Australian Government

AUSTRALIA'S CHIEF SCIENTIST

THE VALUE OF SCIENCE IN POLICY

ATTORNEY-GENERAL'S DEPARTMENT

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CHECK AGAINST DELIVERY

Good afternoon and thank you for inviting me to speak.

Let me start with two comments: I know a little about the Law; and I know little about the Law. What little I do know is because two of my three daughters, our twins, are lawyers. But they are also scientists. They did the still fairly unusual science and law double degree. I remember them coming home when they were students and telling me how much they loved science. I would say 'what about Law' and they would say that they were doing that too, and then they'd stay up most of the night talking, not about Tort Law, but about the magic of biology; the wonder of genetics; the awesomeness of the universe. How we got to be **what** we are; how we got to be **where** we are and how to **sustain** what we have. They all remain topics of conversation when we meet. And they both work as lawyers.

They are generally better than I am at arguing, and are quick to point out any leading questions, or inappropriate use of words and they let me know how little I know about the Law – gently of course. But I am sometimes allowed to think that I have the final say.

Sadly I feel I won't have quite the same parental authority here with you. So I will set aside my competitive spirit for a moment, and talk about how we scientists and lawyers can bring value to each other.

Science and law have much in common:

- Fact-finding in science, and in courts, is an attempt to make findings based on the weight of evidence.
- Both lawyers and scientists develop theories to explain or interpret the evidence.
- Lawyers apply precedents and statutes, scientists apply data and peer review to their evidence.
- Just as the reputation of a scientist or journal holds weight, so too does the reputation of a lawyer.
- And just as so much in the practice of law is subject to qualification and challenge, so too is it in science. Indeed, science and law both progress through challenge and through the robust contest of ideas.

Yet while law is often seen as a human endeavour, open to interpretation, subjectivity… the *thoughts* of judges… the *strength* of a lawyer; science is often portrayed as something beyond humans, an embodiment of objectivity. Scientific evidence is often seen as a source of unimpeachable authority that should dispel political prejudices. Its appeal is as an objective rock that can ground the bias and interests of politicians.

But scientists develop *theories* to explain the evidence. And as new facts emerge, or new observations made, theories are challenged – and changed when the evidence stands scrutiny. The theories of Newton and Galileo have

been altered due to new evidence. Einstein's theory of relativity has recently been challenged by the work at CERN.

Science rarely yields unequivocal facts. It can however, give you the best possible understanding on the best available evidence. It works in the realm of probability.

It is for this reason that the idea of involving science in policy development is gaining traction worldwide.

In the US, President Obama insists that his "dream team" of government scientists should be listened to in every relevant policy discussion, even when their advice is inconvenient - indeed, especially when it is inconvenient.

In the UK, a scientific advisor is appointed to almost every department of Government, including the treasury.

In Australia, you only have me in an official (whole-of-government) advisory capacity but of course there are many important relationships that scientists and their organisations have with Government such as the Defence Chief Scientist and CSIRO and our universities. However this could be officiated more broadly like in the US and UK and a report due to be released this year, the APS200 report on science in policy, may be the catalyst that will see this happen.

And I hope it does, because science is crucial to policy development. It is relevant to almost every decision we make, it is a process by which the best decisions can be made, and it is inherently international. Good science is subjected to the critique and criticism of peers with expertise. To stand, it has to pass the test. Writing op-ed pieces in newspapers is a way to get to the public without the rigour of the scientific process. It is relatively easy to appear knowledgeable to those with even less. But not to your peers.

As I said, science is inherently international. The very process of science means that we don't keep it in-house; that we don't avoid the test of our international peers. We don't expect that only Australians can critique Australian work. Good science will encompass global issues and it will add to the knowledge we need to solve or mitigate global problems.

Now more than ever, governments rely on the perspective of science, the product of science, the evidence, for guidance. The problems they have to grapple with appear ever more complex. And in many complex systems (such as climate) the solutions will not be simple.

And yet, around the world, science is often attacked. Sometimes it is the evidence that is attacked, sometimes it is the individuals, sometimes their motivation – as for example the notion that there is a great global conspiracy or 'group think' amongst climate scientists. The majority of real climate scientists happen to think that the planet is warming and that human activity is part of the cause. It has been said that dumping a trillion tonnes of CO_2 into

the atmosphere, which we humans will have done since the start of industrialisation to some time in the reasonable future, will have nasty effects we just can't predict how nasty. The 'consensus' seems to be seen by some as evidence of the conspiracy, not that they might be right.

And those who reject the scientific evidence and consensus, like some do, are essentially rejecting the scientific process as a whole. I remind you that it is the process that has had an impact on every single aspect of our lives, put the soles on your shoes or the food in your refrigerator, and yet many people seem to want to pick and choose when to trust it, and when to attack it.

Science works, essentially, using probabilities not certainties. Of course that can be used against it, and we see that happen. Sometimes with a remarkable intensity.

But these are not reasons to shun science. We have to engage with it and use it – in the best sense of the word.

There are two ways to integrate scientific advice with policy. The first is to seek expert advice - to give an overview of where the best evidence or where the weight of evidence currently lies. This is the sort of advice my Office provides.

The other is to engage scientists to conduct research to help produce the evidence to underpin the best policy.

One positive example is the banning of smoking indoors in public places, based on scientific consensus that passive smoking is detrimental to health. That the policy makers engaged with scientists, listened to the consensus, and responded appropriately is a testament to the value of a strong relationship between science and policy. There were, of course, scientists and others on the other side of the argument, too. But the consensus was strong and the legislators acted on it; I am guessing that not too many of the shock jocks smoke inside public places.

The relationship of scientists with policy makers is also valuable because by engaging with scientists, we ensure not only that the evidence is available and know where it is strong, but we ensure that the evidence is internationally robust.

For centuries, science, and its ideas, has travelled across the globe, drawing humanity into the search for knowledge and the application of newly discovered facts, to create technologies, businesses and to form the basis of education.

And on the issues this department faces - disaster management, people smuggling, cybercrime and climate change to name a few - worldwide collaboration is crucial to developing the best policies. Science and the outcomes of good science are important in all of these issues, and single nations can neither solve them alone nor develop solutions to every problem.

But as the climate change debate demonstrates, these are no longer solely scientific and technical matters. Solutions must be viable in the larger context of the global economy, global unrest and global inequality. We have to take our communities with us as we go – not tell them at the end that we know what is happening and that we know what is good for them – when they don't necessarily understand either the problem or the solution.

In short, the solutions need to be based not only on sound science, but on sound politics as well.

It stands to reason, then, that scientific expertise should be a fundamental part of policy efforts. As single nations can neither solve them alone nor develop solutions to every problem, scientific cooperation becomes an increasing necessity.

We are fortunate in Australia because our levels of collaboration in science are some of the best in the world.

Our country is in a unique position. Our geographical isolation and small world fraction has had two effects: on one hand it has forced us to be self-reliant and develop our capacities at home. On the other, it has pushed us towards strong research collaborations in areas where we don't have resources or capacity.

In marine geoscience for example, Australia is a partner in the Integrated Ocean Drilling Program, a partnership led by the United States, the European Union and Japan.

Participation in the program gives Australian scientists direct access to seafloor drilling technology that is worth about US$1 billion and has annual running costs of about US$200 million.

The collaboration gives Australian researchers access to seafloor data otherwise unaffordable to mine, and spares any one country the costs of having to build and maintain a facility on its own.

Just this year, Australian researchers collaborated with their US counterparts in a project to drill into the trench that caused last year's deadly tsunami off the coast of Japan.

By examining samples taken from fault, they discovered that the rock caught up in the tectonic plate boundary is literally falling apart as a result of the intense stresses of plate convergence.

The team also placed instruments within the fault to monitor activity and conditions as it builds up to the next great earthquake.

This is science that may lead to better prediction of earthquakes and tsunamis. This is science that will help nations prepare for and understand disasters. This is science that has the potential to save lives, to save cities.

But even on smaller projects where collaboration isn't built through shared infrastructure, between 2002 and 2010 the number of internationally co-authored publications in Australia more than tripled. Now, just under half of all Australian scientific publications are co-authored with overseas collaborators.

More than that, we have seen a shift in the way Australian scientists are engaging with the rest of the world. Historically, we have had strong ties with North America and Europe, and while that continues, there has been much faster growth with our Asian neighbours. In mathematics, engineering and chemistry for example, China is now our strongest partner in collaboration.

As we enter the 'Asian century', and the Government continues to push Asian literacy in schools and industry, the question could very well be asked, out of science and policy, who is following whom?

I began this speech, asking you to appreciate the contribution of science to policy on the basis of its impartiality.

But we cannot forget that science is an innately *human* endeavour. We choose what to study, what to fund, and how to contextualise our findings. Of course, I must add that like any intensely human endeavour there are those who stretch and sometimes break the boundaries of proper and ethical behaviour. We wish there were none- but scientists like lawyers are human and however hard we try to filter, the frailties of the human condition appear amongst us as they do everywhere else. Like you, we have ways of dealing with those whose behaviour could risk the standing of the whole profession.

Putting that to one side, the fact that science is a human endeavour does not diminish its value, if anything it increases it.

To me, science is essential to policy because it *is* a human endeavour, and because the very reason it exists is to serve and advance humanity. And isn't that what good policy should do too?

Scientists do not enter the profession for the promise of huge salaries and unrelenting power.

Most people enter science because it is their passion. Because they dream of changing the world for the better.

I was recently reminded of this very point when I heard the story of a PhD graduate who decided to get into medical research so she could find a cure for HIV and now her research focuses on improving the drugs used to treat HIV AIDs sufferers. This inspires me and restores faith in our kind as to the reasons why people choose to do what they do.

People who study diseases, engineering, even obscure life forms at the depths of the ocean, do it for the sense of discovery and the hope that what they find will make a difference. That they can improve the world.

It is interesting being a scientist.

You can spend years slaving away trying to learn a little bit more about one specific neuron or even one enzyme. The thrill of a discovery, the adrenaline as you draw close, is what keeps you going.

And when you finally find the snippet of information, you send it out into the scientific world, and hope that in the context of everything else being done, it is useful. That it is valuable. And that it stands the scrutiny of your peers.

There are few other careers that are driven by hope as much as science. Except for maybe politics.

I mentioned earlier, the efforts in the US and the UK to incorporate science into policy.

One of the greatest challenges for government is to recognise that science should not just be there when they ask for it, and is otherwise irrelevant.

If science speaks only when spoken to, it risks being ignored and under-appreciated.

But this is why I will not wait. It is why I recently published the Health of Australian Science report. It is why I accept speeches with an audience like this one. Because there are things so important to the national interest that remaining quiet is not an option. The value of science is one of them.

The engagement of science in policy is crucial. My office has already worked with the Attorney General's Department on a few topics and I strongly encourage this relationship and to consider science's role in the decisions you make, that is what I am here for after all.

Is it appropriate for me to say I rest my case here or is that how all Talking Head speeches are ended? If so, I apologise and thank you again for having me here today.