Australian Government

AUSTRALIA'S CHIEF SCIENTIST

AUSTRALIAN SCIENCE COMMUNICATORS NATIONAL CONFERENCE

KEYNOTE SESSION 1: OFFICIALLY OPEN THE CONFERENCE – SCIENCE AND SCIENCE COMMUNICATION IN AUSTRALIA

30 MINUTES SPEECH PLUS 30 MINUTE Q & A

SYDNEY MASONIC CENTRE - GRAND LODGE ROOM, LEVEL 1

27 FEBRUARY 2012

Good Morning,

It is a pleasure to be here today to present this address to you– to so many of Australia's Science Communicators – and to be able to open officially your national conference.

This is an important time in our country's history. The problems we face – indeed, the problems that the world faces – won't be solved, moderated or even managed without science and technology. Yet it is not clear to me that most people, or even many people, really understand the importance of science and technology to our future.

I know that we don't want a world comprised exclusively of scientists and technocrats. Well, I know that I don't. I understand that we probably all want a world that includes historians and writers and artists and musicians – and economists and lawyers and chefs and plumbers and journalists – and elected politicians, too, since the alternative is hardly a cosy prospect.

But none of them will work to their best if the world itself is not a safe and prosperous place – a world where we install a social, cultural and economic prosperity, a sense of security, for the people who inhabit this planet.

And to do that, we need science and technology – and we need to see it embraced - not because we tell people that it is good for them, but because people understand that it is; and want it to thrive because of the knowledge and understanding and benefits that it brings; and because they appreciate that it can, indeed, be the foundation of the world we make for ourselves – the type of world we want to live in.

But we have work to do. It is not a given that people think science is 'a good.' It may surprise those of us 'in science' or close to it; but people seem either take it for granted - as in, it'll be there if we need it but in the meantime it doesn't have much impact on our everyday lives - or their minds can be changed quite quickly - think where we began with climate change and think where we are now – all because of a concerted and concentrated campaign by a few people whose real interests are as variable as, let's say, the weather.

Since I started in this role, I have given something like 50 speeches around the country. Formal and informal; long and short, written in advance and off the cuff. In many of them I have managed to urge the scientists present to take the time to communicate. To go out there and tell people why they do what the do, how they do it, why they do it and why it's important they do it.

They usually treat me kindly - like one might treat an eccentric uncle. But I think they acknowledge the importance of the issue even if they hanker for the old days (my days) when you could largely get by with just being a scientist – just doing science.

So this, my 50th speech, or something like that, as Chief Scientist, and probably one of the few where I can put away the prod, and exchange 'urge' for 'emphasize'. One where I can emphasize the need for communicating our science and its value to the community to a bunch of people already committed to it, a bunch who are in fact intrinsically urgers. This time I am <u>at</u> a podium not <u>on</u> a soap box.

As Australia's Chief Scientist, it is easier for me to speak out – because I have people to help me do it and who prepare me to do it. But as I have said many times in many places, it can't just be me. The science community as a whole has to be involved.

But I know that when I encourage others to do the same they probably don't have the resources I have to make this easy for them to do.

It does mean that the communication between science and the media is patchy - that the effective use of the media to get the message out is uneven. And that does mean that we have to do better. The UK's Science Media Centre's philosophy sums it up perfectly: *The media will 'do' science better when scientists 'do' media better*[1].

So collectively we must do better. But how? Do we do more of the same – more of the old ways? Or do we look to different ways - at the many ways we can communicate these days and use all of them?

The old ways are good ways to learn from. We did some things well although we made some mistakes. We understood that the people who provided the wherewithal for us to enjoy the job of a lifetime – being a scientist and an academic – would probably want to know sometime or other what they got in return. So we made a few amateurish forays into the media, got mocked by our colleagues for the headlines that went with the story, wished that we hadn't been so silly and tried to avoid doing it again.

But the world is different now. The expectations are higher. The expression 'tax-payers money' is used more widely than ever and most often as a prelude to a criticism. As far as we are concerned, it highlights a risk; it emphasizes the need to explain what we do for the money we spend and to explain it convincingly. And whereas there were newspapers, morning and evening in my day, and radio and television – there are now many more ways of getting our message out. There is still the headline from hell, still the cringe-making photograph; but now there is a bit of empathy from the colleagues – there but for the grace of .... go I, they think – and we do it again; we know that we can't avoid it.

I must admit, however, that modern communication methods do baffle me a little. When I hear talk of tweeting and stuff like that I don't immediately think of some messaging medium that instantly connects you with the President of the United States, or to gossip about somebody's private life.
Facebook is a similarly strange beast. I have heard young people call it 'Stalkbook' to keep track of ex-partners, school mates and c-grade celebrities, however I have come to realize that Facebook isn't just for cyber voyeurism and updates about things I don't care about.

I realized it was more than a diversion into the frivolous when I heard about a Canberra based initiative called Science Alert and what happened when it went onto Facebook.

Science Alert was founded by Julian Cribb. It came about because of his concern at the lack of information available about what Australians and New Zealanders achieve in science. So Julian created a website to promote peer reviewed science back in 2004. And it is, of course, fantastic that we have a website that clearly communicates science and research and also promotes jobs and university courses. The incredible thing, however, is that since Chris

[1] Leveson Inquiry

Cassella came on board and got Science Alert on Facebook, it has changed the way science is being communicated.

In saying that, it gives me great pleasure to announce that as of yesterday, Science Alert has reached 1 million followers worldwide. That puts them in the top 10 general news Facebook pages in the world with the likes of CNN, BBC World News and Fox News and number 1 in Australia.

90% of their fans are between 13 and 30 and they reach an average of 250,000 Australians a week. The overwhelming majority of their fans are outside Australia.

This form of instant sharing and global networking changes everything. Not only does it change the way we promote the work we do here in Australia, it helps to improve international collaborations, commercialisation and to attract international students. But it also gets science into the mainstream of people's consciousness. Facebook and twitter have made science more accessible and we must take advantage of that access.

In fact we need to rethink the way we communicate science. We have a lot to explain. What it's for? How it's done? Why it's exciting? Why it's important? All the career options available for somebody with a science degree. The usefulness of an education in science because the method can be applied to a wide range of jobs: because of its rigour, its dependence on evidence, the skills of analysis and observation that are highly developed, the fostering of the skepticism that is fundamental to proper science.

And we need to rethink it right now because we are looking at some serious challenges here in Australia, not unlike those confronting many developed countries.

The Relevance of Science Education (ROSE) program of Norway asked young learners at the age of 15 from more than 40 countries for their views on several aspects related to science and technology. The results reveal that the more developed a country, the less young people are inclined towards education and careers in MST. It is pretty stark and the message holds for whether or not they would like to become a scientist – or to get a job in technology. The researchers suggest that *it might be that we have now passed the era in which the work of physicists, technicians and engineers is seen as crucial to people's lives and well-being*. Today's youth will not make their choices because it is good for European competitiveness or because they may earn a good salary. They are more interested in *who they will be* rather than *what they will do*. [2]

Australia was not one of the 40 countries. But, like most other developed countries, high school students in Australia are not very interested in doing science or advanced mathematics in high school[3].

Between 1992 (after which school retention rates were fairly stable) and 2009, the proportion of Year 12 students taking physics, chemistry and biology fell by 31%, 23% and 32% respectively.[4] The proportion taking one of advanced mathematics or intermediate mathematics has dropped from 41% to 29% over the same period.

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[2] ERT Mathematics, Science and Technology Education Report, 2009

[3] Commissioned study.

[4] T Lyons (personal communication, 27 January 2012). Data provided based on DEEWR statistical collection

And they have lost interest except for what may be an irreducible core. A little over 50% of year 12 students (about 105,000) took at least one science subject in 2010. While the proportion is drifting down, it has at least slowed – maybe that is the close to the irreducible core.

Not all those 105,000 students enrol in a science or engineering degree at university: only 22,500 individuals started a degree in Natural and Physical Science in 2010, and 12,500 in Engineering and related subjects. It could get worse.

A recent survey of year 11-12 students in Australia indicated surprisingly little understanding of the science all around us, all the time. Of those studying science, just 33% thought science was 'almost always' relevant to their future (although 47% thought it 'almost always' relevant to Australia's future!) and only 19% thought it 'almost always' useful in everyday life. Of the students not studying science (roughly one-third the cohort), 1% thought it relevant to their future 'almost always' (42% thought never) and 4% thought it 'almost always' useful in everyday life, 42% thought sometimes and 18% thought never.[5] Considering the science and mathematics in everything from their school shoes, clothes, plastic bank notes, television, mobile telephone and food, this is very profoundly discomforting.

It shouldn't be a surprise that university enrolments for certain science disciplines, mathematics and engineering are low and have been essentially flat over at least a decade. IT enrolments have dropped like a stone.

We graduate around 20,000 STEM-related students a year, 6,000 of whom are engineers. Engineering Australia has reported that there is a shortage of 20,000 engineers right now. But you can't say to somebody that although you applied for Biology, Economics or History you must enrol in Engineering because we need more engineers. It is a democracy, still, and students are allowed to choose. We have to get people **to want** to study engineering – or Chemistry or Physics or Mathematics for that matter.

But we are not alone. There is widespread concern about the decline in the STEM subjects globally, and much effort is committed to working out what to do about it.

Part of the problem is that even after a lot of effort by a lot of people, the numbers still fall, or flat-line at a low a level. We need a step function change, not just a bit more – though not less - of what we have been doing.

The US President has just released a report calling for one million additional graduates in the STEM subjects over the coming decade. That is, one million on top of the current 3m. Australia will produce more or less 200,000 such graduates if we do nothing, or continue to do what we do now. Just to keep pace, that is to achieve the same proportion of STEM graduates in our workforce as the US, we need an additional 135,000 graduates over that decade. A 66% increase; and yet the numbers of students (or the proportion of students) taking the necessary subjects in school is still slowly falling – and the place of science in our world is clearly not well understood.

How are we going to deal with food security, bio security, urban sprawls, degradation of arable land, climate change, declining resources and a burgeoning population – if we don't

[5] Goodrum, Druhan, Abbs (2011)

have the supply of scientists and engineers to use their knowledge and their skill to help us get to solutions? And how will we get them, if not enough care? And is part of the problem that the community as a whole appears to care less than it used to?

We simply have to reposition ourselves, rethink the strategy and identify the step we have to take.

Whatever we do, it is important to take our community with us. We have to take them with us on what are effectively two journeys: one is the need to understand the natural world – what it is, how it is what it is, and why; and the other is the constructed world – the one we have made for ourselves to make life better, or more comfortable, or more secure, or more prosperous. Or all of them.

Australia does very well in the first bit. We generate about 3% of the world's stock of knowledge with only 0.3% of the world's population.[6]

We contribute that to the world, and use our expertise to add value to some of the 97% generated elsewhere. It is one of the means by which Australia acts as a responsible global citizen: we contribute to the well-being of people on the planet and so contribute to a sustainable, secure and I earnestly hope, peaceful world. This contribution is in our national interest.

The *national interest* is the most important reason I can think of for reform. We have to be competitive: to build an economy that has within it a deep knowledge-base which can be used to innovate, to develop new industries, new forms of employment and ensure a level of prosperity for all citizens. And we have to be a good global citizen.

Our national interest is served when we give all Australians wherever they may live, work or study, the opportunity to participate in a top quality education – to develop fully their potential.

It is also served when we don't waste talent.

On the last point, wasting talent, you may well ponder why Australia is 9th in the OECD for employment of scientists and technologists and equal second last when it comes to the employment of women in that area. About 1,000 of our 6,000 Engineering graduates each year are women – not because they drop out but because they don't enrol.

We need to change the way our community thinks about science, mathematics and engineering. And give them the information they need to make informed decisions about what to do, and what is important.

If we are to achieve what we need to achieve - higher levels of participation in science, mathematics and engineering, higher levels of employment of talented women in these areas, higher levels of understanding of the benefits (and pitfalls) of science and its role in the future of humankind, comprehension of the ethical framework that is part and parcel of respectable science - we need cultural change.

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6 reference

As I said earlier, the investment in MES has to be wanted by the community. The STEM professions have to be seen to be part of the solution to our challenges. That will require a relentless 'education program' – why science is important, how it is done, its ethical framework, what it offers, the differences between an expectation of certainty and the reality of probability.

In discussions we have held as part of advice we are sending to the Government quite soon, there was a general conclusion that the level of scientific literacy in the community is not at the level it should be.

So what is it, this science literacy? I give you one definition of many floating around. The NSW Department of Education and Training sets it out nicely:

> *Daily we read and hear stories about global warming, cloning, genetically modified foods, space exploration, the collection and use of DNA evidence and new drugs that will improve the quality of life and make us look years younger. As a consumer, and as a citizen, we need to critically evaluate the claims made in the name of science and make informed decisions and choices about these and other science based issues. In short, we need to be scientifically literate and more importantly we need to develop scientifically literate students.*[7]

It is important to note that this version of scientific literacy requires a broad understanding of the concepts and processes of science - not a burning desire to wear a laboratory coat. But it makes clear the need to understand science and from that understanding will develop an insight into its value. And from that appreciation will flow support.

Personally, I think these skills should be taught explicitly to all students in junior and probably middle secondary school. But that is part of the story.

A recent comment in Scientific American notes that: *teachers at the high school and undergraduate university level aren't giving students a broad enough understanding of how scientists go about their research. While scientific literacy in the United States is increasing, thanks to the requirement that college students take at least one year of science, the general public is relatively ignorant about the process of scientific inquiry and the nature of science. The importance of clearly defining the field and explaining the methodology behind it are paramount at a time when debates among policy-makers about addressing climate change and among educators about teaching evolution are blurring the public's understanding of the difference between science and ideology.*[8]

So this brings me back to you – and the important role that you play.

If our national interest is served by getting the message out, it is you the science communicators, together with the scientists, engineers and technologists, who will get it there – with a bit of help from me and my colleagues on the side.

I don't necessarily mean getting front page stories and plenty of airtime as this can be just as damaging. In a report by the Science Media Centre in the UK to the Levenson Inquiry into

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[7] *What is Scientific Literacy?,* NSW Department of Education and Training 1999-2011 http://www.curriculumsupport.education.nsw.gov.au/investigate/index.htm

[8] Cuchman A, *Schools should teach kids more about how science is done* , Scientific American, February 2011 http://www.scientificamerican.com/science-in-action/

the culture, practice and ethics of press[9], they present some excellent case studies where this has proved dangerous to science, scientists and people: sensationalised stories where only one study has been done and not peer reviewed or where there is inconclusive evidence or plenty of figures to choose from and they cherry pick – usually the one that gets them air time somewhere.

We all know about the rubella (MMR) vaccine debacle where one scientist with a vested interest claimed a link between the vaccine and autism. The UK's SMC reports that it took 15 years for numbers of vaccinations to recover after that, and in the meantime cases of measles in England and Wales rose from 56 in 1998 to 1,370 in 2008.[10]

Sadly, science can also be used for political gain. Think of climate change. How did the science get so lost in the public debate?

A report done by The ANU in 2010 concludes *that Australians continue to be confused about the level of consensus among climate scientists on the issue of climate change. Forty per cent of people think that most climate scientists disagree over whether the Earth has been warming in recent years, and just over a third thinks that climate scientists disagree as to whether human activities are a major cause of climate change.*[11]

Why do you think 40% of Australians believe scientists disagree about the earth's warming when in fact approximately 97% of climate scientists agree with anthropogenic global warming[12]?

Public misconceptions about such things as the scientific consensus of climate change are exacerbated by politicians actively using it as a front in their campaigns – and the way it is reported. We see it in America where one Presidential candidate (a lawyer) reportedly called the science 'junk' and 'patently absurd'; and we saw it in Australia when a political leader declared the complicated science of climate change 'crap' and then later showed his supreme knowledge of science by declaring that CO2 was weightless - to suit another political point. They say what some people want to hear – and facts are sometimes the casualties – but public respect for science is bruised in the process.

Journalists, scientists and science communicators all have a responsibility here. Present evidence accurately and fairly. Don't present high probability as incontrovertible fact. Don't ignore alternative views that have been derived from serious work and analysis by serious scientists. Don't represent balance as equal time or equal space unless the weight of expertise is evenly balanced. Ensure that people know where the balance of evidence lies and where the balance of expertise leads us. Draw the distinction between astronomy and astrology; don't recommend a dentist to treat a broken leg – so don't make it appear that a person with a science degree is by definition an expert in all or every science – test the assumption. Take the time to examine the substance and identify where the weight of evidence lies. Explain carefully an important characteristic of science: scepticism. Prepare the public so that they aren't confused by scientists openly debating a result or an interpretation. It is what we do: part and parcel of it. And help change the image of science and scientists.

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9 Leveson Inquiry
10 Leveson Inquiry
11 http://publicpolicy.anu.edu.au/anupoll/documents/2010-12-07_ANUpoll_science.pdf page 10
12 Reference

And we must be a constant source of information. The odd bit here and there is better than nothing but not enough. We need to make science, mathematics and engineering interesting enough for it to be a regular in the news and views – in all media outlets.

I wish you well in your task. Let me emphasize the importance of the job you do. And remember - to paraphrase: we need to 'do' science better and that will mean scientists have to 'do' media better. Help them.

It is a pleasure to declare this conference open.