**Ideas and Society**

**Communicating Science**

**20 May 2014, 12.30 pm**

**John Scott Meeting House, La Trobe University**

**Professor Robert Manne**

Well, I’d very much like to welcome you all and it’s great to see such a healthy audience here. It’s the first purely science event I’ve run I think, and it’s wonderful to see this audience. Thank you very much.

The university acknowledges the Wurundjeri as the traditional custodians of the land upon which the Melbourne campus is located and we pay our respects to elders, past and present.

As all of you here know, today’s event is about how science can be communicated. In my mind, there are two issues, but there are many more that the speakers will raise. For me, the two issues – the first is what you can call science literacy and I’d like to read an email that I got from Jenny Graves, who is the distinguished professor of the La Trobe Institute of Molecular Science. She apologised for not being able to be here and then, she’s in Singapore, but she then says, it’s a topic I feel very strongly about, as you may know. I would really like to see some acknowledgment that scientists have an uphill battle, communicating science to a community with such a pathetically low level of science literacy. A recent Academy of Science survey in Australia found that nearly 40% of respondents aver that it takes just a day for the earth to go around the sun, and a similar percentage that man shared the earth with dinosaurs. In other words, I think we have to work much harder at improving the standard of school science education in this country, rather than just exhorting scientists to be ever more populist. And then she says, maybe one of your panel might address this question.

The second issue and the one that I have to admit is closest to my heart is what I’d call politically inspired resistance to the conclusions of scientists, something in my earlier years I would not have thought possible. Although there is more than one example, the case I have in mind is of course the rise of climate change scepticism or denialism. On this question, the question of combatting climate change scepticism or denialism, I believe the future of human civilisation, the wellbeing of other species, depends. This is why this question for me has a particular urgency.

Now, today, we’re privileged I believe to have three wonderful speakers, all of whom I know personally. The first speaker will be our Chancellor, Adrienne Clark. As a university, we’re extremely lucky to have her as Chancellor. She’s a former chairman of CSIRO, former Lieutenant-Governor of Victoria. She served many Boards, including the Prime Minister’s Science and Engineering Council. She’s also the author of four major books and a member of the Australian Academy of Science, Australian Academy of Technological Sciences and Engineering and it’s for me, a particular pleasure to have Adrienne speak at one of our events, something I’ve aspired to for some time.

The second speaker will be Elizabeth Finkel. She’s a Vice-Chancellor’s Fellow at this university. She’s the Editor in Chief of the premier science magazine in the country, *Cosmos*. She’s a biochemist and the author of two outstanding books, *Stem Cells* and *The Genome Generation*. She was, in 2011, named the National Press Club’s higher education journalist of the year. So, welcome Elizabeth.

And I have particular pleasure in having to La Trobe University, one of the great characters of Australia, Robyn Williams. I don’t think anyone would doubt that he’s the most important science journalist of our generation in Australia. Serendipitously, we’re about to celebrate the fiftieth anniversary of the Science Unit of the ABC, in whom, for whom, Robyn has been the critical figure, and I think he’s a great hero of science and of civilisation in this country. He joined the ABC Science Unit in ’72, in ’75 he established *The Science Show*. In 1987 he was proclaimed, a very Australian thing, a national living treasure. And in 1993, somewhat more conventionally, he became the first journalist to be elected a Fellow of the Australian Academy of Science. He’s written ten books, or is responsible for ten books and written an autobiography typically called *Now for Something Completely Different*.

So, I’d like you to welcome our three speakers and ask our Chancellor to begin the talks.

[applause]

**Professor Adrienne Clark**

Thank you Robert, for that lovely introduction, and it’s lovely to be here but I feel that I’m at a disadvantage because I’m the amateur of the three, as a communicator, and we’ve got two professionals here. But I could tell you a little bit about some of my efforts to communicate science, some of which have been successful, and some of which have been disastrous.

So, I’d start by saying … and I am a scientist, I’m a biochemist and chemist by training, so science is my background. And I’ll start by saying that scientists generally are not very good at communicating issues of science to lay audiences. Often we don’t even share the same language. The words that we as scientists use every day don’t necessarily conjure up the same images for normal, that is, lay people, or indeed, any image. So I can tell you a story about one of my very first efforts, which was, I was invited to go to Western Australia, to the parliament there, and speak to the parliamentarians about the then new field of biotechnology. This is the early eighties. So I thought really hard about it. And I thought, how am I going to explain what DNA is and how you can cut it and how you can move it. So I had a whole lot of images ready, with little scissors, explaining how DNA can be cut and moved. I got up there and I started my speech, and one of the elected members said, Professor, what are the little scissors? So I said, oh they are representing enzymes that can cut the DNA. Oh, he said, what’s an enzyme? So I said, well, an enzyme’s a biological catalyst. Oh, he said, what’s a catalyst? I said, well, a catalyst’s something, a chemical that will make a reaction go faster than it would normally go. So, what’s a reaction? So I was getting into a worse and worse position. So I said, well, maybe a reaction would be, for instance, if you leave iron nails out in the air, and it’s wet, they’ll go rusty. So, the iron and the oxygen get together and they make rust, and that’s a reaction. And he said, oh, how does that work with the scissors? So, I thought, well, I haven’t got this together. And I’m really on the back foot. When I talked to them afterwards, what was really interesting to them was, whether there were votes in it, and how much money was in it. So I learnt that you actually have to understand where they’re coming from, and, you have to understand the language.

So one of my next efforts was much more successful. And it was a much tougher audience. It was a class of sixty 10 year olds at a local primary school, and my challenge was to interest them in science. So I thought, what are children of 10 years old interested in, and the answer is food. What sort of food? Chocolate. So I got them each a chocolate frog. So I bought sixty chocolate frogs and distributed them and they were wrapped in paper. So I said, we’re not going to eat them, we’re going to look at them. We’re going to look at the paper. What’s the paper made of? Look at the ink. Where does ink come from? Look at the droplets on the paper. How are they made? Then you can open it and look at the chocolate. How is the chocolate made? Where’s cocoa grown? Who controls the diseases of the cocoa palms? And so forth.

Well, I knew I was successful because the wonderful teacher in charge got every child to write a page about what my visit meant and she put it together in a little booklet for me. It’s one of my most treasured possessions. I actually got to those kids and they were very excited about science.

So, that was a good story. But when it came to more complex community debates, for instance the GM debate in the 1990s, I and other scientists, and I think Marilyn Anderson from La Trobe University, Professor Anderson, was very much involved in this, and many others, we had limited success, I can say. And the GM debates and others like stem cell technology, nuclear energy, were very one-sided. It was often the part time amateur communicator, that’s the scientist, versus the full time professional communicator, the activist, presenting a contrary view.

And I found it extremely difficult, because I was a young scientist in a lab then, and what would happen is, an issue would break, and you would have constant phone calls from the press wanting a comment, wanting a comment. But you had to go and teach a lab, or you had to, you know, give a lecture, or you had an experiment running and you couldn’t actually really think carefully to give a considered response. And scientists naturally are very cautious and very careful about giving opinions that can be attributable to them. So it was an extremely difficult situation.

On the other side, there were some very effective communicators. I have to say, they were really good, presenting an ‘against’ view and Mark Lynas of Greenpeace coined the term ‘Frankenfoods’. What a wonderfully emotional appeal to horror? And it was extremely effective. But then some time later, he actually read the scientific papers. And when he read them, he realised that he’d been wrong. And he publicly recanted and apologised. He said he was sorry that he helped start the anti-GM movement and he therefore assisted in demonising an important technological option which can be used to benefit the environment.

So he discovered science, and changed his mind, but the damage was done. It was a very unusual conversion and it’s something that’s not found generally in the public.

It’s actually very, very hard for scientists to comprehend that many people are simply not interested in evidence or data. They don’t care. But a scientist’s life is about data, is about gathering data, interpreting data. But many people just make their decisions based on emotion, or what their friends say, or on their beliefs, or on their religion. And their views will just not be changed by consideration of data. And they’re also very much guided by self-interest. In any race, always back self-interest. He tries hardest. But self-interest is right to the fore, what does this issue mean for me? What does it mean for me, and when? How urgent is the issue? And scientists are just not very good at tapping into emotion. Lay opponents can be much better at emotive language and stories. So I think maybe we need to engage experts in marketing and advertising to help get messages in science and technology across to the public, because the marketers and advertisers know how to tap into emotion, and we’re just not skilled in that art.

Before I wrap up, I’d just like to say that out of all the difficulties that we had with the GM debate being very one-sided, and some other debates, came a wonderful institution for Australia, I believe anyway. It’s the Australian Science Media Centre. So they are based in Adelaide and they would take an issue, for example, it’s coming up about stem cells or autism, or whatever it’s coming up, nuclear power, if there’s an earthquake. They’ll take that issue. They will find say, six or seven experts, and get them to write a piece, calmly and quietly, and that piece will then be aggregated with other experts, and then made available to journalists. And in that way, the scientist only has to write something once, know that they’ve written it correctly, that it will be reported, well, hopefully, faithfully, and then that information can be given to the journalists, and I see the fruits of that coming up in the press and you get really good information flow that way.

So that’s been a great advantage. But as Robert said, our future is increasingly driven by science and technology and we need to lay the foundation for a more science literate public, and I think, out of that science literate public will come more science literate politicians. So this comes down to inspirational teaching of maths and science in the schools. It’s another area where we’re slipping in the league tables. If we look at the latest PISA data, we’re slipping further and further in science and in maths, although we’re doing reasonably well in literacy. But we’ve got to pay close attention and that comes down to getting more inspirational and qualified teachers into teaching. We’ve got to be able to teach more effectively, more rigorously and more competitively.

So, my suggestions are both that and getting engaged with the marketing and advertising people, but particularly being grateful for good communicators that we have like Elizabeth and Robyn. So, thank you very much.

[applause]

**Dr Elizabeth Finkel**

Hello. Thank you very much for inviting me, Robert and for putting me in such illustrious company, with two of my heroes. Excuse me, I think that’s my phone. We’ll just ignore it shall we? Well, we’ll just ignore that.

So, I’m going to talk to you about my thoughts on communicating science to the public. So I’m Editor in Chief of *Cosmos* magazine, this is our latest issue with this gorgeous cover which shows the space ship Rosetta, which was launched about ten years ago by the European Space Agency to make the world’s first, humankind’s first intimate mating with a comet. I can’t remember this comet’s name. It’s something like 7P/Churyumov-something something. And this lovely silver tracing shows the orbit that Rosetta’s been in, to try and slow down and catch the comet, and it will next year, next November, it’s going to release a little lander to, for the first time that a human craft has landed on a comet, take a sample, and figure out what the solar system was made of, because comets are left overs from the ancient solar system.

But anyway, that’s just to introduce you to *Cosmos*. I’ve been the Editor in Chief for the last year but *Cosmos* was founded eight years ago. I was a co-founder but the editor, the founding editor was the wonderful and brave Wilson Da Silva. I don’t think I would have had the courage to have been the first editor to launch an Australian science magazine from scratch, but he did a magnificent job. He’s got us a readership of in excess, somewhere between ten and fifteen thousand, up to even a hundred thousand if we look at the polls based on people who read it without buying it. So all credit to him.

But about myself. I’ve been Editor in Chief since June last year and I have to say I was parachuted into the job. I’d never been an editor before, let alone an Editor in Chief. I’d been a science writer and prior to that, a research scientist. So I’ve had to think long and hard and very quickly, about what it means to be Editor in Chief of a popular science magazine. But one thing I realise is that every magazine has a personality and it’s up to me as an Editor in Chief, to shape that personality with the content and the tone. And suddenly words that really never meant anything to me before, like vision and mission and leadership, suddenly became very real and I had to think well, what the hell is my vision and mission and how do I lead, and ya da da.

So, when Rob asked me to talk about communicating science to the public, I thought, well, I can try to capture some of what I’ve been thinking about this last year when I think about what our vision and mission is at *Cosmos*, communicating science to the public. And I’d say there are three things that fit into my vision and mission. I’m not quite sure what the difference is between those words, maybe you can help me out with that.

One of them is sharing the wonder, the excitement, the karma. The other, number two, is teaching. And number three is really equipping people to be literate, scientifically literate, to equip them to truly be citizens of the 21st century, where they do have to … where science is not a take it or leave it thing. It informs every part of our lives.

So let me take these things one at a time. First of all, sharing the wonder. So the wonder of it all is why I went into science in the first place. I could not, not have been a scientist. It’s just the way I’m wired. I’ve always been enthralled, titillated by the exploration, by discovery, by the stories, and an interview I did recently with Katie Mack, who’s an astro-physicist at Melbourne University, really captures this well. Katie, as I wrote when I wrote her profile – you’d think she was just another student at Melbourne Uni. She looks like she’s 18. She dresses in jeans and sneakers. But if you peer into what she’s doing in her little white office, she’s travelling 13.7 billion years back in time to the dark ages of the universe. I asked her at one point in our interview, so what does it feel like to be probing the secrets of the universe? And she answered, I’m constantly in a state of awe and wonder. The fact that space time does bend, the dark matter does exist, is mind-blowing. On one hand it makes you feel very small. On the other, it’s awe inspiring that we homo sapiens with our ape brains have the capacity to understand these things.

So I think that captures what I’m trying to say when I say that part of our mission is to share that wonder.

When I was a writer – I stopped being a scientist for various reasons, largely having children, but as a writer, the desire to keep exploring, keep being part of that wonder was what drove me, because by collecting those stories as an excuse for other people I get to continue to bathe in the wonder, and there really is a sense of karma in this. Not just about having fun yourself, going exploring, but the sense of bringing it back to others. That idea of karma in the sense that what you do has a timeless influence, that you can offer something to someone, who knows where, who knows when? And that karma certainly, I was a beneficiary of that. As a child, I was a beneficiary of the person who wrote this or that book about the solar system that my father bought for me, or the wonder of life inside the cell, a book that launched me on to, you know, the career of being a bio-chemist. Or David Attenborough, how can you not be just incredibly elated by watching his beautiful, beautiful videos. Or indeed, Robyn Williams, whose programs I listened to as a student and got that same feeling. So thank you Robyn.

So, I was sparked in the same way that Irving Weissman, a very famous cancer researcher in America, told me he was sparked by reading Paul de Kruif’s lovely little book, written in 1926, called *The Microbe Hunters*. And Francis Crick was inspired by reading Irwin Schrodinger’s 1944 beautiful, beautiful essay called *What is Life?* I highly recommend you read it, written by a towering physicist, but so accessible, anyone can read this beautiful essay on what is life, and it’s an essay that launched geneticists to truly discover what is life, ending up in the double helix.

So, this sense of karma, this sense of wonder that you help propagate by being a science communicator, it may spark the next Francis Crick, or the next Irving Weissman. But that’s not really what it’s about. I don’t do this because I want to spark the next Francis Crick necessarily. I do it because I want to open a window to the universe, to show its wonder. Because without the window-openers, the universe is a darker, smaller, dingier, more miserable place.

And also, I know that *Cosmos* readers, I know we have convicted criminals, I know we have plumbers, I know we have professional scientists who read us, and my sense of satisfaction is actually greater knowing that the non-trained scientist, that I’m able to open those windows for that person.

Okay. So the next part of the mission vision. Teaching. It is really tough to keep pace with science. Science moves at a head-spinning pace, these days particularly. It’s not just a challenge for the lay person – it’s a challenge for the working scientist, it’s particularly a challenge for teachers, whatever they’re trying to teach in their curriculum. If they’re trying to teach from textbooks, those textbooks as soon as they’re published are out of date.

From personal experience, I know how hard it is to keep up. I was trained as a bio-chemist, spent five years studying genes and a few years ago I thought, you know, I’d really like to write a book about what we’ve learnt for having a human genome. We’ve read *The Human Genome*, the book of instructions for how to make a human being in 2000, and I thought, I really should write a book about what we’ve learnt from doing that. Writing that book took me four and a half years. I had a hell of a time catching up, and I had been trained in this stuff. So it is a hell of a challenge.

That’s particularly one of our missions at *Cosmos*. The magazine itself, I’m trying to teach a classroom that is everybody from criminals to professional scientists, but we also directly try to help teachers start at school by every issue we put out, and indeed every week, we cannibalise one of our stories and we put it in a ready to use form that teachers can use on their iPads for an interactive lesson with their students. So the teacher’s got a form on their iPad, she can send it off to the students on their iPads, test them, all very interactive, all state of the art and so that’s our contribution there.

It’s great to talk about trying to teach and it is a huge challenge. As I said, it was a challenge for me just to get on top of my own field, but I was recently very, very humbled. I tried to edit a story that Paul Davies has written for our next edition of *Cosmos*. And some of you may be aware, in March we had a monumental break-through. Since Einstein’s time, one of the things he’s predicted, and bear in mind, a lot of things he predicted have come true, like relativity and the bending of light waves as they travel through the cosmos. One of the things he predicted that had never yet been proven by data, was the existence of gravitational waves. Well, last March, thanks to some astro-physicists working in Antarctica where the sky is wonderfully clear, they think they got the first evidence of gravitational waves, looking at their signature on the way they twist the cosmic microwave background radiation, and for those of you who don’t know what cosmic microwave background radiation is, it’s the echo of the big bang.

So, my challenge was to edit the work of this … of Paul Davies, a great, great physicist and a great explainer, and I was having a hell of a time, because I could not follow all his explanations and at some point I just had to take things as an article of faith. When I’m, for instance, writing about genetics, I feel I can take the reader back to first principles. There’s nowhere where we have to stop. I can go all the way back to first principles. Like Adrienne talking about the scissors, going back to chemical reactions and then the rusting of the nail. When I was grilling poor old Paul Davies to explain to me about inflation and our universe like this expanding balloon, at one point he got totally exasperated with me and he said, Ella, you just have to accept this. Unless you can do the complex mathematics, you know, you just have to accept this. So that was very humbling and yes, it did make me realise I just had to accept this as an article of faith. So, a bit of a challenge.

Okay. The last thing. Equipping citizens of the 21st century. So up till now you might say, well, this is a take it or leave it sort of thing. Not all of us are possessed with a sense of wonder and want the windows of the universe opened. Not all of us are possessed with this great hunger, this great thirst for knowledge and a desire to learn. But all of us live in the 21st century. All of us see doctors. All of us have to influence our policy makers, our politicians, either with votes or you know, the things we send back to our local members to say, we want you to do this or that about climate change. So I can, you know, list them all – climate change, homeopathic medicine, the nuclear industry, fracking, go shopping in the supermarket – how do you make sense of all the foodoscience there? This polyunsaturated, low sugar, this or that is better for your heart health. Or, you know, will prevent cancer. You know, if you’re a vain woman like I am, and you go into the pharmacy, and all these claims that this cream or that are going to prevent wrinkles. Agriculture – how are we going to feed nine billion, or more likely, somewhere between eleven or twelve billion when our population finally bottoms out some time towards the end of the century? It’s astounding to scientists like Adrienne, or people who follow the evidence like myself, that as the evidence for genetically modified food grows, and grows and grows, showing that on twenty years of evidence that it is safe, that it is environmentally incredibly full of answers to how we are going to sustainably grow food, using less nitrogen, sending less nitrogen and phosphate pouring out into our waterways, sending less pollutants out into our atmosphere. As all that evidence grows, so too does the public reaction against it. I cannot say it any stronger than that. We’ve put out a whole issue of *Cosmos* trying to help the interested reader, trying to have another look at the arguments that they may hold so dear, and just question how they stack up against the evidence. And Mark Lynas, who Adrienne mentioned, has an article in there, talking about the absurdity of it all.

So, I could go on, you know, cloning. What are we to make of cloning. We’ve just this last month made a breakthrough after seventeen years after Dolly the sheep, we’ve finally learnt how to do it in human beings.

So, I’ll leave it at there. Thank you.

[applause]

**Robert Manne**

Just before Robyn starts, I wonder if someone could shut the doors at the back to stop a wind blowing in.

**Robyn Williams**

Thank you. The wind of change. So, why would you want to communicate science? As you heard, the 50th anniversary of the founding of the Science Unit on the ABC and it was set up because several knights got together, knights can be useful. I don’t know about dames, but knights … In 1964 were extremely useful because Sir Fred White, head of CSIRO, and Sir Rutherford Robertson, the botanist from the ANU, and Sir James Darling, who was then head of both Geelong Grammar and chairing the ABC, got together and said, there’s an awful lot of science in Australia, it’s very important, why aren’t we covering it? And the reason that they did so was quite interesting because the Academy of Science was founded ten years before, it’s the 60th anniversary, all these dates coming together, it’s wonderful. When you think about it, in 1963, Jack Eccles got the Nobel Prize. In 1960, Mac Burnet, before that, Howard Florey, and just think what they did. Florey, antibiotics, changed the world. People lived rather than died. Enormous changes. Jack Eccles with the brain and the nervous system. How you work, phenomenal stuff. And the genius, Mac Burnet, self and non-self. How your immune system works, how you can defend yourself against invasion. And how you can actually have transplants. This is gigantic stuff, and Mac Burnet had pioneered also, doing that work here in Australia. So there were all sorts of good reasons why they wanted a science unit set up and it was, fifty years ago, and I joined it in 1972.

So, it’s important, and it’s history, and it’s going on, therefore the journalists should tell you what’s happening.

Secondly, it’s about you. It’s about your body. It’s about your employment. Can you think of one job you can do without some kind of connection with science? What if a cook has never heard of salmonella? Ooh. A sex worker who’s never heard of HIV, or clap. Or a lawyer who’s never heard of forensics. A banker who’s never come across computers. There is no job on earth you can do effectively ignorant of science. And your surroundings. You know, if you walk through the grounds here, the ducks – how do ducks work? How do their brains, the brains of magpies and parrots – they can do things that we thought were absolutely impossible. They make tools. How? There are all sorts of stories about Betty the crow that I can tell you some other time, but the studies of these creatures – the last one I did was from Oxford, cockatoos. Given five locks, separate locks on a cage with food in it and they just opened them. Serially, you change the locks around, they open them still. It’s amazing stuff. Your surroundings. So it’s not just the scientists’ world – it’s your world.

And the third reason really why we actually do this, the ratings are wonderful. Well, modesty should forbid but it won’t. If you look at the podcasting figures, the science programs are always in the top five. Number one is Phillip Adams, LNL, Late Night Live, then we’ve got breakfast, of course they’re on five times a week. The *Science Show* is only on once a week, and it comes third. And if you look at the total pods of all the networks, including Radio Australia, teaching yourself Chinese and English, you know all that stuff you don’t think of. We have five or six programs from science in the top 20. And the ratings for *Catalyst* are at least 600,000, often a million. The ratings consistently are absolutely huge.

There are five reasons for citizens to be connected with science, whether you like it or not. And one, the first one of course is money. Dollars. Did you know that when it comes to the Australian manufactured export, you keep your figures in your head don’t you? Well, top is medical and pharmaceutical products. Did you know that? You probably think it was tin or iron or something and gadgets like that. So number one, medical and pharmaceutical products. Vehicles down there, next comes machinery, general industrial machinery and transport equipment at 4%. And when you come to innovation, you know, that was not my phone going. This is my mobile phone. It’s the smartest mobile phone in the world. It never rings. And I was showing Rob how you do it. You take a chalk out and you write on the slate on the other side.

But if this was a real smart phone, and you were to tell me that Jobs, Steve Jobs is the entrepreneur who made it all happen, that science and labs and all sorts of old-fashioned stuff, seven science and technology parts made up this phone. All came from state-funded campuses. The touch screen, GPS, you name it – he put them together. He was a great entrepreneur, we need that marriage between the entrepreneur and science. But without those seven ingredients, there would be no smart phone.

So money is the first one. Democracy is the second reason, and if you go and vote locally or federally and you have absolutely no knowledge of energy, climate, health products – you name it, I would suggest your vote ain’t worth as much as it could be.

The third reason is who you are. Even Darwin thought the women were inferior. He said a few rude things about blacks. He wasn’t talking scientifically. He was just reflecting the prejudices of the time. Since then of course, we’ve found that indeed, despite different brain size, women are as bright as men, and vice versa. Human beings tend to be pretty much the same. You could compare Aboriginal people, Japanese, Irish – you know are the Chinese smarter? You know, look around the campus. Are they smarter than the Irish? Well, in fact you can find evidence. You can test whether that’s true or not. And the science comes in. It could come in in all sorts of ways. But it just happens to come in to suggest no. We’re pretty much equal. And science telling you who you are has been incredibly important in Australia. When I first came here in 1964, I was told Aboriginal people had been here for 4,000 years and it was essentially terra nullius. They turned up and kind of hung around. Now it transpires, in my short working life time, that they’ve been here for fifty to sixty thousand years and have the oldest technology in history. That makes you think differently about the human beings around you.

Then you’ve got quarantine, my fourth reason. Do you want RU486? Do you want the new computer games coming from somewhere? Do you want all sorts of innovations coming from outside your province? Do you want citizens trained in science who can actually help you decide whether it’s a good idea?

And finally, you’ve got, here come those cockatoos again, science is fun. It really is wonderful stuff. And if you get the kids, and say, look, here’s a lesson about food and here’s a lesson about botany – what we’re going to do now is grow your lunch. Where does your lunch come from? Okay, Adrienne, it’s an interesting thing to wonder about rust and to wonder about enzymes, but when you actually see, because you’re doing it practically, where your lunch comes from, that’s quite fun. Going into the abattoir might not be as much fun but I think that should be part of the experience as well.

Very few people do science communication and that’s a paradox, because you would think with all that build-up, surely it’s the top rating thing and everyone’s going to be doing a *Cosmos* like Ms Finkel and gang and, do, doing science programs like on the ABC and SBS and Nova in America and the CNC in Canada, but they don’t. And the reason they don’t is you need a critical mass, just like a science team. You can’t just go off like a cowboy and do it. Well, you can, but not that well. You need interaction. You need a team. You need young people coming up.

And so, you also need a team to get that critical question that Rob led off on about these various questions to do with climate, and GM and suchlike, which is really making our lives as science communicators rather troublesome. Now, what I do, to find out what’s going on – I don’t turn around to my bank of researchers – there aren’t any. Okay? No reporters, no abc researchers where I am. So, you’ve got to do it yourself. Just like a person who’s a member of the public would do it herself or himself.

You read journals. You read journals such as the *New Scientist*. I read three on the way down. And you read reliable magazines such as the *Economist* which has got a fabulous science section. They have a critical mass. The *New York Times*, the *Economist*, a couple of other journals have got a science team, and it makes all the difference in the world. You can also check, as you’ve heard from Adrienne already, thank you, the Australian Science Media Centre. I happen to be Deputy Chairman, and one thing that intrigued me this week was the way the front page of the *Times* was splashed with a climate story. Somebody from the University of Reading had had his paper turned down and so he had resigned, because he thought his career was in jeopardy from Nigel Lawson’s global warming foundation, which is a ginger group. Nigel Lawson is Nigella’s dad and he used to be Chancellor of the Exchequer in Britain, and if you saw the *Australian Spectator* last week, you might see on the cover, various all lonely, with that rabid mob, the climate people, after he, lonely as a cloud, is trying to get sense talked. The silence of the sceptics it says, global warming alarmist is wicked. Okay? So, what was the story on the *Times*? A researcher from Reading had had his paper turned down, so I went to the Science Media website and bingo, there it was, about five or six statements saying, the reason his paper was rejected, he got some of his facts wrong. Science papers get rejected all the time. That is the story. And the story with both GM and other hot questions is not so much an open debate on the facts, the issues, which would be interesting and wonderful, but these days enormous pressures coming from lobby groups. When it comes to the climate group, if you think of the Koch brothers in the United States, how many people here know about who the Koch brothers are? One, two, three, four, five. That’s interesting.

If you look at the *Sunday Times* rich list, they are number two. In 2012, they made thirty six billion pounds. A year later, in 2013, they’d made fifty-nine billion pounds. In other words, they’d gone up forty billion in one year. Forty billion dollars. And they’re in oil and they fund the IPA and other pressure groups, such as Nigel Lawson’s outfit. And that is why you have not an open debate, but a pressurised debate – lobby groups with immense power and sway.

Similarly with GM. Every time I broadcast something on GM, you get an outfit who are pushing the supposed green line and I would reply to them saying, I’ve interviewed someone who’s just published a paper on the evidence, regarding something to do with one of those scissors if you like. I’m not debating the whole question of GM. I’m simply saying this is what’s been found. And every time we do anything and mention the name, even if it’s only a motor car rather than the plant, there you come, instantly. And we try to avoid lobbies. And once I talked to Greenpeace, the head of which was Rupert Posner, I said, why do you keep on flogging GM? Because, if it were me, and I had a list of the most important environmental questions, it might be 249. He said, because we can. Frankenfoods. Yes, it gets the response.

So, being a science journalist is a tricky business and sticking to the evidence, sticking to the truth as it is presented to us, is something that is an unending quest. It’s very interesting. And the regret I have in many ways is that our numbers are being depleted, which is why I’m so absolutely thrilled that Finkels keep going with *Cosmos* and the other enterprises, broadcasting and suchlike.

A great number of people like Leigh Deighton from the *Australian*, stepped down a year ago. Deb Smith, you know, the culling of our ranks has been substantial. And so I wonder about the future of a place like Australia, where, if you think about it, you have four million people in the workforce, who are functionally illiterate and functionally innumerate. And you ask yourself, as a proportion of the workforce, are we in a healthy way going forward to the future?

I don’t want to end on a doom-ey note, but I think 2014 is a time when we have lots of choices to make, and I hope we’ll go in the right direction. Thank you.

[applause]

**Robert Manne**

The format from now until 2 o’clock is a short discussion amongst the panel, which I’m going to ask some questions and then I hope there’ll be plenty of time for questions from the audience.

I’m just going to say a couple of things which were stimulated by listening. The first is kind of irrelevant, but deep for me. I once sat next to Paul Davies in an aeroplane and for an hour in a fascinating conversation he explained to me why human beings are likely to be the only such beings in the universe, which struck me as one of the most interesting things I’ve ever heard. His argument was wonderful and I’ve forgotten what it was. I’ve never got over it.

Secondly, and this is slightly more serious, some time ago we held a session here where Elizabeth spoke and was railing against the irrationality about GM science, amongst many people, as we’ve heard today. Shortly after, I had an event with I think the leading political figure in the struggle to bring climate change to human beings’ attention, Bill McKibben, who we filmed for the Ideas and Society, and after that I was invited to a lunch with Bill McKibben, and one of the people who came to the lunch was a young woman who was seething with anger at not only Elizabeth, on the GM question, but at me for even allowing GM to be debated. And there you have a question of Bill McKibben’s whole life is based on his attention to the science of climate change, and someone came along who’s greatly a friend of Bill McKibben’s on the science question on that issue, who on the question of GM food, was livid that we should be able to even consider that GM … so there’s left and right questions on science and it interests me a lot as to … and I’m going to ask some questions about such matters in a moment.

I did promise before this event, because it occurred to me that this was a week after the budget, to say a little bit about … I’d like to ask Adrienne this first question. What effect do you think the last federal budget will have on the place of science in this society? And also the CSIRO in particular, of which you were Chair some time ago.

**Adrienne Clark**

Well, of course, nothing’s been legislated yet. So we don’t know exactly, but certainly the CSIRO budget will be diminished and that is difficult because you can’t really just take little cuts over everything, you’ve got to take slices out. And that is a problem.

Overall, I think the best thing that’s happened is the idea that there would be a sinking fund for medical research so that would be like a future fund for medical research, which is a fantastic idea, because it would be funded partly by this proposed co-payment to the GPs. However it’s funded, the idea of having a long term future fund for one part of science, is fantastic, because it can then be a model for what we really need is long term secure funding for the basic research that underpins the medical research. So, if you can achieve those sorts of things, that would be a wonderful step forward, but this is just one little step.

I think overall there is very little understanding of the importance of science and technology amongst the political group. The reason is that even though they might intuitively think it’s important, very few are trained in this area, and the other thing is, as I mentioned, it’s not immediate and everyone says … they all would say, well, what does it mean for me? And when is it going to mean something? The reason that medical research has got up so quickly I think, and so effectively, is first of all they’ve had business people really saying this is important, and secondly, everyone has had … either been ill or had someone ill in their family and have really needed to benefit from scientific research and medicine. And so it’s a little bit easier, but when you talk about other things, climate change is not going to happen to you, well it is happening now, but the effect is not going to happen right now. You may not see it. So it doesn’t seem to have the immediacy.

So, the answer is good and bad.

**Robert Manne**

Yes, on that question, the United States was very early in supporting action on the ozone layer question. One of the reasons given is that Ronald Reagan had developed a skin cancer. But climate change, you don’t develop cancer, so far.

Robyn, if I could ask you a two-pronged question, before we get to general panel discussion. Partly, what effect the cuts on the ABC might have, but also I’d like you to reflect a little bit on the … how the science unit has gone over the very long time you’ve been at the ABC. It’s vicissitudes if you like.

**Robyn Williams**

Well, the cuts. It depends what Board decided. In the past … I know that they’ve been working very hard, assuming that this is stage 1, and they all know that there’s going to be stage 2 and that’s going to be the real humdinger, and they’re going to close I suspect a great number of overseas offices. The change to the ABC science unit – when I walked in many years ago there was a whole bunch of people, about six programs. Now, if you go, for instance, to a news room, you will see the open plan. Now we used to have offices. We don’t have offices any more. We’re in the open plan. And you might find a sort of pimple which is now the science unit. And there are about four and a half of us, and as we’re moving, before, when we had an office, we had to pack up. I found an old phone sheet from ten years ago, and there was seventeen of us there. And there is absolutely no one who is groomed for succession. I’m 70. You know, and Adrienne I’m all very impressed by the prospects of the future fund, but by the time it gets to start paying for research in 2022, I’ll be dead. And similarly, when you look at the succession plan. For science itself, for CSIRO, the ones who were fired in the first culling, nine months ago, which we’ve forgotten about, were all the kids. I knew some of them. You know, the temporary ones on soft money, who were going off to Brisbane to start work, suddenly the trip was cancelled. They weren’t there any more. And it’s that kind of succession that worries me most. Because that really is what’s coming on in ten years’ time, the talent that should be in this country, and the tradition of Mac Burnet, and I want us to tell the young people, we value you. The message they’re getting now is, we do not.

**Robert Manne**

Can I ask everyone on the panel maybe starting with Elizabeth, whether you agreed in general – remember at the beginning I read the email about the appalling level of science literacy in the general community, and the question is, what can be done about it? But can I ask you whether you agree with that general diagnosis and what you’ve thought about, apart from editing *Cosmos*, the question of how science literacy might be improved in our society. I’d like then Adrienne and Robyn to say something about that as well.

**Elizabeth Finkel**

You know, you get certain information from doing a survey that discovers people don’t know how long it takes the earth to go round the sun. So, I can only speak to my personal experience. I’m not quite sure how to answer it, because I think there’s a spread. There are people out there who have a thirst for knowledge. There are, you know, I’m forever bumping into plumbers for some reason, who know a great deal about everything. So, a lot of this is sort of private learning, driven by a person’s own passion.

So I don’t know how you can address that except by doing the sort of thing that we all do, that Robyn does, that I do. I open these windows on the universe, to allow, you know, that to be nurtured. And keep that excitement well fed. School education – you know, keep that exciting. I was incredibly dismayed when my own sons started learning science at school. I couldn’t help but force feed them science at home, and then I was very excited when they started high school science. What did you do? What did you do? Oh, we learned about the Bunsen burner. I thought, what? They’re killing science. They’re killing it. So, I think it’s well appreciated that high school science is in need of a bit of a renaissance. We’re doing out bit. Myself, my husband, we’re very passionate about education. All of *Cosmos* is a passion project I would say.

So, that high school teaching – something has to be done so that the death knell is not given to science in schools. It is not about learning how to operate a Bunsen burner.

**Robert Manne**

Adrienne. Do you have a response to that general question about the appalling level of science literacy in the community.

**Adrienne Clark**

Yes, well I agree. It’s patchy. But the latest international data, the PISA testing, shows that Australian school students are slipping … that’s the 15 year-olds, are slipping further and further down the league tables in maths and in science. And, why is this so? Well, you have to say there’s nothing wrong with the kids. They’re smart. Although, even at the top end, if you look at that data, and people can query the data obviously, but at the top end of the data, our very best performing students are still not as well performing as the top students from, I think, it’s seven other countries. And they used to be right up there in number two and three.

So, what is happening? It probably does come back to the teaching. And then that comes back to the universities. We are a university. We teach the teachers. Do we get the best students coming to teaching? Possibly not, if you look at the ATAR entry scores, obviously some are very good, but some are very marginal. And I was dismayed when I went to listen and look at the enrolment at the Open Days here, I heard one student saying to another, well, I think I’ll have to do teaching because I haven’t got any maths. And that’s sort of what it is. And when I see my own grandchild, again it’s personal experience. I had to sit down and do multiplication with her. Because they don’t learn in this way any more.

That’s not to say there are not some wonderful teachers out there. And some schools do a fantastic job. And I think some of the enrichment programs from the academies are very good, the Australian Academy does primary connections and the Technological Academy does Stellar, which is for the secondary schools. So, people are trying. But it really comes down to the quality and the esteem of the teachers. The esteem in which we hold them, so how do we recruit the very best young people to go into the teaching profession and excite the students. Because the students are very excitable. They are wonderful little vessels for learning. They love to learn. I’ve had limited experience with the little ones but they certainly took to chocolate frogs. Yes. So, to me, it comes back to quality of teaching and the standards which we apply.

**Robyn Williams**

Well, if you didn’t hear the *Science Show* on Saturday, as broadcast yesterday, I urge you to do so, because it was all there. It was called Citizen Science. And this has been going for a number of years in various shapes and forms. One of the most spectacular which we featured was Galaxy Zoo, which has been going in Oxford for some time because there was a PhD student who was working on galaxies and he had to sort a million and he realised that if he did it the conventional way, he’d still be doing it 264 years later, except he’d be blind. So, he put it out on the internet, asked the public to sort one galaxy versus another, and the first thing that happened was the server melted. They recruited six year-olds to 96 year-olds, and as in February they had their millionth person signed up. And not only did they do the work, and connect to authoritative science and therefore learn much more about it, but also they spotted things that the scientists hadn’t, because they were too busy looking for one thing. And the public said, what’s that funny thing over there? And they made original discoveries like they used to in the old days when they were all amateurs.

And so you’re doing it for astronomy, you’re doing it for health, you’re doing it for environment, birdos, you name it, and we ran two schools, one particular school in the ACT, which is doing seismology, which has got its own little seismometer which can measure not just when the kids jump up and down in the classroom next door, but with a very slight quake in Yass, but they can then register something in South America. Suddenly, they can connect it to the rest of the world. This is transforming things. So, as I said, it’s teaching them, and it’s also connecting them to authoritative science so that when, for instance, David Karoly at the University of Melbourne, did his bit to do an analysis of the weather extremes of 2013, I think they sent up, was it 20,000 people already. I mean, this is lightning stuff. This is changing the world. And what you’ve got to do is latch on to it. And then you go to the politicians and say, the people are moving. Your constituents. See. And instead of propaganda, you will have the people connected to the real stuff, and the whole point about science is, it’s real. And if it’s bullshit, you reject it.

**Robert Manne**

I’m going to have one more question which I want to ask everyone, and then I’ll open it to questions from the floor. And some here will know I’m not a scientist, to put it mildly, but I’ve thought a lot about the question from the point of view of someone who thinks about political matters. The question of climate change scepticism and denialism. An audience like this and a panel like this would be slightly I think, biased towards the view that science literacy in the community is connected to the rise of scepticism about climate change science.

My view is a little bit different, in that I know, I read quite a lot of books about climate science because I’m interested in it, but I don’t know, I would never claim to know much. On the other hand, the … what’s been shocking is not so much the absence of knowledge of climate science in the community and the willingness to accept the views of the tiny minority of scientists, what’s shocking to me is the decline of something like public reason. For me the big breakthrough I had was something written by a friend of mine Clive Hamilton, where he said, the question here is not what to believe, but who to believe. And I’m of the view, as a non-scientist, that if 97% conventionally of scientists take the view that this thing is real, then as a citizen, that’s what I accept, because I know I know some things and I know what I don’t know.

So what I’m really asking is, whether the rise of climate change scepticism and denialism, particularly in the English-speaking world, is connected to the lack of science literacy, or the decline of public reason, or something else. It’s a slightly when do you stop beating your wife question, but nevertheless I’d like to throw open the two possibilities.

**Adrienne Clark**

Well, perhaps I could have a go. I think it’s … the idea, or the fact that 97.2% of climate scientists have one view, and a very low proportion, the remaining 2.7, 2.8% have another view. And if you look at the published papers, it’s about the same figure.

When you have a debate on the television, you have one denier and one scientist who’s saying, this is the way it is. So I saw a wonderful YouTube clip and I can’t remember the name of the guy …

**Robert Manne**

I saw that too. And I’ve forgotten his name as well.

**Adrienne Clark**

Who had the three deniers and he had the 97 scientists. And he said to the deniers, okay, open the argument. And the argument went, we don’t think the science is in. So the 97 scientists said, it’s in. So I think this is one of the questions that we often have, that in the GM debate you don’t have one anti and one who’s presenting the facts. You should have a more balanced view. So, looking at the published papers, what have the deniers published? Nothing. So, and the peer review is ultimately the arbiter.

So I think we need a balance. A better balance, in the public arena.

**Elizabeth Finkel**

Shall I go next? One of the things I’ve always found very difficult is the majority thing, because in fact amongst that 3% of deniers are scientists, quite high standing scientists and in Australia we have Ian Plimer for instance and well … you know.

**Robert Manne**

The only one, I think, is Richard Lindzen, who I think most people accept, is MIT. I don’t think any of the others are regarded by climate scientists as eminent, from what I know.

**Elizabeth Finkel**

Whatever – they’re card carrying scientists.

**Robert Manne**

They’ve got jobs at universities.

**Robyn Williams**

Plimer’s on the Coal Board of Queensland.

**Elizabeth Finkel**

You know, we all loved Plimer when he was taking on the creationists.

**Robert Manne**

I didn’t. I thought it was bizarre for a scientist to be trying to convince us that Noah’s Ark didn’t exist. I mean, if you don’t know that and you require a scientist to tell you that … anyhow. It doesn’t matter.

**Elizabeth Finkel**

And I think I make that point to say that I think what we have here is a bit of a culture clash. What Adrienne alluded to before. Scientists work with evidence. We’re not particularly, they’re not particularly policy makers. They provide the evidence, they’re measured, that’s the way they talk, and I think a few years ago the dialogue very much exploited that, where people who were in the denier camp would say, you see, they don’t have certainty. Why should we create this economic pain? Why should we stop growth? Why should we do yah, da, da? You know, because we’re not certain that this is going to happen. So I think that’s a huge part of the difficulty. It’s a culture clash. And I don’t think actually, I disagree Adrienne, I don’t think scientists should start taking lessons or employing PR people. That is what this culture is about. It moves ahead in lock step with the evidence, and that is the language we have to … we have to educate the public is that we work on evidence. 97%, 95% certainty that the climate … well, I think that the climate is changing there is no doubt. Where the 95% comes in, is it because of what human beings are doing?

So I think that’s part of the difficulty. I’m not sure what the answer is. We just have to keep explaining what science is about.

**Robert Manne**

Robyn, just briefly, so we can some time for questions.

**Robyn Williams**

Well, paradoxically, people like me don’t want to peddle the orthodoxy. We want to have a different sort of opinion, so years ago, I was putting the Bob Carters and the Ian Plimers and all the rest of them on, left right and centre, because it was fun. And then it was quite clear – two things. One of them, they always said the same thing, and secondly, it was a political push. Now, the thing I find most irritating is implying this is the left wing prejudice. It’s nothing to do with that. What we’re looking at is what is published. Do you want me to broadcast what I perceive to be not true?

You know, you have a paper that is published and you get someone wheeled in to say it’s crap. And if you want to follow that sort of argument, it’s happening in the letters pages of the *New Scientist* this week, where someone from the BBC says, oh, we are obliged to continue the debate. Well, the debate is being pushed by professional propagandists. There is no real debate, at least there wasn’t one something like eight years ago. We just talked about climate and the science and we were concerned about it.

I also hesitate to go for science by plebiscite. The numbers were impressive – 97.2%. But there’s also consilience. If you go to Scripps Institution of Oceanography where the Keeling curve of CO2 was first found and say, hey, it keeps going up. My gosh. There you have 2,000 scientists once led by Tony Haymet, the Australian, until about a year ago, and they’re all doing twenty or thirty different lines of enquiry. The travel of sound through the ocean. The movement of fish and birds, as well as the chemistry, the CO2 dissolved in the ocean – all sorts of things. And all those different strands of evidence are coming back to the same conclusion. That’s more powerful even than the 97% it seems to me. And there’s the story.

**Robert Manne**

We’re opening for questions. We’ve only got a few minutes unfortunately, but those who would like … there’s a microphone around, so there’s a time for a couple of questions at least.

**Question:**

I’m [indiscernible], I’m a journalist and I’ve interviewed lots of scientists over the years. And it’s interesting to sort of think about how you get scientists to communicate in their particular area of interest or research, because they are, by nature, very cautious people, which is completely contrary to what you’re often trying to do as a journalist, which is to tell a story, connect up various elements and often the scientists you will talk to, don’t want to make any leaps from their own tiny little specialised area, or make conclusions, which I perfectly understand. But I think that while I do not agree that they necessarily need to employ marketing or PR people to tell their stories, I do … often when I’m researching, sorry, interviewing scientists, I try to get them to go back to their first motivation for their particular area of science. What sparked that fascination for this particular area and how they see that particular of research in the bigger picture of what it is trying to achieve.

So I suppose it’s that clash of cultures, between the very cautious, step by step, let’s just look at the data, let’s not make big leaps, to communicating it to a non-science public, which want the stories, want the wonder, want the emotion, which Adrienne spoke of. It’s an observation rather than a question, but you can answer it as well.

**Robyn Williams**

Quick answer – practice. There is a revolution going on called the Three Minute Thesis Competition. It’s happening at this university. The young people, as part of their course, stand up, talk about why their science is wonderful, what they’re doing, and that performance is then recorded by me, I’m doing four tomorrow morning, and I’m putting them on every week. It’s a revolution.

**Adrienne Clark**

Perhaps I could come back to the marketing question. The reason I say that is that we’ve been doing, looking at data, being cautious, putting the data forward, looking at the peer review papers, and you lose the battle. Who wins the battle is Frankenfoods. One word. Now that is an emotional word that no scientist would ever have imagined. Now maybe there is a need to really think of the alternative. You know, you’ve got unequal sides in this debate. You need someone who can evoke, maybe it’s you, the emotion in people, which the scientists are not good at. They are cautious people. Their name will be attached to this and they don’t want to reach too far, beyond their data. That’s actually their professionalism.

So, you can still explain I think, the broad field, and I think we can do a lot better at that, and I note that at La Trobe graduations, I have been shocked at the attempts of our PhD graduates to explain what their PhD is about, to their parents. It is gobbledegook. I could often, in about ten PhDs in the last graduation at which I officiated, there were two I could understand. How the parents could understand, I’ve no idea. But if a student cannot explain to their parents, to their grandparents, what they are studying, that’s not what they have necessarily discovered, but what the field is that they have studied, and where their contribution lies, then I think we’re not off first base. So, good on you Robyn.

**Robyn Williams**

You give them the practice and you give them the training, and you get the results. I broadcast them every week.

**Adrienne Clark**

It’s good.

**Robert Manne**

Now we have time for one more question.

**Question:**

To come back to your question … Roger Parish. To come back to your question Rob, about climate change. I think it’s something to do with human nature. People don’t like bad news. I mean, I think the fact that we have to live with immortality and manage and have to manage to do it, has something to do with that, and I think maybe if the psychiatrists and psychologists could try … sociologists … to explain to people why they don’t want to believe this. And the consequences of not believing. That might be a better way, because I think the information is there.

**Robyn Williams**

Well, the surveys being done by CSIRO and they found that the 33% who reject something like climate change, do so because it clashed with their own values. And if you’ve got values that are down home, let’s say, on the land, farming – what you need to do is talk to the people on the land, in their own terms, about this stuff affects them. Then you get a completely different response. You’re not talking about … here’s the whole world, we’re all stuffed, what are we going to do? No human being can deal with the whole world. Not even Obama.

**Robert Manne**

We unfortunately have to stop there. A couple of things I want to say. The first is, if you’re interested in future events, there’s bits of paper out in the hallway which I’d love you to sign and then you’ll get emails with information about future events. I would personally like to know, if you don’t mind, if you could put up your hands, as to how many people here come from the science area of the university.

**Adrienne Clark**

We’re talking to ourselves.

**Robert Manne**

Well, that’s good. That’s very interesting to me. I’m old enough to remember *The Two Cultures* and C P Snow and I thought that might be the case. I would love it if we could bring parts of the university together because as Roger was saying, sociology and politics play a very big role in the question of climate science in explaining we need the two cultures coming together more.

Finally, could I mention the next event we’re having which I think will be even as good as this one, is on whether manufacturing in Australia has a future. Ross Garnaut, the economist, Roy Green, who’s the doyen of industry policies is coming down from Sydney, and Dave Oliver representing the Manufacturing Workers’ Union, and the ACTU will be speaking. And so, it’s on September 3rd, so it’s quite a way in the distance, but if you could come, I’d be grateful and if you could tell others about it, I’d also be grateful.

But can I ask you now to thank three splendid speakers.

[applause]