



Australian Government

Chief Scientist

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ADDRESS TO THE NATIONAL PRESS CLUB

Aspiring to something magnificent

30 minute speech

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It is good to be back to address the Press Club. It is something I seem to do around this time every year.

And like all the other years in recent times, I am here again to talk about science, as you would expect from somebody who has been described by one old friend in the media as *relentlessly consistent*. Now, if you believe all that you see, hear and read in the media, then OK. But I want to advise those amongst you who are viscerally skeptical of news reports, and I believe there are a few in this room, it is true: I am relentless when the cause is worthy, and I aim to be consistent.

So you won't be surprised if I am relentlessly consistent again today: to be clear, without science, the world would be heading into an even less happy place. Without science we would have too little food to provide for the world, too little water for agriculture, too little potable water; without science our health would suffer; without science our lives, indeed our very lifestyle, would be miserable now and probably beyond repair into the future; that future would be bleak – to say the very least.

Science **serves** our community, is **supported** by our community and is essential **to** our community. And acceptance **by** the community of what scientists do is a critical part of how we build the future we want, rather than drifting along until one just happens along.

Working with the community is a key. As Tony Blair said about a decade ago, and I paraphrase: science lets us do more, but it doesn't tell us whether doing more is right or wrong.¹ He went on to argue that for the community to get maximum benefit from science there needed to be a renewed social compact between the community and its scientists based on a proper understanding of what science is trying to achieve.

¹ Tony Blair, 'Speech to the Royal Society', 24 May 2002. Available: <http://www.theguardian.com/politics/2002/may/23/speeches.tonyblair>.

It is an important message – a message about mutual dependence. And it can't be lost as scientists and the community focus on the exigencies of the moment.

Since I last spoke here, the Commonwealth Science Council has been established, the minister with responsibility for science is the 'Science Minister' once more, and a Parliamentary Secretary has been appointed to support his work towards a long-term Australian science strategy.

I look ahead now with cautious optimism – I also look forward to working with Minister Macfarlane and Parliamentary Secretary Andrews. Last night the Minister identified some of the issues that we have to grapple with this year; and he spelt out what will be an interesting remaining nine months in office for me.

It will be interesting because I believe there is an increasingly widespread understanding that science will play its part at the core of future development. We need it in Australia; we see it in other countries.

As the Council of Learned Academies has pointed out, there is an almost universal preoccupation amongst the nations of the world with science, technology, skills and innovation.²

I spoke today at a gathering of the Australia-China Business Council. And so I am reminded that the Chinese government is investing more than \$50 billion every year in science³ – something like our defence and education budgets combined.⁴

But I could just as easily point to the United Kingdom – which largely ring-fenced science and research against austerity cuts, in the belief that these investments were critical to their future

² Australian Council of Learned Academies, *STEM: Country comparisons*, May 2013. Available: http://www.acola.org.au/PDF/SAF02Consultants/SAF02_STEM_%20FINAL.pdf.

³ <http://www.nature.com/news/china-goes-back-to-basics-on-research-funding-1.14853>

⁴ http://www.budget.gov.au/2014-15/content/overview/download/Budget_Overview.pdf

and to the position the UK would have in the world of the future.⁵

Or I could talk about India, which put a satellite into orbit around Mars last year, becoming only the fourth nation in the world and the first Asian nation to do so.⁶

Or for that matter I could mention the Vatican City, where the reigning Pope is a qualified chemical technician with work experience in the food science sector. And where the Pontifical Academy of Sciences will next month hold a meeting to discuss how to 'Protect the Earth, Dignify Humanity: the Moral Dimensions of Climate Change and Sustainable Humanity'.⁷

Sustainable humanity; sustainable planet. Hard to imagine the first without the second.

Our Pale Blue Dot

But we could do with some perspective on this matter.

If you are out and about in Canberra early enough these autumn mornings, you will often see the hot air balloons rising out of the mist.

We forget how remarkable it is that we can enjoy a perspective of the Earth from the air - a perspective our species has only known for a little over two centuries.

And science has kept pulling the viewfinder back ever since.

About a hundred years ago, we looked down from an aircraft.

About fifty years ago, we looked back from the Moon.

⁵ Osborne, G. (2014) Chancellor of the Exchequer's speech on science in Cambridge. Available: <https://www.gov.uk/government/speeches/chancellor-of-the-exchequers-speech-on-science-in-cambridge>

⁶ <http://www.thedailybeast.com/articles/2015/01/17/why-china-will-win-the-next-space-race.html>.

⁷ <http://www.casinapioiv.va/content/accademia/en/events/2015/protectearth.html>.

And twenty-five years ago the Voyager 1 spacecraft turned its camera around and took a photograph of the Earth from six billion kilometres away, a place beyond the planet Neptune.

That image became known as the 'Pale Blue Dot' – because dot it was. The photograph had over 600,000 pixels, of which one tenth of one pixel was planet Earth. One thousandth of one pixel would be Australia.

Reflecting on the image in 1994, Carl Sagan wrote perhaps his most famous plea to the custodians of that fraction of a fraction of a speck:⁸

From this distant vantage point, the Earth might not seem of any particular interest. But for us, it's different. Consider again that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives.

Our posturings, our imagined self-importance, the delusion that we have some privileged position in the universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark.

The Earth is the only world known, so far, to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment, the Earth is where we make our stand.

It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world.

*To me, it underscores our responsibility to deal more kindly with one another and **to preserve and cherish** the pale blue dot, the only home we've ever known.*

⁸Carl Sagan, Pale Blue Dot: A Vision of the Human Future in Space, 1997 reprint, pp. xv–xvi.

One planet, one home, and one lifetime for each of us to help shape it. And remember - a lot can be accomplished in one lifetime.

The pace of progress

Think for a moment of the Earth that Voyager captured in 1990.

What have we done in the 25 years since then?

- Since that time we have added an extra two billion people to the planet.
- Global carbon dioxide emissions have grown by 42% or close to an **additional** twelve billion tonnes⁹ each year.
- Our world is connected by websites, smartphones and tablets - things that lived only in the most imaginative minds of 1990.
- There is probably a device in your pocket with something like 240,000 times the memory and millions of times the processing rate of the onboard computers¹⁰ that took Voyager 1 many billions of kilometres across the solar system and into interstellar space.
- You can have your genome sequenced for around \$1,000 – something that took 200 scientists, \$3 billion and eleven years to accomplish from the time the project commenced in 1990.¹¹
- You have every chance of living longer, travelling further and learning more through study than your parents.

⁹ 1990 – 2013: Boden, TA, Marland, G and Andres, RJ 2013. Global, Regional, and National Fossil-Fuel CO2 Emissions, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., USA doi 10.3334/CDIAC/00001_V2013

¹⁰ http://www.nasa.gov/mission_pages/voyager/multimedia/vgrmemory.html#.VQ_Aqj64a70

¹¹ <http://www.businessinsider.com.au/super-cheap-genome-sequencing-by-2020-2014-10>

All of these things have come about through science, the good bits **and** the bad. They have come about through societies which made choices about the uses to which science would be put.

If you looked at our planet today from 6 billion kilometres away, you might not notice much of a difference. But then again, you would be 6 billion kilometres away, and you might not care. We are 6 billion kilometres closer. We have no choice but to care, because we live with the consequences of our decisions.

To act, or to avoid an issue. To take an interest in what scientists do and say, or to ignore them, or disparage them if their message is not what you want to hear. To plan for the future, or assume that 'she'll be right' - just because it seems always to have been.

It seems to me that the future is everyone's business, and so is the science that allows us to shape it – for better or worse. That is science at the level of the planet, science for our nation, science for all living systems. Science that helps a global community *preserve* our world because we *cherish* it.

That would give us something to pass on to the coming generations that they might appreciate just as much - or maybe more than - a balanced budget.

Science for a stronger future

Imagine our Australia if we had the courage to build that kind of legacy.

Imagine if:

1. We had an education system that so fired our curiosity that nearly all year 12 students would take at least one science subject, understanding it to be critical to their future. Not to be scientists, necessarily, but to be citizens who had a level of

scientific literacy that would help them judge when an expert is an expert; and when a self-styled 'expert' is a ranting entertainer.

2. Imagine if all secondary students received a thorough grounding in the history and philosophy of science, and in the scientific method, from teachers we supported and celebrated.
3. Imagine if many of those students went on to study a science at university – where lecturers engaged them in an interesting way, teaching science as it practised, with the intention not of creating more science lecturers, but of shaping curious minds fit for all sorts of careers.
4. And imagine if employers could see the benefits of the skill sets developed as part of an education in the scientific method - whether or not they needed the knowledge intrinsic to the particular discipline studied by the student.
5. Then imagine if there were few, if any, barriers in front of either the people uncovering new knowledge or the people applying it in new ways to meet the needs of the market and the community.
6. Imagine if we no longer ranked at the bottom of the OECD table for industry and higher education research collaboration, and imagine that we might aspire to be at the top. That we would limit the stultifying but pervasive notion of that being a 'fast follower' is OK when all that it does is condemn us to never being better than second.
7. And imagine that because of all the inspired students, and inspiring teachers, and inspirational achievements, we were **proud** of the intellectual capital of this country, and that we nurtured curiosity and valued talent wherever we found it.

Then imagine that we thought of all these things not as ends in themselves, but as some of the means to the most important

end of all – building the best Australia that we can, and making the best possible contribution to the world.

A grand ambition, perhaps – but if the Pope can have a science qualification, and the wealthiest people in the world can be IT tycoons, it seems to me that this country can be bold enough to say that every primary school ought to have science teacher and a mathematics teacher with continually updated knowledge of where the science was up to..

Get it right - accepting that it is a long-term investment to get it right - and I believe we can build something magnificent.

The cornerstones of prosperity

How magnificent? I am often asked to put a number on it by the people who like having numbers to tell them what's important.

And of course that's very hard.

So the Academy of Science and my office combined to do the next best thing, and asked some experts from the Centre for International Economics to calculate the value of science to our economy.

The report that we released earlier today¹² focuses specifically on a subset of core disciplines - physics, chemistry, earth science and the mathematical sciences - and the contribution that advances in these disciplines over the last 20 years have made to our economy.

So what is the value? Well, I'll tell you that it is estimated to be \$145 billion.

¹² <http://www.chiefscientist.gov.au/2015/03/report-the-importance-of-advanced-physical-and-mathematical-sciences-to-the-australian-economy-2/>

When we add the indirect impacts, it accounts for over 22% of Australian economic activity, or about \$292 billion per year.

This suggests to me that science is close to the heart of our prosperity and critical to the sort of economy we need to build. An economy that provides good jobs regardless of the global prices for the things we can dig out of the ground.

You can read all about it in the report we launched today.

And I put these numbers forward in the belief that the national economy is important, that it lets us do things that we want and need to do, but it is a means to an end – not an end in itself. The end must surely be something bigger than the sum total of the things we **think** we can afford at any given point in time.

It's been put to me (indeed to all of us) that we shouldn't borrow from the future to fund the lifestyles of today. I can understand that. It is a reasonable aim and it would not be fair if we were to ignore it.

But isn't it also unfair for us on this planet to release carbon dioxide into the atmosphere to reach levels beyond any levels known in 800,000 years, at a rate many times faster than any previously known,¹³ and have futile discussions about whether it will have any impact on the planet, rather than what to do about it?

It will be science that searches out new low emission energy sources, that captures CO₂, that develops methods to store energy, that works out how to protect our biodiversity. And it will be science along with the social sciences that helps us to identify how our communities will mitigate and adapt to change.

And isn't it unfair to dawdle on the sidelines whilst infectious diseases turn from outbreaks to pandemics, exhausting today's

¹³ Lüthi, D., M. Le Floch, B. Bereiter, T. Blunier, J.-M. Barnola, U. Siegenthaler, D. Raynaud, J. Jouzel, H. Fischer, K. Kawamura, and T. F. Stocker (2008), High-resolution carbon dioxide concentration record 650,000-800,000 years before present, *Nature*, 453(7193), 379-382, doi:10.1038/nature06949.

therapies without breaking open new pathways for treatments in the future?

It will be science that helps us identify new methods of treatment, new antibacterial agents, new ways of identifying and containing threats.

And isn't it unfair that some students leave school with no grounding in science or technology, to confront a labour market that puts a premium on these things and a society that is often unsympathetic to those without the skills to connect?

It will be science that helps us to develop new and better products and processes for our industries, and real opportunities for our children.

We ought to aspire to leave credits as well as debits on the national balance sheet – credits of knowledge and the capacity to use it.

And perhaps in that way we can pass on the capacity to deal with the challenges that we will face, whether or not we see or acknowledge them today.

That is why I am happy to continue another project this year – the framing of national science and research priorities. The list is available on my website.¹⁴

This is not a particularly revolutionary idea. If we look at the nations that are set apart by the strength of their science and the innovative capacity of their industries, priorities are a common part of their plans.

Let me emphasise this is not a push, not a push, not a push for an exclusively applied research agenda – it is a whole of research agenda.

¹⁴ <http://www.chiefscientist.gov.au/2015/03/draft-science-and-research-priorities-for-australia/>

Priorities do not displace the sort of fundamental, curiosity-driven research that underpins all human progress.

It is clear that in this nation we must support curiosity driven research; we must also support that fundamental search for knowledge when we are faced with an explicit issue that we can't address because we don't know enough. And we do have to support the translation of the ideas, of knowledge to goods and services that improve the lot of humankind.

The priorities simply recognise that it would be better if we could agree on the things that are important to our nation, right now; the things that we need to do or can do in a way that gives us a competitive edge, or a comparative advantage or satisfy a real need that we have in this country as well as the things that are most important, amongst all the important things, we could support if research funding were not rationed.

All in it together

And I hope the priorities will serve another purpose, as well.

For a long time, it has been received wisdom that science policy isn't something in which the general public can be expected to take an interest.

I don't think it's true. And if it is true, it shouldn't be.

Let me give you an example. Professor Ian Frazer is presiding this evening over the formal launch of the Australian Academy of Health and Medical Science.

It will be a source of independent expert advice on medical issues, and promote the translation of new knowledge into better treatments and diagnostic tools for patients.

It strikes me that this is the sort of national asset we should know about – particularly in a fortnight that has seen two

cookbooks pulled from publication, for fear that the public will mistake them for science.

It also strikes me that the public might like to think about the future in something other than budgetary terms.

If the research priorities remind us that we have something worth striving for, a common set of goals for our nation, they have served an important purpose.

And if they help other nations to join us in the challenges we hold in common, then that is a good thing too.

Since this is likely to be my last Press Club Address at least in this job, I will finish by drawing on something I said during my first address four years ago. I was asked why I had accepted the job.

What I **thought**, but didn't say then, was that I looked forward to being described as relentlessly consistent by people who watch what you do and over a period of time and can see a thread. Because when the cause is worthy, you have to be consistent.

My three word mantra these days is passion, patience and persistence. You have to be passionate about what you're doing; you do have to persist because it's not easy; you have to be patient because it takes a long time. But if you don't have the combination of the three, you don't get anywhere.

So I was quite happy to be described as relentlessly persistent and I hoped and thought that would be a good description of me all those years ago. But I actually said that science would still matter when people then in the news (whose names I can't recall) were forgotten.

It was true then and it is true today. The need for good science will outlive us all. Each and every one of us will be outlived by good science. But the platform we build now will be the

platform that supports the science of the future. When we support the future we are handing on to those who come after us something worth handing on.

Thank you.