Acknowledgements

Professor David Wood, President of RACI

Ladies and gentlemen

Good afternoon,

Thank you for the invitation to speak to you today and congratulations on the inaugural meeting of the RACI Fellows. It is an honour to be part of this memorable day.

It is not easy being a scientist these days, notwithstanding the exceptional contributions science has made to society, It is quite different from what it used to be. I, for example, grew up in an era when science and scientists were largely trusted by the public. There was an assumption or an acceptance, that science was done responsibly and ethically; that it was how we learnt about our natural world – and that it was important that we did. There was also a belief that the applications of science, or scientific principles, could better our lot as human beings. We were excited by public displays of science and we were in awe of satellites and men on the moon and the control of diseases through vaccination. When we saw that such-and-such a toothpaste was ‘university-tested’ we took that to be positive and that it would do what was claimed for it;

that science underpinned the claim. Somebody thought that would be good marketing.

It is a bit different now, as I said. Science is not where it used to be – nor is it where the world needs it to be.

You only need to look at how the so-called ‘debate’ on climate change is conducted to sniff the difference. The science is attacked mainly by attacking the scientists. They are represented simply as venal; looking only to the next research grant or, as one put it, their business class airfare to their next conference. They have been accused of engaging in some form of ‘group think’ – and of conspiring to ensure that their research funds continue to flow by telling governments all around the world what they apparently want to hear. Evidence is unimportant in this ‘argument.’ Just make the assertions often, loudly - and sew doubt. Considered views are rejected with a ‘they would say that wouldn’t they’ comment.

The result is there to see: public regard for science appears to have dipped and the trust diminished.

It is time for science and scientists to stand up to be counted. All scientists - all explaining their science. It is too important to the future of this world for science and

scientists to be diminished by the few whose own real agendas are unclear. It is also unwise to think that your science is not vulnerable. All science is at risk through attacks on some science.

I hope that the International Year of Chemistry will celebrate chemistry and go a long way to increasing public appreciation for the role that this particular science, chemistry, plays in our everyday lives. It is important, too, to remind people of the career that studies of chemistry can offer.

When we take the time to sit back and think about the great challenges that confront our world, we scientists can make the case that so many of them will be solved, ameliorated or eliminated by scientists. It will be with the understanding that comes from scientific work and then its application that may well mean that humanity survives in some recognisable form.

And an important science is Chemistry.

If I can quote from the RACI: *'it is chemistry that allows us to understand the material nature of our world and the chemical reactions that control all living processes.*'

For this reason, the full extent and benefit of any area of science cannot be fully realised without a basic understanding of chemistry.

Understanding and applying chemistry has helped our societies thrive. I note that to mark the start of the International Year of Chemistry, the RACI listed the top 10 contributions of chemistry to humanity.

It is a wide range - from medicines through water and sewage treatment, cosmetics, plastics and synthetic fertilisers. With a lot in between: for example, our knowledge of neurochemistry helps explain our very behaviour, Or, I might say, if only it could.

While that is impressive, when you get into the detail, the world needs still more. It is hard to imagine that with a global population of around 9 billion by 2050, humanity will survive, let alone prosper, if all we do is a bit more of what we do now. We will need to do things differently – to do things better. And to do more.

I doubt that anybody really knows where the need will take us; where the additional demands and challenges will take us. But it is important that our science is ready wherever we must go, and that work is done to a high standard and with integrity. It is important, too, that community trust in science and scientists is rebuilt. Therefore we must take

our work into the community and explain why we do what we do, and why it is important that it be done.

For example, pause to think about the newer technologies of biotechnology and nanotechnology. In some form or other, they are increasingly used or influence us – everyday by many people. It might be fair to say that as generic technologies they have acceptance. But there are applications that are questioned. The risks are accentuated. Now, I believe that the public has a right to know – the risks and the benefits. But they need proper and considered information, not scare campaigns. And it is up to us to help them make their choices because they can see the difference. We need to work hard to keep the public informed as we go.

All this is why it is so important to use this International Year of Chemistry as a way to raise awareness of just how much value science, and chemistry, adds to our lives. And how quality science properly used can benefit humankind.

Of course, the key phrase is quality science properly used.

To have good science we need good scientists. To have good scientists, we need good science courses. And to make a difference, we need good scientists in sufficient numbers in the right places to be able to stretch to the problems we face.

But will we have the numbers of graduates to make all this a reality and how do we ensure that we will?

This is how it currently stands:

A study conducted for the Department of Innovation, Industry, Science and Research by the Australian Council for Education Research two years ago projected that the PhD qualified workforce in chemical sciences will grow by over 38 per cent by 2020.[1] However:

- Domestic PhD commencements have remained relatively constant over recent years, while overseas PhD commencements have demonstrated a strong upward trend.

- Domestic PhD completions have trended slowly downward over time (most markedly between 2001 and 2005), with a decline of 23 per cent over 2001-2008, while overseas PhD completions have trended upward, increasing by more than 100 per cent between 2001 and 2008.[2]

[1] Australian Council for Educational Research (ACER) 2009, *Supply, demand and characteristics of the higher degree by research population in Australia*, report for the Department of Innovation, Industry, Science and Research, June.
[2] Ibid

- In 2001, PhD commencements in chemical sciences accounted for l5 per cent of all PhD commencements in natural and physical sciences. In 2008, it was 12 per cent.[3]

At undergraduate level, the number of full-time student equivalents commencing Chemical Sciences at the undergraduate degree level in 2010 was 5150[4] (or ~10% more than in 2009); nearly two-thirds of them students in the Natural and Physical Sciences, with health accounting for over 20% and Engineering nearly 10%.

But if one important question is do with the numbers, another one is simply about the quality: how good are we? Sizeable student numbers in poor to average courses is not what Australia needs. We do need to know where the students are and what they are studying. We already know that not all enrolments are in courses that lead to scientific careers – and the quality in terms of depth and breadth - the standards achieved – will also vary.

These are not questions routinely asked in Australia. We have been too content with assumptions and presumptions and surrogates – we think that if our

[3] Ibid
[4] ***'Students: Selected Higher Education Statistics, Department Education, Employment and Workplace Relations (2010)***

processes are OK then we can presume that the standard must be OK. We need to think again.

Recently, and at last, we have made an attempt to get to the question: how good are you? At least in research.

The Excellence in Research Australia (ERA) 2010 results show that nationally there is research in the chemical sciences in 26 higher education institutions

The average rating was 3.5 - which is above world standard.

To drill down further:

- two institutions are **well above** world standard with a rating of 5,
- nine are **above** world standard with a rating of 4, and
- the remaining 15 institutions are at world standard with a rating of 3.

The next important question then is: how does this research translate into the education offered in those institutions.

It is an important question because we have long argued for the teaching and research nexus in higher education. So, if we accept that teaching and research should go

hand-in-hand in our universities, we can look to see how the research outcomes match undergraduate enrolments. A crude measure, but not a gross measure.

Students are enrolled in Bachelor degrees with some Chemical Sciences component in 36 of the 41 Universities assessed in ERA. There are also a further 9 institutes teaching some Chemistry to Bachelor students. Approximately 70% of the enrolments are in first year.

There are 22 universities with honours students undertaking some load in Chemical Sciences, four of which had no identified ‘chemistry’ research in ERA. In 2009, just over 10% of Chemical Sciences commencing student load was being taught in institutions that had no Chemical Sciences research in ERA.

This probably means that if you want to do Chemistry (or anything else for that matter) pick where you do it wisely.

So if we have the courses, we have the chemistry graduates and therefore we have the talent, what next?

I suggest that the ‘next’ is the application of that talent to enhance Australia’s innovative capacity.

We hear much discussion about the importance of innovation as a driver of the Australian economy into the future. Indeed, we have been hearing about it since at least 1990 to my certain knowledge. And we have grown some of that innovative capacity as our universities have added to their own capabilities in order to add capacity to the workforce.

But not enough. From the data that I have presently, Australia had some 8 doctorates per 1000 in the workforce. Switzerland had closer to 28. Most of Australia's are categorised as researchers; in Switzerland it is roughly a number as Australia. In other words, a country like Switzerland has many more highly qualified people, doctorate trained people who are arguably amongst the most creative people, in their workforce than they have in their workforce as researchers. Our workforce seems less willing to absorb such people.

But when the resources boom is over, where will we turn? To an innovative workforce driving an economy that can endure? Or the same old, tired old, ways of doing what the world used to want sometime in the past?

Your industry, the industry based on chemistry, is a prime enabler of needed innovation.

Regardless of whether it’s in medicine or energy, computing, or transport – your sector’s involvement leads to products and services that make people’s lives better, healthier and safer.

And Australians make a difference. While Australia has done well on the world stage, including a number of Nobel Prizes, it’s sometimes the less celebrated that we notice.

For example, in 1957, CSIRO scientist Dr Arthur Farnsworth added enormous value for the wool industry and saved us hours at the ironing board.

He introduced a special resin to wool fibres to change their chemical structure and gave us permanent crease trousers where do we go from here?

And before him, in 1949, an Austrian immigrant Charles Rothauser developed the world’s first plastic disposable syringe at his Adelaide factory, Industrial Products Ltd.

He was responding to a problem caused by the new wonder drug, penicillin, since it tended to clog glass syringes and make them hard to clean.

Packaging materials based on converted starch have been developed and commercialised in Australia by Plantic Technologies.

The company is a spin-off from the Cooperative Research Centre for International Food Manufacture and Packaging Science which first developed the technology more than a decade ago.

The company made inroads into packaging for the confectionary and baking markets.

In partnership with the CRC for Polymers, Plantic has expanded its R&D to reach a broader packaging market.

A major breakthrough came in 2008 with a new bioplastic suitable for products ranging from Easter eggs to USB thumb drives.

It’s been well-received, with the major UK retailer, Marks and Spencer, using Plantic - developed plastic trays for its entire Swiss chocolate range last Christmas.

Another highly successful collaboration over 30 years between the Vision CRC and its successor, the CRC for Eye Research and Technology, with US and Swiss partners has produced soft contact lenses for safe continuous wearing.

The resulting contact lenses made from a silicon hydrogel are capable of transmitting six times more oxygen to the eye than other lenses and can be safely worn for up to 30 days and nights.

Silicone hydrogel contact lenses represent around 40 per cent of the worldwide market for extended wear soft contact lenses.

Annual sales are to the order of $2 billion.

And, of course there are more. But the message is clear.

In order to ensure our R&D effort continues, that we continue to innovate, that we change what we do and how, that we take charge of our own future, we need to continue, all of us, to be advocates for science so the community realises its value.

That's it, at the most basic level.

The International Year of Chemistry is an opportunity to focus on chemistry's central role as a creative science.

It marks two remarkable centenaries:

- the 100th anniversary of the awarding of the Nobel Prize to Madame Marie Curie, enabling celebration of the often understated contribution of women to science and
- the centenary of the founding of the International Association of Chemical Societies, surely a chance to celebrate international scientific collaboration.

Can I ask that you join me and that you work at all levels, to engage with your industry partners in Australia and overseas, with the community and with your local schools to remind them just how important science is to Australia.

It's incumbent on all of us to ensure that we raise the profile of science.

In turn this will encourage more people to embrace the notion that a career in science is worthwhile.

We, too, can set out the reasons why we pursue science as a career. I would bet that for most of us they would include: understanding the very nature of things; translating knowledge into devices and other uses; solving problems; facing down the big challenges that confront humanity; security; alleviating poverty and suffering; improving health; ensuring adequate food supplies in the right places; underpinning economic prosperity. I am sure the list goes on.

The reality is that if we don't tell people about the importance of science and what it means to them, how will they ever really know? If we don't tell them about integrity in science and how it is conducted and correct itself, how will they ever know? It is all too important to leave to others - it is up to us.

Thank you