opportunities to place science at the heart of policy development.

This is a fabulous thing.

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Science is critical to solving humankind's greatest challenges.

Science underpins Australia's drive:

- to become a global leader in low-emissions technologies;
- to transform manufacturing and build stronger sovereign capability;
- to have enough food to feed ourselves and to export; and
- to safeguard the health of our people, from navigating a pandemic to tackling chronic illnesses afflicting half of all Australians.

Science will show us how to achieve a prosperous nation while protecting our environment and biodiversity.

I'm here to talk about my vision for making that happen.

But before I do I want to share some of my personal story. Hopefully, it will help you understand my approach.

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As a child, being Australia's Chief Scientist was something I could never have imagined. Nor could my school teachers – I wasn't the best student!

I have dyslexia which made those early school years difficult. I'm also left handed so my messy handwriting got me into trouble.

I was good at maths despite never bothering to learn my times tables. Why learn them when they were on the back of my exercise book! You can see, I'm a pragmatist.

I was brought up in a middle-class family of five children. Dad was an accountant and my mother was an architect. When she had children she was not allowed to continue working for the NSW public service, so she ran her own practice. Being a working mum was pretty unusual in those days of the 1950s and '60s.

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When I was nine, my mum died suddenly.

I still remember overhearing a conversation about whether we kids would be sent away to be brought up by others. Fortunately, my dad was able to keep us together, eventually remarrying and adding two more kids to our tribe.

Suffice to say, I never imagined I would be a scientist. That was for the likes of Einstein's cousins. Or so I thought.

But my experiences as a child gave me a knack for problem solving.

Figuring out how to work my way around my dyslexia at school and navigating the world. Coming at solutions from a different angle.

I have always had a keen interest in how things worked, how systems fitted together and the wonderment of the world around me.

Science was a sweet spot for me. I found it exhilarating.

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These early lessons have stayed with me throughout my career in science.

At university, I thought I would become a science teacher.

I couldn't think of anything better than helping to shape the young minds of tomorrow and introducing them to the amazing world of science.

I actually have a diploma in education.

But I was wooed away to follow my passion in research.

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For my PhD, I worked on a semiconductor material called indium nitride, and made some simple light detecting diodes.

What I discovered was that indium nitride was responsive to the right spectrum for creating white light.

This might sound a bit obscure. But the significance will become clear when I tell you that this ability for nitrides to operate in the white light frequency range is the basis of LEDs.

I knew my research was a potential game changer.

But back then, commercialisation wasn't the mindset.

The job of a scientist was to publish a paper. This was the end point. And there was no concept of passing the baton to someone else.

So I published the findings, got my PhD and moved on.

Publishing research in a scientific journal so it can be picked up by others is critical for the process.

Fortunately, the research baton was picked up, and eventually a Japanese team worked out how to create an LED with nitrides.

That Japanese team won a Nobel Prize for the invention. And LEDs, of course, are now the world's major form of lighting.

With the benefit of hindsight, you might describe that as a brutal lesson in lost opportunities!

Not only for me, but for Australia.

But it has been a valuable lesson.

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From where I stand, a few things are clear.

There is no shortage of excellent research in Australia.

Our discovery research must continue.

But let's be frank, our research is not being translated into new products and innovations nearly as often as it could be. As a result, Australian ideas and industries are being lost offshore.

Science is a crucial tool for solving the big challenges that we face here and overseas.

It's an important tool for policymakers as they look for solutions and for industry as it looks to increase competitiveness.

The question for me is how to strengthen the connections – connecting the work of scientists, researchers and innovators, with industry and policymakers.

How do we ensure the science community makes the biggest impact it can and the biggest contribution it can?

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Now, I've often found when I'm faced with a difficult question that it helps to go for a run.

I started to do this when I led a team at the CSIRO trying to build a complex quantum device for detecting the likes of gold and silver deep underground.

Going for a jog wasn't to bring about that light-bulb moment.

Rather, I found that when I got back to the lab I knew the next step.

Running has helped me think about the sticking points in the research commercialisation process.

You might remember the men's 4 by 100 metre relay at the Rio Olympics in 2016 when the Jamaican team led by Usain Bolt won gold.

But it was the Japanese team that I want to draw your attention to.

They took everyone by surprise when they won silver.

The runners weren't household names like Usain Bolt. Individual brilliance wasn't what tipped them on to the medal dais.

Their focus – and it was a meticulous focus – was on the baton exchange.

They adopted a new technique for passing the baton – they used an "up-sweep" exchange, instead of the usual "down-sweep".

They also paid attention to the precise place where the outgoing runner should start his run.

I don't know whether it's apocryphal, but after the heats at Rio and before the final, the coach apparently shifted the position markers for the baton exchange by 7 centimetres.

The unachievable suddenly became achievable. The Japanese runners made it to the medal dais!

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I like the scientific precision of the way the Japanese tackled the problem. The lateral thinking.

And that focus on that interface between members of the team helps me think about where we need to improve our performance in Australia.

We have quality research. Industrial capability. Institutional and regulatory strength.

There's no shortage of effort or investment, expertise, or peak organisations.

There's certainly no shortage of expert reports!

We have all the components.

What we need to do is pass the baton more efficiently.

We need to make sure the system links up at these interfaces.

Science is where we start.

But science cannot do it alone.

We need to engineer the solutions, with the right design and user interface. We need the right business model, supporting policy and regulation, and the social licence to ensure that a given technology is what society is willing to support.

Discovery happens in small teams. But innovation and impact needs bigger teams. We need to coalesce around common goals and concentrate our efforts to get that critical mass.

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I've come to this role from the CSIRO, where I was focused on just this – linking the work of researchers, start-ups and industry.

We commercialised and partnered on a whole series of new technologies and products. The Green Whistle emergency analgesic now used across the world.

A sunscreen based on the natural sun protection used by corals on the Great Barrier Reef.

A stent to treat heart conditions now sold throughout Asia, to name a few.

I set up an innovation hub with the NSW state government where deep tech start-ups could be located within CSIRO labs to support their acceleration. One of the companies this helped was Baraja, which makes components for driverless vehicles. Baraja grew in two years from two guys in their garage to employing more than 100 people.

The project that I'm best known for is the development of a superconducting sensor that can detect and map deposits of silver, gold and nickel very deep underground. This sensor has been used in the discovery of billions of dollars of ore bodies here and overseas.

All these experiences were about knitting together different components of the research and commercialisation system.

As Australia's Chief Scientist, I'm now in a position to do something similar on a national scale.

This is the task of building connections and collaboration to advance the adoption of Australian science, technology and innovation.

To take our science to impact.

I will be strongly focused on this.

On making sure the baton is passed smoothly.

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This is important work for the future of our nation.

But while we are focused on taking our science forward, it is critical that we don't lose sight of the foundations.

Today, I want to outline four critical foundational issues that I intend to champion.

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First, we need to recognise that the tools of science are changing fast.

We are on the cusp of realising some incredible technologies. Artificial intelligence and quantum computing will transform the way science is done.

Artificial intelligence is already here, in our phones, our elevators, our traffic lights, our cancer screening clinics. It's helping our businesses make better decisions. AI is protecting our environment and identifying therapies and vaccines.

You'll be familiar with the long process normally involved in the trial of new medicines. Ninety percent of starters don't make it to the finish line and even when they do, the process – lab to market – takes an average of 12 years.

Artificial intelligence can reduce the time dramatically.

One of the drugs used to treat COVID-19 was discovered and then modelled using a deep learning algorithm. Once it stacked up virtually, this COVID therapy was able to go straight into trials and then to market. All in a matter of months.

Automation and AI are also changing the way scientists work day to day.

Sifting through literature will become the sphere of artificial intelligence.

Dealing with exponentially larger datasets is increasingly a task for supercomputers.

The benefits are enormous.

Greater adoption of AI could add as much as $315 billion to our economy by 2030.

But that's only "if".

If we have the right skills to engage with the technology.

If our businesses are able to find and adopt AI solutions.

If Government builds the environment we need to allow the technology to emerge.

And *if* the technology is developed in a way that is responsible, ethical and inclusive.

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The next step change in the digital transformation is quantum.

This is a particular interest of mine.

It is a priority because I see it having enormous potential for Australia.

Quantum computing is more than just doing things faster. It's a whole new way of computing.

You probably think of quantum computing as a future technology. And it is certainly the case that there are big hurdles before the promise of a fully error-corrected quantum computer is realised.

But the first manifestations are already here. If you live in Singapore or Korea, you can buy a 5G mobile phone that contains the world's first Quantum Random Number Generator as a security tool.

IBM and Google have already built small, 50 or 60 quantum bit computers.

Once we get to 300 qubits, we're told a quantum computer will be able to process more pieces of information than the number of particles in the universe.

What was impossible will become possible.

Quantum information technology is going to be a massive game changer. And we need to be on top of it.

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This brings me to my second foundational issue.

And that is the education of our children.

Fluency and familiarity with digital technologies, artificial intelligence and robotics is currency in this new economy.

If Australia is to avoid locking in a two-speed society, we need people with the expertise to design, develop and operate future technologies.

We need people who are creative thinkers, who will use their imagination to push the boundaries.

Our young people need to know where to obtain trusted information. Know how to make sense of information. Have the ability to challenge information based on evidence and understanding.

Above all, we need them to know how to combine many bits of information into a broad picture of the world.

To achieve all this, we need to find new ways to share the knowledge and talents of our fabulous teachers, and to increase science literacy.

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So, one: Embracing the new digital tools of science. Two: New ways of learning.

My third foundational issue:

Diversity.

This is something you know that I am passionate about, but despite some great initiatives, progress is painfully slow. And it's clear that this is an incredibly complex and difficult issue.

More women in science, engineering and technology is only part of the diversity equation.

It shouldn't need saying that we are more likely to succeed if we use our full human potential. If we call on as many different perspectives, experiences and backgrounds as we can, including the knowledge base of Indigenous Australians.

Simply put, diversity of ideas and experience equals better results.

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My final foundation, improving open access to research.

Australia lags some other nations in regard to open access, with well over half of Australian academic papers requiring a payment to access.

This is a significant challenge for practitioners such as pharmacists, teachers and nurses, or people in business wanting to keep up with latest research in their field.

Caught behind a paywall, it can cost $50 to access a single research paper.

This makes it really difficult for the Australian community to find research on, say, a rare disease, or climate change.

Access to information is the great enabler for innovation and for research commercialisation.

Lack of access to information is a real roadblock, and hinders our ability to compete internationally.

There is substantial interest in developing an Open Access Strategy in Australia, and it is something I am closely considering.

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These four foundational issues – digital capability, STEM education, diversity in the research community, and open access – are all, like the world we live in, interconnected.

And they are all critical to scientific impact.

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We are meeting here today in person. Just as we did 21 years ago for the first Science Meets Parliament.

There are 180 people in this room.

That should be an unremarkable observation.

But of course, we live in times when the ordinary is suddenly extraordinary.

The past 14 months have caused much so much heartache.

The COVID-19 pandemic has brought profound changes to the way we live our lives, and some of those changes will be lasting.

It has also brought significant changes to science.

And we can learn from them.

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Think back to this day, one year ago.

On March 1 2020, Australia recorded one new case of COVID-19. We had a total case load of 26.

By this day a year ago, the case load had risen to more than 400.

We were on a steep upward curve.

By the end of the month, Australia had more than 4500 cases of coronavirus.

From 26 to more than 4500 in the space of one month.

This time a year ago, Australia's trajectory hung in the balance.

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But it was also a year ago that the Doherty Institute in Melbourne announced that it had mapped the immune response to the virus. A world first, and an important step towards a vaccine.

Science was already moving fast.

Here we are a year later.

More than 170,000 Australians have been vaccinated against COVID-19. Next week, Australians will begin receiving vaccines made here in Australia.

The vaccines were developed in a quarter of the time of the previous fastest vaccine development.

The pandemic has shown us that what we thought to be impossible becomes possible if we have the building blocks in place and if we work together.

The vaccine is not a miracle, as it is often described. It is the result of preparedness.

We had all of those measures in place that I have been talking about today.

Researchers across the globe had done the fundamental work. They knew how to build the new types of vaccines.

The pandemic demonstrated the power of open access and open research.

Journals made COVID research freely available.

Australian virologist Professor Edward Holmes shared the genome of the virus with the world on the 10th of January on behalf of Chinese colleagues. Within two weeks, a test had been drawn up.

The spread of the virus over the past 14 months has been tracked through open-source databases, and more recently, US researchers have established a mapping tool that tracks variants right down to individual cases as they appear around the world.

It's this kind of close global monitoring that will allow us to get ahead of the virus as it shifts and moves.

Open sharing of data has been essential to the international science community coming together around a common goal.

We have passed the baton smoothly from researchers to pharmaceutical companies and to medical manufacturers.

Governments have moved quickly and invested significantly, and have been able to capitalise on their decades of support for medical research.

In short, COVID-19 has been an international disaster story and a scientific success story.

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History tells us that science works best when there is a sense of urgency. A crisis such as wartime or a pandemic. Or a competitive deadline. Such as the race to Mars.

Now it's time to bring those lessons to the challenges that come next.

Climate change, energy and food security to name a few.

These are challenges, but they are also opportunities for science.

We know where to focus our attention. The government is investing in modern manufacturing, low emissions technologies and has identified priority industries, such as space. There are exciting things happening in each of these spheres.

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When Alan Finkel passed the baton to me, he told me to be prepared for big surprises and unexpected turns in the role of Chief Scientist.

So I can't be sure what the next three years will bring.

But I know science, research and technology will play a significant role. We are at the table.

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So in closing, my message to government: Thanks for placing science at the centre. I look forward to making sure you have access to the best scientific advice.

My message to industry: Our science community is the incubator of discoveries that can transform your business. Let's find ways to make that relationship as useful as it can be for you and for science.

And finally my message to the science community: I have talked a lot about impact and commercialisation today.

But I don't want you to come away hearing that everything you do must have a foreseeable commercial outcome.

I am not suggesting that you are expected to do it all, make a great discovery, win a Nobel Prize and spin out a company.

When academics were told back in 1984 that they were hopeless at lobbying, you can imagine how that went down.

We are scientists, not lobbyists!

What we did was find our own way to take up the challenge and improve our links with Government.

Now we need to strengthen the connections with the other parts of our economy.

This is how we make sure we don't find ourselves in the position of inventing something great, then standing on the dock.

Waving goodbye.

Hanky in the air.

This is how we ensure a positive impact for Australia and for the world.

This is how together we can realise the promise of our science.

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So today I invite each of you to think about how the baton is passed so that we can shift the dial on science research and translation.

I stand ready to work with you.

To seize the opportunity for Australia.

Thank you.