



## CSIRO Oral History Collection

**Edited transcript of interview with Tom Spurling**

**Date of interview: 26<sup>th</sup> April 2017 and 8<sup>th</sup> August 2017**

**Location: Swinburne University of Technology (Hawthorn campus)**

**Interviewers: Garrett Upstill and Terry Healy**



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## **Professor Thomas Harley Spurling AM, BSc(Hons), PhD (W Aust) FTSE, FRACI, FFACS**

### **Summary of interview**

Tom Spurling talks about his early life in Perth, Western Australia, his secondary schooling at Albany High School and his experiences at the University of Western Australia. Tom then talks about his PhD at the University of Western Australia on the high precision measurement of the properties of gases and the influence of his PhD supervisor, Dr G A Bottomley. He recounts his experiences at the University of Maryland where he was a Post-Doctoral Fellow and his return to Australia in 1967 to take up a position of Lecturer in Chemistry at the University of Tasmania.

Tom joined the CSIRO Division of Applied Chemistry in 1969 and stayed with the Organisation in various roles until 2003. He describes his various roles in the Organisation, including the Assistant Chief of the Division of Applied Organic Chemistry, Manager of Policy and Planning in the Institute of Industrial Technologies, Chief of the Division of Chemicals and Polymers, Manager of a World Bank funded project in Indonesia and a CSIRO Fellow.

He talks about his second career at Swinburne University of Technology when in 2003, he was recruited as the Director of IRIS and promoted to the Dean of Engineering and Industrial Sciences.

He discusses his active involvement involved in professional societies including the Royal Australian Chemical Institute, the Federation of Asian Chemical Societies, the Federation of Australian Science and Technological Societies and the Australian Academy of Technological Sciences and Engineering.

Tom was a Member of the CSIRO Board from 2008 to 2015.

## NOTE TO READER

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## Introduction

*It's April 26<sup>th</sup> 2017 and this is part of a set of interviews, oral histories with senior CSIRO people. Today we're talking to Tom Spurling and my name is Garrett Upstill, I'll be doing some of the questions and Terry Healy will be also doing some questions as well.*

## Family background

*Thanks Tom. What we were planning to do is run the first session for about an hour and cover the period from your early life through to 1980 which is I guess we'll call that early life and education, and so if we could kick off with the first question, could you open up and offer some thoughts on your early life and what led you into chemistry?*

Thank you very much Garrett and Terry for interviewing me today.

I was born in Perth on Christmas Eve in 1940. My mother Jessie Spurling and my father Bernard Spurling weren't expecting twins but I was born first and my sister Ruth came 20 minutes later, and the family story is that I was called Thomas meaning twin and my sister is called Ruth meaning companion, and so Ruth and I have been great friends and companions all of our life.

Ruth and I were the third and fourth children, my two older sisters were seven and nine years older than we were and so my early life in Perth first of all was around my father being absent during the war, he was in Melbourne with the air force from 1941 to 1946, he was an accountant in the air force and he had to stay in Melbourne to close up the books in some way. So he came in and out of my life for the first few years, but then when he came back my sisters were doing the later years of their high school -

*Tom, your location during these periods?*

We lived in Wembley, a suburb of Perth just near Subiaco; my parents rented a house there. So a lot of my early life was about stories of my sisters Rae and Lynette and their high school. They were both very good students. They both went to Modern School, which was a selective high school, and Rae went to university and did an arts degree and Lynette went to Adelaide to do nursing. She never finished because she got polio. So at some stage during this time my father who was very restless after the war, so he never really settled down being an accountant, after the war he got jobs being an accountant for a while and then he became a builder's labourer for a while and so on.

One of his times as a builder's labourer he met a person called Norm Reedman and another person called John Butler and they said that they were going to Albany in Western Australia to set up a building company because Western Australia was booming at that time with a lot of migrants coming in, there's a lot of activity particularly in the country, towns like Albany and Bunbury, for housing. So my father decided we'd all shift to Albany. Rae and Lynette didn't come because they had gone to university and Adelaide, so Ruth and me and my mother and father went to Albany where my father helped set up this company which unimaginably was called Albany Builders, and that was in 1951.

I had the final year and a half of primary school at Albany. I got a scholarship which if I'd wanted to I could've gone to Modern School but I went to Albany High School. Both Ruth and I got scholarships but we both went to Albany High School, and it was there that I became interested in science. It was just after the war and the education department in Western Australia recruited a whole lot of very smart people into teaching. My first science teacher was Bob Vickery who ended up being the Director of Education in Western Australia, very good science degree, and made me and others very enthusiastic about chemistry and physics and mathematics. I got interested in science there.

## Attraction to chemistry

*What attracted you to chemistry?*

I think I was attracted to chemistry because – our textbooks in Western Australia were written by Alexander Boden and Boden books on chemistry were very interesting in that they connected chemistry with an industry. So whether consciously or unconsciously I thought that chemistry was a useful subject because it was connected to industry, and during that time the superphosphate works opened in Albany and there was a whole lot of chemical industry activity then. So I think that's why I thought chemistry was an interesting subject for me to do.

I would sometimes tell the story of when I was doing geography for my final year, or maybe my second final year, I was looking at the flow of water in Western Australia and I came across a CSIRO publicity article about Bill Mansfield's work on controlling the evaporation of water from dams, I thought that was the most interesting thing I'd ever read in my life and that's what attracted me to CSIRO, I thought this is an organisation that does useful interesting things.

*Do you recall if you would've understood the molecular interactions between the covering and the water at that point?*

In retrospect I may not have – I can't recall how much I knew about that but I thought it was very interesting - a monolayer of molecules on water. I was very excited in 1969 when I walked into my office at Fishermens Bend to see that Bill Mansfield's office was opposite to mine.

*So when did you go to university? You went to the University at Western Australia and you studied science there?*

My interest in chemistry has to some extent always been in the theory of chemistry. So I never had home chemistry experiments or wasn't particularly interested in mixing things together, I was interested in the mathematical background of chemistry. We weren't a wealthy family so my mother and father couldn't support me to go to university by myself. I probably could've got a Commonwealth Scholarship, but in my fourth and fifth year of high school I got a bursary from the education department, I was paid some money to do fourth and fifth year and I then went to the University of Western Australia on a teaching – I was paid by the education department to become a teacher. So I spent my first four years doing teacher training as well as doing my degree.

*So what years were you at WA?*

I was at WA from 1958. That was my first year. I did my Honours year in 1961 and I enrolled for a PhD in 1962. At that point, I resigned from the Education Department and agreed to pay back all my money. I'd decided that I was more interested in chemistry than in teaching.

*What influenced you at university and who were the important people for your career?*

I mentioned Bob Vickery at Albany High School, but the chemistry teacher was himself quite an interesting character. His name was Jimmy -

*Sorry this is back at -*

Back at Albany High School, Mr Jimmy Doyle. He was a big man who was a very good teacher. In my opinion he didn't know very much about chemistry so my friend whose name was Clive Nockolds – Clive went on to become a senior academic at the University of Sydney in crystallography – we decided that we'd learn chemistry ourselves and we read Linus Pauling's book. So we read College Chemistry in that final year. So who influenced me? Well Jimmy Doyle was a big influence on my career because he liked me I think and he supported my interests, but Linus Pauling and his approach to chemistry was a very big influence on me. When I went to the University of Western Australia the professor there, Professor Bayliss was at Berkeley when Pauling was a student I think, I think they knew each other.

So Bayliss was a very interesting lecturer because he was one of the first people in chemistry in Australia who introduced modern chemistry. So he understood quantum chemistry and spectroscopy and so on. He was a marvellous lecturer, so he really made me very enthusiastic about chemistry, particularly physical chemistry. So he had to be an influence in my life. Mathematics at WA was also very good. The lecturers that I remember, Frank Gamblin and Ray Storer were both towards the end of their careers I guess when they were teaching us, and they were very good teachers of mathematics and gave me, and I suppose others, a very good background, particularly in the applied mathematics. So they were my early influences.

## **Research at the University of Western Australia**

*What field of chemistry were you drawn to?*

I've just visited my PhD supervisor who was Gerry Bottomley and I explained to him what happened at the beginning of our honours year in 1961. There were five physical chemistry honours students in that year and at the beginning of the year we were summoned to the lecture theatre in the Chemistry Department and all of the academics, the lecturers, gave a spiel on why their work was interesting and why we should be their honours students. Gerry Bottomley gave a talk which said that he was interested in measuring the high precision properties of gasses because it was the best way at that time of being able to understand the way that molecules interacted.

So if you studied the PVT properties of gases using the statistical mechanical theory of gases you could extrapolate from those deviations from the ideal gas law how the strength of the interactions between intermolecular forces, and I thought that in a way, a bit like my thinking Bill Mansfield was clever, I thought that was a very interesting thing and that's basically why I embarked on that project of high precision measurement of properties of gases.

*Even though you were only operating at a very macro level, you weren't trying to actually use techniques that would allow you to look at the interactions between individual atoms or the more statistical -*

No that's right but statistical mechanics is the part of physics that enables you to connect the properties of molecule and atom interactions with the bulk properties of gases. So while you say we weren't measuring it, it was the best way at that time of actually understanding it.

*And you approached this with a strong mathematics background?*

I approached this with a strong interest in the theory of it whereas my supervisor Gerry Bottomley was a brilliant experimentalist. So the two of us, we got on pretty well in that regard.

*Where were you living during your university period?*

My parents were in Albany so I came up to Perth and lived at what was known as the University Hostel, and the University Hostel on Mounts Bay Road was the old buildings that the US marines used during the war. They had a fleet of flying boats on Matilda Bay and they built this hostel, and after the war the University took it over as the University Hostel and I lived there. I lived at that hostel until halfway through my PhD, and then I went to another hall of residence, Kingswood College.

*So that would've been 1958 to -*

To 1965.

*Did you meet Heather your wife at that time?*

No I didn't meet her till much later. So the University Hostel, my first year there were 100 men in the men's college and there were 50 women in the Women's College which was separate from the hostel. Of the 100 men, there were about 60 first years/freshers. Of those 60 freshers only Alan Sandcock and I passed. So the next year the University decided that they needed to do something about this and took over the administration either that year or the year after and it became Currie Hall. Sir George Currie was a former Vice Chancellor of the university. So I lived on campus my whole university career.

*And your PhD was on what?*

My PhD was on the high precision measurements of the properties of gases. It was an apparatus which Gerry Bottomley had thought of, I helped build it. We measured the

temperature variation of the deviations from the ideal gases for a whole range of gases and worked out some parameters to do with particularly the interaction of dipole moments and quadrupole moments in gases. So that's when I became interested in - quadrupole moments. During that time I did teaching rounds before and after university but I didn't like that very much, I wasn't a very good teacher.

*Or just poor students.*

Well I remember one of my lessons was, I had to teach people how to factorise quadratics. So, "How do you factorise?", "Well I factorise by inspection." But it turned out that telling 14 year old kids that you looked at it wasn't very smart in retrospect. The University was very interesting of course because I was a member of various groups. I was a member of the Fabian Society and I was also the treasurer of the group against the white Australia policy. I've forgotten what our group was called, but it was a group that was agitating for the abolition of the white Australia policy. It was quite a successful little group. So I had various activities there.

## **Interest in politics**

*Was that the start of your interest in politics?*

I think so. I think my interest in politics started in a sense with the Vietnam War. It was 1958, the end of conscription but people were still being conscripted. I was in a ballot, I didn't win the ballot, people went into national service in those days, and eventually the Vietnam War came and it was a period of great – so my interest in politics was really from the war and also the white Australia policy and the general feeling that the Menzies government had outlived its usefulness.

*And John F Kennedy?*

See that was 1962, I remember feeling that the election of John F Kennedy and Harold Wilson was a turning point in the post war history. I can't remember how this all occurred but it must've been a gradual influence. The Hawke Government in Western Australia was probably not a great government. They were a very conservative Labor government and I'm not sure that I was terribly upset when the Hawke government fell because I think it was a conservative Labor government.

*Many people of your generation, or at least amongst the university fraternity thought of Kennedy as actually inspirational and turned people's mind a lot more to the international scene, international politics. Was that your experience?*

I was certainly excited when Kennedy was elected. At university I was very active in the student religious organisations, the Evangelical Union it was called, and some of my time was spent in those activities.

*Were you personally religious?*

I wouldn't say that I was religious but I'm a member of the Uniting Church in Victoria.

*Was it a big influence back in say the '60s?*

I think of myself a bit like Harold Wilson as a person whose life is influenced by my understanding of the nature of humanity and its relationship with –

*Is that what's commonly called humanitarianism?*

I'm not sure Terry.

## **Marriage**

*When you did your postdoc and you went over to Maryland – when did you meet your wife?*

This is a story that I've told other people so I'll tell you. I was a senior tutor at Currie Hall and then Kingswood College which was a Methodist college, the Methodist church decided they'd open a hall of residence and they were recruiting people to be the tutors. So they recruited me to be the chemistry tutor at Kingswood College, they recruited Gordon Stanley to be the psychology tutor, and Gordon and I were great friends. Sometimes during this period I became the senior tutor and so one of my jobs was to be the personal charge of dinner on Sunday night at the high table, we had a high table in those days. So Gordon and I said, "On Sunday afternoon can we get a guest to come?"

So we went out on Sunday afternoon, I in fact for some reason had gone to the opening ceremony of the assembly of the Presbyterian Church of WA and Gordon had gone somewhere else, I can't remember where he went, and at this assembly I walked in and I recognised Heather who was sitting down in the thing and she turned around when I came in for some reason or other and looked at me and I said, "I'll get her." Gordon went somewhere and he met Jan Ranford. So Jan Ranford and Heather and Gordon and I had dinner together on that Sunday night. Jan Ranford went on to marry Robert Holmes a Court.

*So she did second best -*

I went on to marry Heather. So that would've been in June or July of 1964, and we got married in April of 1965 and we spent the first few months being married at Kingswood College in the senior tutors apartment.

## **Post-doctoral work at the University of Maryland**

*That was when you were finishing your PhD?*

Yes. Then we went to the US in September of 1965. I'd decided that I would try to become a theoretician so I looked up who was a good publisher of papers in this area and I came across E. A. Mason. So I wrote to him and said I was interested in becoming his postdoc and he said, "We don't have much money" and I said, "What if I get my own money?" and he said, "Do that. If you've got your own money you can come for as long as you like." I was at that point on a CSIRO Senior Studentship for my PhD and I applied for an overseas postdoctoral fellowship, I think it was called an Overseas Studentship and I got that.

So I went to the University of Maryland on a CSIRO Overseas Studentship and that was for a year and I worked with Ed Mason. I did a few things with Ed. It was there that I published the book with Ed, 'The Virial Equation of State', which is the summary of all of that stuff that I was talking about of how you extract the information about the intermolecular interactions between molecules from the properties of gases.

*So that was drawing on your PhD work?*

Yes. So that was a major influence in my career. Publishing that book as a 27 year old was pretty good I think. I was very lucky to have that because Ed Mason had arranged with someone else to be the co-author but that other person, whose name was Homer Schamp, had been promoted somewhere else and so Ed was left without a person to help him so I took over that place. My contribution was mainly talking about how experimental methods have developed over the years and the main chapter that I wrote was the experimental chapter.

*You mentioned the CSIRO Senior Studentship and the CSIRO Overseas Studentship, do you have any reflections on those programs as to how much good they did?*

They were marvellous. The CSIRO studentship, when I was a PhD student, they were very generous. I was paid 1,500 pounds a year or something tax free and I felt myself to be reasonably well off.

*Do you remember when you got that?*

I got that in 1963. The first year of my PhD I was on a university scholarship and then while I was doing that I applied for the CSIRO one and at that time CSIRO, through Sefton Hamann and Ian Brown, had a very strong program in the properties of gases and liquids. So Sefton Hamann -

*Sorry, who's Sefton Hamann?*

Sefton Hamann was the Chief of the Division of Physical Chemistry and Ian Brown was a senior scientist in that Division. So there was a very strong interest in CSIRO in the thermodynamic properties of gases and liquids. I think they may or may not have had some influence in me getting that scholarship, and they certainly were very interested in what I was proposing to do as a postdoc because I went to see them when I was on my way to America -

*That was your first face to face but they knew about you before?*

Oh no, they'd known about me a long time before because I'd been to visit Ian Brown when I was a PhD student. Ian Brown had a copy of my honours thesis -

*Sorry, so Sefton Hamann and Ian Brown, wasn't it?*

Yes, and I'd given a talk at ANZAS in a session where Sefton and Ian were both there. So they knew me and Sefton in fact was one of my PhD examiners. Australia was very strong in the properties of gases at that time.

*Was there an expectation that people who got these scholarships would go onto work in CSIRO?*

Well this is the interesting thing; for some period of time people who got CSIRO overseas posts had to sign a form to say they'd work for CSIRO when they got back; when I did it I had to sign a form to say I understood that CSIRO wouldn't necessarily employ me when I got back. *So they had no obligation to employ me.*

*And do you know how big the scheme was in terms of numbers?*

No I don't.

*We could look that up, but from your personal point of view it was generous and was an important part –*

The PhD studentships were very generous; the overseas studentships weren't generous at all. When we got to Washington we were quite poor in a way, we got on alright but Heather was a school teacher and she went to the Immigration Department in Baltimore and said, "I'd like to have permission to teach" and they said, "What is your husband's salary?" and she told them what I was getting, "That's below the poverty line" they said –

*And what year would you have got the CSIRO Overseas Studentship?*

1965. So we went in September 1965, I spent a year there as a CSIRO student, and then Ed Mason gave me an extension of that on his own money which was funded by NASA. NASA at that time was very interested in the properties of gases because of the need to understand how gases interact when you –

*Rocket fuel?*

Rocket fuel.

*And just coming back to the CSIRO studentship program as a whole, before we leave that do you have any comments as to why CSIRO did it in the first place, put all this money out there, how it selected the students, and what was the result in terms of improvement of Australian science overall?*

CSIRO had a number of these schemes. Before there were a lot of PhDs in Australia there were schemes to send people overseas for training to do PhDs. I don't know this, this is just my impression that the Organisation had a great interest in developing science in Australian universities so that there'd be a supply of scientists. It was particularly true in chemistry where Jerry Price was very interested, through the natural products project, in developing organic chemistry in Australian universities. But the Divisions of Physical Chemistry and Chemical Physics also had interest in developing physical chemistry more broadly in Australian universities. So there was a mutual interest in the universities and CSIRO in doing this.

*So CSIRO was actually promoting university research –*

Yes.

*Research by university students, not CSIRO employees at the time.*

Yes.

*Do you perceive that that was a carryover from CSIRO's previous existence as CSIR and SIEF?*

Yes, well in the paper that Sue Smith and I have written about this, I don't know how much you need to go into this now, but the original Science Industry Endowment Act gave SIEF, the Science Industry Endowment Fund trustee the responsibility for training people in science and so for most of the history of the organisation the first 15 years or so of CSIR much of the training was funded by SIEF rather than by CSIRO. In the 1950s when inflation took over there wasn't enough money in SIEF, so in order to keep a training program going CSIRO had to fund that itself out of its own appropriation. I think for much of the '50s the PhD programs in the universities were just building up and so there was a need for the organisation to fund some of this to make sure it got training. But as you can see from my experience by 1965 they weren't guaranteeing my employment, so there was a transition there, where maybe it wasn't as needed as it was in the early days.

*Or they were running out of money.*

I don't think they were running out of money because they could recruit people without having to pay for their training, they had no trouble recruiting people.

*So the market for scientists –*

The supply of scientists was at that point possibly exceeding the demand. So when I was at the University of Maryland I applied for jobs at Macquarie University which was just starting up, Latrobe University that was just starting up, and the University of Tasmania and I very quickly was offered a job at the University of Tasmania and so I withdrew from the other two and took the job that was offered at the University of Tasmania.

*And we're talking about 1966 here?*

I would've applied for that job at the end of 1966 and went there in 1967. At that point I wrote to John Barker who was at the CSIRO Division of Applied Chemistry - John Barker was one of Australia's great theoretical physical chemists – and I said to him, "John, I'm interested in coming back to CSIRO" and he wrote back to me and said, "We don't have a vacancy at the moment but I think there might be one coming up soon", but Heather decided that we couldn't wait for that so I took the job in Tasmania. The job that was coming up soon turned out to be the fact that John Barker was negotiating with the University of Waterloo to leave CSIRO and go to Canada as a professor there, and so it was his job that was going to come up. In those days there were numbered positions; eventually I got that job.

*We've been jumping around a bit but just to conclude, that CSIRO program of educating Australian scientists ceased to be so important by the mid '60s*

I think so.

*How long were you in Tasmania and what –*

Can I just tell you one other story about the University of Maryland and why Ed Mason thought I was clever? The three of us when we were being educated in primary school, we could manipulate pounds, shillings and pence and so we could work out how much a tonne or whatever they were cost. So we could manipulate fractions, and it turns out when you expand the exponential to work out the virial equation of state there are whole lot of fractions that appear and Ed Mason was amazed that I could look at this equation and tell him instantly what that the fraction was as a decimal. He couldn't do that.

*Like a quarter is .25?*

Yeah, or six-sevenths is whatever it is.

## **University of Tasmania**

*Okay. So University of Tasmania?*

I went to the University of Tasmania as a lecturer in chemistry. The professor was Harry Bloom, Noel Roberts was the other physical chemist and I was the third physical chemist, so there were three physical chemists. John Polya was the reader in organic chemistry, Ralph Bick was the organic chemist, and Geoff Cheesman and Peter Smith were the inorganic chemists, so it was a very small department.

*But a strong one.*

It was quite a strong department. I in the arrogance of youth thought that I knew a lot more about modern chemistry than any of the others. That was probably not right, but anyway. I taught second, third and fourth year physical chemistry. I taught second year physical chemistry to everybody and third and fourth year to the students, there weren't many, and so I taught modern chemistry to them and some of those students have gone onto – Ian Snook became a Professor of Physics at RMIT and a couple of them have done pretty well.

*By this time were you a better teacher than you were as a tutor back at the University of Western Australia?*

I quite enjoyed lecturing. Heather and I had been living in Washington DC at the time of the – Lyndon Johnson was the President. It was an enormous change and excitement living in Washington at that time, so Martin Luther King's march had just been completed, there was a whole lot of ferment about the –

*Great Society.*

The Great Society but also about the Vietnam War, so we were involved in a lot of movements in the university against the Vietnam War. We got quite interested in the Democratic Party, so without being able to vote we got involved with a local guy whose name was Dervy Lomax in the primaries for the governor – 1968 was the midterm election.

So we got involved in this and in particular in the primaries for going into that we were supporting a democratic radical called Carlton Sickles, but in that time – do you remember George Wallace?

*Absolutely.*

He had a candidate in this election –

*And this was as Governor of Maryland?*

Yes, and there was a moderate. So there were three candidates; a left winger, a moderate and a right winger and we were supporting the left winger but the vote was split and the Wallacite candidate won and so he became the democratic candidate to be the Governor of Maryland. So we the democrats decided we'd not support him, we'd support the republican candidate -

*So you had some pretty good training in politics.*

He became the vice president under Reagan, so we were republicans for Spiro T. Agnew. I had a sticker on my car, "Democrats for Agnew." He ended up in jail I think. He was the first republican governor of Maryland.

*Training in politics at a very high level –*

Dervy Lomax became the first African American mayor of College Park. He was our friend there.

*So you then went to Hobart which was a political backwater.*

Hobart, and it didn't seem nearly as exciting. In fact when the plane arrived at Hobart I did feel that I was going to the end of the earth.

*Back in time and all that, yes. So was Hobart a place you just wanted to get out of as soon as you got there?*

No, we had some quite interesting times in Hobart. I didn't think that I had enough - possibly lack of confidence in my ability, I didn't think that I had enough people who I could work with there. I like working with people rather than doing everything myself, so I thought I'd be pushing uphill a bit in developing an academic career in Hobart. I kept in touch with Sefton Hamann and I wrote to him and said, "I'm here now in Hobart" – actually I think the sequence of events might be that I had an ARGC proposal to do something and I think he was one of the people on the panel that gave me the money. When he came round I said, "Should I come and visit you?" and so I spent a fortnight at Fishermens Bend when I was at the University of Tasmania and Sefton said to me, "John Barker has gone, we're going to advertise for a position, maybe you should apply for it", so I did.

*So you were in Tasmania 1967 to '68 and –*

I left Tasmania in the September of 1969, so I was in Tasmania from May of '67 to September of '69 and I had three honours students and one PhD student there. Ian Snook was my PhD student.

*And did you continue your same field research?*

I did two lots of research in Tasmania, one was continuing work on the theory of gas interactions. I tried to be an experimentalist there to build an apparatus that would enable me to measure the properties of gases at higher temperatures without the need of mercury as a manometric fluid, that was my ARGC grant, but that didn't work very well. I was interested in the diffusion thermoeffect which is the reciprocal to thermal diffusion, and I built an apparatus that enabled me to measure the diffusion thermoeffect in mixtures of gases. Brian Sawford did that for his honours degree, and Brian Sawford and I wrote a very good paper on that. Brian Sawford ended up being the Deputy Chief of the CSIRO Division of Atmospheric Physics.

*During those years at Tasmania your research priorities were driven by the forefronts of international science, in other words you were trying to advance knowledge?*

Yes, certainly was. Your first couple of years as an academic, however, a lot of time is spent preparing and giving lectures so you don't have a lot of time to do research.

*As a general question you actually are a theoretical chemist but it's interesting to hear you talk about a lot of experimental work you did both in Maryland and Tasmania, is that something that changed during your career?*

I think that I now describe myself as a computational chemist. I don't know that I've ever advanced the theory of chemistry terribly much but my contributions have been mainly on connecting experiment and theory and using computations to do those computational experiments. So I'm not a theoretician in a sense but I'm a computational chemist.

*But you did experiment and build machines –*

Yes, yes.

*Was that something that continued or –*

No, I stopped- when I came to Fishermens Bend I became entirely a computation chemist. The job I applied for was as a theoretical physical chemist.

## **CSIRO Division of Applied Chemistry at Fishermens Bend**

*Perhaps we could talk a little bit about your time at the Fishermens Bend. You joined the division of applied chemistry, could you talk about what CSIRO was like at that time, the environment and then also what you yourself did there?*

The Division of Applied Chemistry, Sefton Hamann was the Chief and it was a combination of the old Divisions of Physical Chemistry and Organic Chemistry, and my title was theoretical physical chemist. So my understanding of my job when I applied for it was that I

was there to apply theoretical methods to whatever was going on in the Division. As I think I've said in another place when I got there I knocked on Sefton's door and said, "I'm here, what should I do?" and Sefton basically said to me, "Do whatever you like" and so I said, "Well I'll come back to you" – and I think he may've said to me, "Write down a few ideas and come back to me." So I wrote down a few ideas of what I might do and one of them was (I'd written a paper with Harry Bloom on molten salts) I said, "Maybe I'll do something with molten salts" and he said, "No don't do that, that's too hard." So he said, "They look quite good." Essentially I was saying, "I'll continue some of the work that I was doing about the properties of gases."

*So there wasn't an industry perspective driving any of this?*

Not my work, no but after a while he said, "I think you should go and talk to people. You'd like Wolf Sasse" he said, "Talk to him." So I talked to him and I talked to George Holan. Sefton said to me to see what you can do to help them. So it was at that point that I became interested in the application of quantum chemistry to the prediction of biological activity of large organic molecules. So I got started on some work using fairly primitive quantum mechanical calculations on the properties of these large insecticides that George was working on, and George and I wrote a few papers on that. I think I was generally helpful to George in showing him how understanding the electrostatic structure of a compound helped him mimic DDT for example, how do you mimic DDT in another compound, and I think I was quite useful in that. I published a few papers with him on that.

Soon after, I became interested in the surface chemistry work that Bill Mansfield and John Lane were doing on how can you use an understanding of intermolecular interactions in predicting the absorption of gases on solids, and John Lane and I wrote a series of papers that are still being cited today using the Grand Canonical Ensemble Monte Carlo method for calculating the absorption of gases on solids. Those were very interesting papers which we could do because CSIRO had just purchased a very large Control Data 7600 computer. So we were well up in the world in computing power and so we did a whole lot of work on that.

*What year would that have been roughly?*

That would've been from about 1974 to 1978, the first paper would've been published – '78. *And you were very productive in terms of papers during those years, early '70s.*

I was yes. So I had those three bits of activity, the third one was with Charles Johnson. Charles and I continued this work on the properties of gases and the paper that we wrote on the third virial coefficient of water, that was a very interesting paper. We probably got it wrong but we used a numerical method to calculate – it's a nine fold integral for the third virial coefficient of water –

*So there's one about the third virial coefficient of water and nonadditivity in argon and neon.*

No –

*That was '72.*

Yes.

*And then you did a similar thing for water, 1970.*

Yeah, the first thing I did at CSIRO was that paper. That was a very good paper, very good bit of work.

*So looking at your research activity there, could you talk a little bit more about the CSIRO that you came to at the time and the CSIRO that -*

When you went to Fishermens Bend in 1969 it was a most exciting place to go to. So the morning tea room, you had to get there early enough to get a table. It was a very exciting place. Sefton Hamann himself didn't go to morning tea but he was a grand figure in Australian physical chemistry. Ian Brown was a very prominent physical chemist, we had [Wolf Sasse], one of Australia's great inorganic chemists really, Peter Wales, Tom Mole, Charles Johnson, Bill Mansfield in our area. The ceramics group was there, Richard Hannink and all those - there was a whole lot of people there. The Division of Applied Mineralogy was still there.

So a very, very interesting place to be, very exciting and some of it was connected to industry, I think Applied Mineralogy was. The Division of Applied Chemistry was still very much an academic sort of area. Not all of us were interested in industry. Don Weiss' group was there, he was very connected to applications of his work. So there was a mixture of applications oriented research and more pure research.

*Am I right in saying that these various research groups mixed socially as well as there was interaction between them at Fishermens Bend?*

To some extent there was, yeah. During that period though various groups left, so the applied mineralogy group left to go to Perth, all of the chemical engineers eventually left to go to Clayton. The place during the period I was there, the number of people started to decrease. The ARL used to come to our morning tea but the fence was built in between and so we lost contact with the ARL people a bit.

*So here we're talking about the decade of the 1970s really?*

The decade of the 1970s. So I really had quite an interesting job there as you can see that because I was the sort of theoretical physical chemist I interacted with a lot of the groups whereas Charles and John, the other physical chemists, probably didn't do that as much as I did. There are papers with Wolf Sasse, papers with George Holan, I published a couple of papers with Sefton. It was there that I met up with Dave Solomon who came into the Division and Dave and Sefton and I published a few papers on –

*So what year is this?*

This was in the 1970s.

*Mid '70s?*

Yes, on the application of quantum chemistry to predicting some cyclopolymerization.

*So you moved from physical chemistry as in very small molecules and gases and water and that sort of thing through to organic chemistry of the kind that was being used for insecticides and then into polymerization. Was that a –*

I see that my whole career, apart from my time as an experimentalist, has been as a computational chemist. So I try to understand the theory and then attack problems which require numerical methods to solve them.

*So polymers were considered to be not accessible for computational chemists in the early days –*

That's right and so Graeme Moad and I did a lot of early work in solving – so basically the polymer problem is that to understand the kinetics of polymerization you've got to solve huge sets of differential equations. Graeme Moad and I did some early work on that and continued to do that during the early '80s up until the '90s.

*And looking back from 2017 how significant was that work on a world stage?*

I think that the way that you judge these things in retrospect is by citations, so the Lane Spurling work on the Grand Canonical Ensemble are very well cited in physical chemistry terms there. They were quite a significant contribution and I was invited to give a lecture on that at UCLA. That was quite interesting and those papers we had very good referees reports, people said they were extraordinarily good work. So I think that was a significant work. The book *The Virial Equation of State*, by the mid '70s atomic force microscopy had started to emerge and so the need for analysing the properties of gases to understanding intermolecular forces had declined. You could measure them directly using atomic force microscopy and other laser driven –

*And you didn't do that?*

I didn't do that. So my most significant work on that was probably in that early '70s and the publication of the book. The book is highly cited, people still cite it today, *The Virial Equation State*.

*And still actually use all that stuff?*

It's still actually used, yes.

*And it's important in polymers or more generally?*

No, no, it's important in chemical engineering so you need to know the properties of gases – so say if you're ESSO selling gas to the state government whoever sells gas now, Origin Energy, you need to know what the properties of methane are at various temperatures to know how much gas is actually going through the pipe. So chemical engineers and other people use all of this stuff still today. So I think the work that I did with George, other people were doing it. I think the significance of it was that it enabled CSIRO's chemists to understand the rational design of drugs. I don't think my contribution of that was anything more than that, but the work was important for CSIRO rather than for international science.

I think the work that Graeme and I did on polymerization and kinetics was an important contribution.

## Politics again

*Did that lead to RAFT? So we're now moving into the '80s aren't we and you've come to the point about the polymers, you applied to become an Assistant Chief in 1980, if you could talk about that and also if you could talk about how the polymer activity in CSIRO actually got steam up?*

In the period we're talking about which was 1969 to 1978, this is a period where we had the 1972 election, we had the rise and fall of the Whitlam government, we had the Birch Report, and we had a whole lot of activities going on outside of CSIRO in understanding the role of science in economic development of the country. I was very much involved with the 1972 election. I was an active member of the Mt Waverley branch of the Labor Party with Frank Larkins who became the deputy vice chancellor of the University of Melbourne, John Morris who became the Chief Executive of the Peter MacCallum Hospital and a few other people, Barbara van Ernst who was the deputy vice chancellor of Swinburne for a while.

There was a group of people in Mt Waverley who actively campaigned in the 1972 election and were very excited when Whitlam won, watched the Connor affair and we were involved in the internal party activities to try to get the government to reverse the takeover of the minerals part of CSIRO, for that to go off CSIRO into the department of minerals and energy. So I became quite actively involved in politics. I got to know John Button at that point and Barry Jones, or he was a bit later. But in the aftermath of the fall of the Whitlam government I was very much involved in the policy committees of the Victorian branch of the ALP. So I was part of the resources and energy – I think we called it the energy policy committee, so I was part of a group of people who started to think within the Victorian party about what energy policies we should have, what science policies the organisation should have.

So the Victorian branch after the downfall of the Whitlam government reformed and had a whole lot of people thinking about policy. So I was part of that policy committee process. I was interested in the Birch Report, how was that going to affect CSIRO? I think I talked to Dave Solomon and people about these sort of issues informally, but my view on the role of CSIRO changed during that time. When I first joined CSIRO it was a wonderful place for me to do whatever I liked, which I did, but by the end of the '70s I'd started to change my view that maybe the organisation needed to interact more with industry. "How do you do that?" was the question that was in my mind.

So I think unconsciously my connection to politics through the policy committees and so on made me think more about the role of CSIRO. I think that when Dave Solomon needed to spend more time on the bank project he thought he needed to have an assistant chief and so when you say I applied for the job, I didn't apply for the job, he called me into his office one day and said, "I want to appoint you as the assistant chief" and I said, "I'll do that."

*In order to do what?*

Well in order to have an influence in the direction of the division.

## **Assistant Chief of Division**

*To let him get on with the banknote?*

That was his motivation, my motivation was that I thought it was a good opportunity for me to have an influence on the direction of how we use the science at Fishermens Bend for some economic benefit. This is a bit in retrospect, at the time I thought it was a good idea.

*Yes, because you wanted to?*

Well I suppose I was ambitious. A number of us say, this is an arrogant statement I suppose, "If you don't do these things some other clown might do it."

*Absolutely, that's right. Even if you don't want to do it you've still got to do it.*

When Sefton had resigned in 1974 and the division advertised for a replacement the two internal people were Don Weiss and Dave Solomon, they were the two likely candidates and we the physical chemists had to decide amongst ourselves that we didn't want Don Weiss to be our chief. Don Weiss was a magnificent character and he was the person who led and devoted a lot of his time and effort to connecting CSIRO with industry, particularly water treatment industry and resource treatment industry. But we the physical chemists were suspicious that he wasn't keen on going the next step in science. Once he'd solved his industrial problem he moved on to another one, he wasn't interested in following up the science. So we didn't think that he would be a good chief for us, even though he was a physical chemist.

We thought Dave Solomon would be because he was the person who, in that experience we'd had with those polymer papers, was very interested in, if he couldn't understand it, asking other people to help him, "Why does this happen?", so he and I published papers. John Lane and I at the time went to his office and said, "Dave, you've got to apply to be the chief" and explained our reasons, and so he did. Eventually the Executive divided the two Division of Applied Chemistry into the Division of Applied Organic Chemistry and the Division of Chemical Technology, and curiously the Division of Applied Organic Chemistry took the theoretical and physical chemists. The logical thing would've been for us to go to Chemical Technology but Dave wanted us to be part of his Division because he understood the need for rigorous science in what he was interested in.

*And he wanted a small, let's say 100 scientists?*

Yes.

*But top quality scientists, and so you were part of that group.*

Yeah. When he wanted an Assistant Chief he had this background of my interaction with him. Also during that time the bank project was in the background and I'd made contributions to the bank project.

*So just as the computation chemist does have an experimental hands on experience, so the theoretical chemist really cares about the application of the research, was that always part of your interest in science, the link to the application?*

I think as I said earlier my understanding of chemistry as a kid at high school was the Boden understanding of chemistry, that chemistry was the only discipline that was also an industry. So I think the answer to that is yes. I was basically interested in doing whatever I liked but I was a reluctant convert to the need for CSIRO to have a greater link with industry. It was during that time from when I was the Assistant Chief for those few years that I thought a lot about how the organisation should do that, and Dave and I had a range of different approaches to this problem.

*Maybe that's getting close to this first part is it?*

So why did I seek a management role? I didn't really seek a management role, it was thrust upon me.

*Thank you Tom, perhaps we can resume in a few minutes.*

*Okay, I'm going to pause this one.*

*[Pause]*

*We're back on the air, it's 12:05 and Garrett is going to lead off.*

*There's just a couple of follow up questions Tom, before we move onto the period 1980 to 2000. One I want to ask is the movers and shakers in the division during your time at Fishermens Bend?*

I think it's important to understand that there were some very senior scientists there. George Holan was a very important person in the insecticide project. Wolf Sasse joined the Division from the Division of Coal Research and he brought a great interest in inorganic chemistry to the Division. The senior organic chemists, John Lamberton and Dennis Horne, were very good scientists, they didn't have much of an influence in the industrial development of the Division. People like Peter Wales got involved early in the hydrogenation of coal project, he was a very influential person. Tom Mole was a senior inorganic chemist.

But what I'd like to talk about just briefly is the role of Stan Johns in this. Stan Johns was a person who was an NMR spectroscopist and he, like me, worked right across the Division. NMR spectroscopy interacted with every part of the Division as did theoretical physical chemistry. So Stan and I had a lot of discussions about how we should progress the Division if we needed to interact more with industry. Stan, I would've thought, would've been destined to become the Chief of the Division, but unfortunately he died of cancer sometime in the period that we're talking about, I think in the early '80s.

So I think a lot of people in CSIRO in the '70s, especially after the Rex O'Connor incident and the Birch Report a lot of us started to think much more about the role of the organisation, why were we here and Stan was an important influence on me in that regard.

## The Royal Australian Chemical Institute

*You also were involved in societies and academies during this time, do you want to reflect on that and how that fitted with your role with CSIRO?*

When I went to Tasmania I wasn't a member of the RACI but pretty soon after I got there Peter Smith said to me, "We'd like you to be the secretary of the Tasmanian branch of the RACI" and I said to him that I'd do that but I wasn't a member. So we joined me up and the same day I was elected the secretary of the Tasmanian branch. That was in 1967 and I've been a member of the RACI ever since then. At Fishermens Bend chemists were in a sense expected to be members of the RACI. There was nothing written but the culture of Fishermens Bend was that we took part in RACI activities, and in particular we expected in those days the President of the Victorian branch and the President of the national branch every three years would be someone from CSIRO, or a university or an industry or CSIRO.

So in order for that to happen you had to have people involved in the Institute. John Lane and I decided that we would start a physical chemistry group in the Victorian branch, and eventually we were the movers in setting up the Physical Chemistry division of the national organisation. So I with John Lane was very much involved in the RACI, and I became the President of the Victorian branch in the '80s sometime I think. Then I became the national president in 1987. So that was a very big part of my professional activities. We organised a lot of meetings and for example, Peter Andrews who was the professor at the Pharmacy College, a theoretical and physical chemist like me became interested in drug design, so we started thinking through in his case how should Australia approach having a research based pharmaceutical industry?

So we had discussions with various people including Barry Jones who addressed some of our meetings. So there was a lot of interaction in those days between the universities, CSIRO and industry about the interaction of chemistry academics with industry. It was in those days also in the institute, since there was an expectation there'd be an industry person as the president, there were a lot of industry people as part of the RACI and so I and my contemporaries at Fishermens Bend got to know people – Alan Dun and Peter Wilkinson from ICI, Paul Donaghue - a number of the research people involved in the chemical industry were part of the RACI.

*So just to clarify that was in the early '80s where –*

The late '70s early '80s –

*- there was interest in greater engagement with the chemical industry.*

Yes. But I think my involvement with the Institute started much earlier than that. I became known and knew people within the chemical industry through that involvement with the Royal Australian Chemical Institute. It's one of the disadvantages of time management in universities and CSIRO where people don't have the spare time to devote to professional activities and it's probably to the detriment of the scientific civil society.

*Yes, so what you're saying is that investment of time in those is actually high priority but is not given the priority it deserved by the system in CSIRO and universities?*

It was then, it isn't now.

*Right okay, got it. Just following on from the session before we broke, CSIRO traditionally has performed a very important role on behalf of Australia in providing linkages between Australians and the rest of the scientific world, particularly in United States and England and other parts of Europe. You were very active during the '70s as a scientist, you had interactions internationally. Can you reflect both from your personal point of view but also more generally from CSIRO's point of view about how it was going in terms of the importance of those linkages and how they were maintained given that transport was changing rapidly, communications were changing rapidly, and so instead of having to take a month on a boat you could communicate instantly. Could you comment, because you were actively involved in that period, about the importance of those international linkages and the role that you played and the role that CSIRO played?*

A lot of the linkages with international science organisations occurred through the RACI and IUPAC connections. I personally wasn't much involved in IUPAC but the people in the Division were. So Ian Brown as I've mentioned, John Lane, Dave Solomon, many people at Fishermans Bend were part of International Union of Pure and Applied Chemistry, the Bureau of the International Union of Pure and Applied Chemistry, and the Divisions of that organisation and that continues to this day; Graeme Moad for example is still active in IUPAC polymer division and so on.

I think CSIRO played a very important role in that. In connecting with international science it was much more difficult in those days but we had a program of sending people abroad to conferences. I for example spent two or so months working at Smith, Kline and French, a pharmaceutical company in Philadelphia on looking at aspects of drug design. So it was a program that people tried to go overseas and connect with people. But a lot of connection to overseas science in those days was done by letters, correspondence.

*A significant part of CSIRO's budget was devoted to participation in international science activities and people were expected to make at least one trip a year once they were senior scientists was my recollection.*

That was never my experience. I was in CSIRO from 1969 to 1985 when I went to work with Gareth, I only went overseas once at CSIRO's expense.

*Is that right?*

Yes.

*I remember people arguing about how much they had to contribute and CSIRO scientists having to find money themselves, but they were pretty studious about getting overseas to a conference at least once a year.*

I didn't.

*That's not your experience?*

Wasn't my experience, no.

*Or of those around you?*

No. Well I think some of the organic chemists did more than we did, but our physical chemistry group, I don't think Charles Johnson went overseas at all, John Lane would've gone overseas more frequently but he was part of the IUPAC group. So that wasn't my experience.

*And participation in scientific work with overseas scientists, your joint papers, those sorts of things?*

We did it by correspondence.

*And how did you meet them?*

Some of them I met when I was at the University of Maryland, some of them I met by correspondence. People wrote to me, especially the Grand Canonical Monte Carlo calculations, overseas science would write to us and say, "Could you do this or that?" So letter writing was a much more important means of communication than perhaps it is today.

*Okay, I'm done on that thanks Garrett.*

## ***The Bank project***

*Turning to a very busy period in your life as a senior manager in CSIRO and particularly looking at the first time in that you were Assistant Chief of Applied Organic Chemistry 1980 to '85, could you reflect on what you saw as the main challenges facing the Division at the time?*

I think we haven't mentioned the bank project very much up till now, but the bank project played a very important part in the Division of Applied Organic Chemistry. Dave Solomon was the Chief but he was also the leader of the bank project. Because of the flexibility of funding of CSIRO Divisions in those days he was able to put resources in and out of the bank project as needed. So somebody like me for example, my involvement in the bank project was that I did a lot of the help with the statistical analysis of various experiments, so I was able to use my knowledge of statistics to help them understand whether the polymer note was doing any better than any other note.

Dave said to me, "We need to convince the bank that plastic bank notes have the same quality as paper bank notes, how do we do this?" I had a talk to my friend Gordon Stanley who I mentioned in relation to my meeting of Heather. Gordon Stanley was the Professor of Psychology at the University of Melbourne at the time and he introduced me to the concept of psychophysical properties. So I invented the psychophysical property of 'bank note quality' and I devised an experiment that had people do an experiment that I said to them,

it was a blind experiment, “What you’re feeling, does that have the quality of a bank note?” They were sitting here, I had the bit of paper, they didn't see what they were touching.

Anyway, so I did this for a number of people, including the senior management of the Reserve Bank, and it was that experiment that showed that people feeling a plastic bank note without knowing that it was, said that that had the feeling of bank note quality and in a statistically significant number better than the paper bank note. In a sense that was one of the turning points in the project where the senior manager of the bank was convinced that you could make a plastic bank note have the quality – I don't know how I got onto that.

So the bank project was very important to us in the Division because Dave was able to draw on all of the expertise of the Division in solving the problems of the bank note. So we weren't full time on it. John Lane, who I've mentioned, he helped understand the program that was driving the electron lithography device in Japan which wasn't working properly, so John Lane spent a few days understanding the mistakes in that program with Graham Quint and I. So the bank project was a great thing for the Division because it brought us all together, and we felt that the Division was doing something that was vitally important to the nation – which it was, very good project. So how do we do that for the rest of the Division, and when I became the Assistant Chief that was one of the things that I tried to think about.

I should say that at one point during the '70s Dave Solomon decided that our, John Lane's and my program on the Grand Canonical Ensemble Monte Carlo calculations wasn't actually going to lead into any great industrial significance so he chopped it. We were very cross with him about that and there were a number of letters on various files from international scientists saying what a disaster that is to the future of this work that CSIRO was stopping this project. But we got over it and did other things.

*You didn't just keep it going underground?*

We kept it going underground 'till we'd finished writing the papers but we stopped it.

*And just what is the significance of that in lay terms, that project?*

It's a theoretical significance in that if you understand – it's a fundamental understanding of the way that molecules interact with surfaces. So in terms of catalysis, in terms of the way that drugs interact with their receptors, the way that paint adheres to walls, so understanding how the particles assemble on surfaces is a fundamental importance across a number of areas of science. That's why our papers are cited and people are still working on it.

*Yes. As a lay person I'm surprised that across those widely divergent areas of application that there's anything in common from a theoretical point of view even.*

The theoretical point of view is how do you calculate how a molecule interacts with a surface, so how does the interaction occur vertically, well from the molecule interacting with the surface but also the molecules interacting with one another as they come onto the surface. So the Grand Canonical Ensemble is a statistical mechanical ensemble that keeps

the energy constant but varies the number of particles in the system. So we were able to do the simulation of this keeping the free energy constant but varying the number of particles. So we were able to study how when particles come into a surface how they assemble on the surface.

*And that was theoretical as opposed to –*

Entirely theoretical, yes. You were asking me how I managed to transition myself from being a highly theoretical scientist to being a manager of this. So the bank project was one thing, my interaction with industrial chemists at the Chemical Institute was another influence on me, the influence of Don Weiss who became the planning manager of the organisation, after the Birch Report he became the –

## **Planning, priority setting and industry engagement**

*PEAU, planning evaluation advisory –*

Yes. I was the person who assembled stuff for him and at that point I realised that I could say anything I liked to Don, to this planning evaluation unit, and that the organisation at that level had no way of knowing whether I was making anything up or doing whatever. So I thought this was easy for me to do, but it wasn't a good idea for the organisation. It was then that I started getting interested in science priorities and how should the organisation work that. Dave and I, driven by Dave but with me helping, started to think of the areas of the chemical industry that the Division of Applied Organic Chemistry should be working with. Should we be talking to the commodity manufacturers like ExxonMobil and Monsanto, or should we be talking to the paint manufacturers, the colour chemists, the specialty chemical manufacturers, how should we be interacting with the pharmaceutical industry, the insecticide industry?

It was then that the whole origin of Dunlena; should we form a commercial interaction with a large insecticide manufacturer to help us decide what were the best compounds or the best area of crop protection chemicals that we should work with. That was when we came up with the idea of Dunlena, and DuPont was the company that interacted with us. We tried to get links with Monsanto, which eventually went out of existence. So we were thinking about this in a sense during a time when the chemical industry in Australia itself was in transition with the tariff reductions and the globalisation of industry.

*So that's very consistent with theories about how CSIRO should operate namely that that kind of thinking should be done at divisional level by the people who actually understand not only the science but the industry and it couldn't be done at a higher level in the organisation.*

*That's what we thought, yes.*

*Yes. Did you get any encouragement or did you just do it below the horizon as far as management was concerned?*

After the Birch Report the Institute of Industrial Technology was very lucky, and Hill Worner was the Director of that Institute and he had a very hands off approach to this. Also those

early Institutes had no staff to speak of so they had little capacity to influence any of this so it was really left to the Divisions to work this out.

*Did you have economists and other people to help you with that?*

The answer to that is no, we didn't really. We had good interaction I think with Paul Grant and the IP group in head office, but in the early years of the Institutes we didn't have much. It was that time in the building up to the 1983 election where people like John Button and Barry Jones were very interested in CSIRO. So there was a lot of political activity of people to say that the Institutes weren't working very well. Button and Jones for example were quite interested in what an incoming Labor government should do to make CSIRO more effective. Those discussions, which various people had, including me with Button, led to the government of the day thinking that they needed to have an enquiry into it. The ASTEC Report came pretty soon after the election of the Hawke government and led to the formation of the Board and the change of the institutes. So Barry Jones I think was interested in changing the governance mode of the organisation.

*Just before you leave those earlier days with Hill Worner, Paul Grant et cetera, did you come across a guy called Yen Ip who was working in Paul Grant's group and beta carotene economics and those sorts of things?*

Yes, yes.

*Was he helpful to the division?*

No, no.

*He was an economist -*

He wasn't unhelpful. We didn't interact with him, he interacted very much with Don Weiss' division.

*Also in this period it would seem that the Division of Applied Organic Chemistry was the vanguard in terms of seeming to engage with industry, could you reflect on the impression you had at the time how CSIRO as an organisation, how other divisions were dealing with the challenges in regard to dealing with industry?*

I think other parts of the Organisation, particularly the rural parts, were always very closely involved with the industry because of the structure of those sort of industries. I think at that time the Organisation started thinking, that was when the Division of Manufacturing Technology was being formed – Tribophysics became the Division of Material Science sometime in the '70s or early '80s –

*Chemical Physics –*

Chemical Physics stayed on, the minerals divisions were closely interacting with their customers more than we were probably, the more pure chemistry and physics Divisions weren't interacting as much. So I think we were in the vanguard of thinking about how CSIRO should interact with the manufacturing industry. So other Divisions did their industry

interactions, but we were looking at the chemical industry and various parts of the manufacturing industry.

*You used the RACI as like an industry association because you could interact with industry through the RACI.*

Yes, but we also were closely involved with the ACIC and ACSMA, so the Australian Chemical Industry Council and the Australian Chemical Specialties Manufacturers Association. Dave and I, Dave particularly in the early days had good links with industrial people. But how do we work with them? Tariffs were a big problem because the big companies like ICIANZ, even though it was an independent group, had links with their corporate headquarters so their research activities were basically being done in collaboration with the corporate laboratories and Dulux Paints which was a subsidiary of ICIANZ, they had good links with the paint division of ICI so they probably didn't need us.

*So it might be convenient here for you Tom just to give us a thumbnail of what happened about tariffs and what the drivers were about local industry and why it was that they weren't all that much interested in doing research in Australia.*

Much of the chemical industry of Australia was built up after the war with high tariff barriers and this resulted in the Altona chemical complex, which was a very large chemical complex. It was essentially built from imported technology producing commodity polymers under a tariff barrier so they didn't have much incentive to do research. Monsanto had its own, and I think ICI – many of those companies had their own crop protection chemical business, ICI produced crop protection chemicals, Monsanto of course produced Roundup. But those compounds were all produced under licence from their head office and if they wanted a new chemical they would tend to not rely on CSIRO to do this, but they would interact closely with their corporate laboratories in the US or England.

*Can you explain why they did that?*

Because they had some intellectual property restrictions – if they developed something in Australia it was owned by head office anyway.

*So they were subject to serious constraints.*

Yes. George Holan worked for Monsanto and Monsanto reduced their local research activities in crop protection chemicals and then we recruited George to CSIRO and he brought his whole research group to CSIRO.

*So there was a whole regime which affected Australian science or the utility of doing research and development in Australia leading then to Australian manufacture of products for the purposes of exporting from Australia and that regime was driven by the big companies and their own internal arrangements which are in turn driven by Australia's tariff arrangements.*

I would think that's correct, that was my understanding. I'm not an economist but that was my understanding of the restraints that the organisation had in interacting with these companies. CSIRO through the Division of Material Science had a very world class catalysis

project developing new catalysts for the use in say making polymers or doing large scale chemical interactions. But it didn't lead to very much commercial activity because the companies who built these sort of plants in Australia had their own laboratories doing this in America and they used proprietary technology. So it was a dilemma for our Division when we tried to think of ways of working more closely with industry - what to do.

That's when we thought that linking directly with a large multinational like DuPont would be a good way to go because we'd have first of all insights into what the company was doing, which we didn't really have as independent scientists, and secondly it would provide a direct route to the manufacturer of our stuff, probably not in Australia though. So we probably didn't think far enough ahead in that. I think one of the most interesting things that we found in the interaction between CSIRO and Nippon Kayaku which in a sense was before my time, and then the interaction between CSIRO and DuPont was the following, that if you were an independent researcher in Australia following the literature you were some years behind because typically companies published stuff on compounds and developments after they'd done any commercial development of them, and often what was published were things that didn't work.

When we got into more closely with DuPont we were amazed by what the DuPont scientists knew of what was going on in other companies and the importance that the DuPont scientists placed on the patent literature. George was always very keen on the patent literature but that experience with DuPont taught the organic chemists that they had to look very closely at the patent literature; if you wanted to make advances in crop protection chemicals you had to understand the patent literature as well as the academic literature.

*If that's where it got published first maybe the only place it got published.*

Yes.

*It was a longstanding relationship with DuPont wasn't it?*

Yes, it went for a long time and it was very valuable to the Division. It turned out it didn't actually produce a commercial compound. There were two that got close, one was a rice herbicide and another was a fungicide, but none of them actually got into commercial production.

## **Gareth Evan's office**

*In 1985 you joined the Office of the Minister for Resource and Energy, Gareth Evans, why and what did this all mean for CSIRO in the end?*

I don't know that it meant much for CSIRO. The 1984 election the Hawke government was re-elected and Gareth Evans had been the attorney general in the first Hawke government and I think the story that was around was that the Prime Minister thought that it would be a good idea for Gareth's education if he went into a ministry he didn't know anything about. So he was appointed Minister for Resources and Energy and he didn't really know much about that. Why did I take the job?

I was rung up one day in January, actually we were in Perth, they tried to contact me when I was away and when I got back from Perth from holidays someone from his office rang up and said, "The Minister has heard that you'd be a good person to be his Senior Private Secretary. Do you want to come in for a talk?" So I went in for a talk with Gareth and at the end of it he said, "Can you start on Monday?" and I said, "Probably not." Why did I do it? It seemed to me to be an opportunity and I take opportunities if they come up.

*And the attitude at CSIRO to this?*

I rang up Dave and said, "Can I have leave without pay?" and he said, "Yeah that's good", he thought it was a good opportunity.

*And head office?*

I think they thought it was – there was no reluctance on anyone to give me leave without pay.

*So you didn't talk to the Chief Executive or –*

I didn't talk to – I just talked to Dave. When I was at Albany High School we used to have religious education and the Presbyterian minister at Albany was a person called Alex Macliver, and the only thing I can ever remember him saying was that you have to think of opportunity – this is a corny story – you think of it as a bald person who's got a bit of hair still growing at the front, he's got a forelock, so if opportunity comes to you and you don't grab the forelock when it gets past you and you try to grab it you can't get hold of it. I've always remembered that, so when opportunities come to me I always grab them.

*Again as an aside Macliver, is that a common name in Western Australia because –*

His granddaughter –

*Sara Macliver?*

Yes, Alex Macliver's granddaughter.

*Absolutely wonderful, Australia's best soprano.*

Certainly is.

*And I also worked with her brother I think who was an attorney general in Perth when we were having a fight with the Western Australian water department.*

Yes. So why did I do that with Gareth? Well I'd been involved a lot with the policy committee that had developed some of the Hawke government's resources and energy policy so I was known to the various people in the party as someone who was interested in these issues. I worked closely with David White on this and Brian Howe who was the member for Jaga Jaga and became the Deputy Prime Minister. So it wasn't a completely out of the blue request for me to do that. I thought it was an interesting opportunity for me.

*That really is a breadth of interest though isn't it; water, mining, energy which is not directly related to chemistry?*

Well physical chemistry Garrett, as you know, is all those things in science that are interesting, so there's an element of physical chemistry in resources and energy.

*So you were with Gareth Evans for what, one year or -*

Not very long, not quite a year. I found commuting from Melbourne to Canberra very wearing and so I didn't stay there for very long. I think I made some contribution to that but I decided I suppose looking back that I was more interested in the larger picture of energy policy than in the detailed administration of it.

*The politics.*

Yes. The politics was very interesting to me, I got to know Peter Cook quite well. Peter Cook was the Chairman of the caucus committee on resource and energy and he and I worked quite closely really and so I got to know him quite well. It was an interesting experience for me. It was a help to the Organisation I think when we had the first McKinsey review of – the Board hired McKinsey to look at research priorities particularly in the rare earths, so the rare earths study. When I got back from being the Minister for Resources and Energy I came back to the Division and Peter Wailes had been appointed the Assistant Chief so I didn't really have much of a job to do.

It was then that I started working with Graeme Moad, but pretty soon after I got back this rare earth study came along and I was part of the CSIRO team that worked with McKinsey on developing that. I think the contacts that I'd made particularly with the bureaucrats in the Department of Resources and Energy and in some mining companies was quite helpful in that project.

*Any discussion about CSIRO when you were in the Minister's office either at a departmental level or with politicians?*

The answer to that is, not much. The minister and the senior bureaucrats in the Department of Resources and Energy were much more interested in higher level policy issues than in detailed aspects of the R&D, although the notion of long wall mining which was a CSIRO invention – was considered to be very important. How the organisation organised water, the Murray Darling Basin was an issue at the time. CSIRO wasn't a major part of the discussion that I was involved with higher level policy.

*And climate change, global warming –*

It wasn't an issue then. This is in 1985, it wasn't really an issue that was being discussed. So there was very much of an economics aspect to this. Craig Emerson, who was Peter Walsh's private secretary was very much interested in resource rent tax, so the petroleum rent tax regime came in during that time and Craig was a driver of the thinking about that. Craig went on to become a Minister in the Rudd-Gillard government. So I think the answer to your question is CSIRO wasn't top of the mind of the Minister for Resources and Energy, and as you know those days were days of discussion of quite important policy changes in the

development of particularly the natural gas, offshore gas development in North West Shelf and coalmining.

*And Gareth was not using you as a conduit to get advice from CSIRO or anything like that?*

No, no. The Minister for resource and Energy had the Atomic Energy Commission - ANSTO was part of that portfolio.

*But he wasn't trying to push them together?*

No.

*Was there any residual bitterness from the department about CSIRO?*

Not that I detected.

## **Work with McKinsey**

*You've mentioned the McKinsey study and that led to the formation of the Institutes, can you describe that period?*

My memory of this which may be different from other people's but this is my memory of what happened. There was a perception amongst people at my level in the organisation and certainly in my informal discussions with people like Senator Button and Barry Jones that the organisation had not implemented the Birch Report as well as they could've. The Birch Report advocated quite big changes in the role of CSIRO, so from being perceived as an organisation that was science driven to become an applications oriented research organisation. It took us all a while to understand what that meant, but there was a perception outside that the organisation had said they were going to implement the Birch Report but it only had lip service to it, and the institutes being structured without any staff or any actual way of doing anything was a good example of the organisation not actually taking this seriously.

That was the perception that I had as a scientist because my life hadn't changed very much, and certainly was the perception of the outside, particularly people like John Button and Barry Jones who were part of this. Victorian branches of the Labour Party had three factions if you remember, the left, the right and the independents and Button and Jones were the independents, and that was the sort of thinking that they had.

*Where were they getting information from about CSIRO?*

They were getting information from people like me and Frank Eastwood who was a scientist at Monash. Button and Jones had great connections within the organisation, so where they got the information from, they got it from their friends.

*Not the unions so much?*

Possibly the unions, I don't know. So this was the perception leading up to the election of the Hawke government. The expectation of the group of people that I met with was that

the Hawke government would be a positive for CSIRO because of particularly Button's and Jones's interest in sunrise industries and the transformation of the Australian economy to become much more of a knowledge driven economy. Remember this was in 1983, and so there was a feeling that they were going to change things. It took a while for the board to be appointed and Neville Wran became –

*If I can just go through; so the ASTEC Report was commissioned in '85 I think, that was a product of the Hawke government, and then there was a McKinsey Review of CSIRO, and then there was this decision to reform the organisation?*

Yes. So from 1983 to 1988 when the new structure took place was a long time. So it took the Hawke government a long time to make the changes that we in 1983 thought may well be necessary. But the first thing was the Act was changed so the Board was appointed and then the Board commissioned McKinsey to help them understand the best way to restructure the organisation and make the new Institutes. A feature of the new Institutes was that they had much more resources and staff. So I came back to the Division after being with Gareth in a sense to start my career again. I've written about this somewhere, the Organisation isn't actually very good at sending people off to do something and then bringing them back. I was left entirely to my own devices really about what I should do next.

*Except that you got a salary.*

I got a salary, yes, a very nice salary thank you. So fortunately for me Dave Solomon was the Acting Director of the Institute at that time and when the discussion of the McKinsey rare earth study came up he put my name forward. So I got into that and that was a very interesting experience for me because I learnt a lot about the way that McKinsey thought about strategic planning and research priority setting and so on. That was a help in the end in that the John Stocker Research Priorities exercise. So when I got back to the Division after I'd been on that rare earth study I had various discussions with McKinsey about the restructuring but I wasn't part of that team.

By then Dave Solomon was the Acting Director of the Institute of Industrial Technology because Bill Whitton had got ill and had resigned I think by then. After a while Dave said to me, "You'd better come on as my assistant." So from the end of 1987 to 1988 I was seconded to the Institute of Industrial Technology as Dave's assistant, I didn't have any particular –

## **Work in the Institute office**

*You had policy adviser in your CV.*

Policy adviser, okay. And my role in that was partly general policy advice but mainly I was involved in discussions with the Reserve Bank about the selling of the technology. So I was very much involved with talking to the bank, "How are we going to proceed with the commercialisation of the bank?" So Dave and I and others did a lot of the work on selling the technology to the bank for the \$9m, and that took place right up until 1988. I think the thing was signed –

*It was '88.*

In '88. During that time it was when I became involved also as Dave's adviser in devising the new Institute of Industrial Technologies and the Divisions involved in that.

*So it's curious isn't it, it was the Institute of Industrial Technology and then in the new formation it became Institute of Industrial Technologies and that was the one with the extra staff and –*

Yes. So the first proposal McKinsey had broken up the Division of Applied Organic Chemistry into a materials division and a biology division. The polymer group was destined to go in that first proposal to a Division of Materials Science. We, namely me and Max Jordan who was there as an industrial person, we developed an argument that said that you needed to have a chemistry division in CSIRO that spanned physical and organic chemistry and served the chemical industry. We said that having chemists and physicists all mixed up in a materials division defeated the purpose of the McKinsey restructure in that there was no materials industry, there is a chemicals industry. So we argued that you should have a division of chemicals and polymers, and a division of biochemistry or whatever, and a physics based division.

That argument won the day and so the Division of Chemicals and Polymers emerged combining all of the Division of Applied Organic Chemistry plus the main chemistry parts of the old division of chemical technology and a new division of forestry and forest products. We were quite successful, Max Jordan and I in arguing that the McKinsey restructure needed a Division of Chemicals and Polymers.

*Were you the first Chief of the Division of –*

No. The division thought that Dave Solomon who was the Acting Director of the Institute of Industrial Technology would become the Director of the new Institute of Industrial Technologies but he didn't, Colin Adam became the Director and Dave came back to become the Chief of the division of chemicals and polymers and Colin became the Director. At the end of 1987 and beginning of 1988 Dave and I and Colin had a discussion and Colin decided it would be a good idea if I came to the Institute of Industrial Technologies as his policy and planning manager, and I did that. Dave became the Chief of the Division of Chemicals and Polymers and he, as he said, was never happy with the way that the \$9m got distributed.

*Who was sorry, Solomon?-*

Dave. That money came to the Institute and Colin decided that that should be applied broadly –

*Where it was needed, yes.*

Yes, whereas Dave wanted it all to come to – I don't think he wanted it all to come to the Division but he didn't think that he got a good job, so he got a bit disillusioned and left the organisation in 1989 and I got the job of Chief of the Division of Chemicals and Polymers in 1989.

## Chief of Division of Chemicals and Polymers

*Which you wanted?*

Which I wanted. I thought it was probably time for me to become a manager. Up 'till then all my experiences had been as a staffer; so I'd been Dave's assistant, I'd been Gareth's Senior Private Secretary. I'd been working with Dave doing staff functions and I thought it was probably time for me to take responsibility myself.

*A real manager.*

A real job, yes. So I was very happy to get that job. I would've I must say been extremely irritated if I hadn't got it.

*Perhaps this is a good launching point for the next session; does it make sense to pause now perhaps?*

*Okay, I'm going to pause the machine.*

[Pause]

*Okay, we're on recording again now. It's 2:45 after a break and we're continuing with the interview of Tom Spurling for the CSIRO history project. Garrett?*

*So Tom we were at the stage where you've just become Chief of Chemicals and Polymers in the Institute of Industrial Technologies, it's 1989, could you offer some thoughts on what the environment was like in CSIRO at that time and your thoughts on the whole institute arrangements?*

I think I should go back briefly to my time as the Policy and Planning Manager in the Institute Industrial Technologies. As we transitioned from that I went from working with Dave Solomon in the Institute of Industrial Technology where Dave decided that he didn't have enough staff so he recruited me, and I don't know who paid for my salary, presumably the Division, but in that old Institute we didn't really have the capacity to analyse what the Divisions were doing and understand how the Divisions in the Institute worked together or if they did, and how they affected industry. The Institute of Industrial Technologies had a Planning and Policy Manager, we had a Business Manager, Colin appointed Trevor Thacker, and we had John Yates as the resource person. We had the capacity to hire people to do analysis for it and you remember Garrett, we hired you to look at the opportunities in biomaterials in that area.

So there was a lot of optimism I think in the formation of the new institutes. It was my impression that we had the opportunity to understand which industries we were working with and how we would interact with those industries and how the Divisions within the Institute could work together on some larger problem. It was at that time that Colin Adam introduced the Boeing project, which was a really multidivisional project and in the end crossed Institutes. So, from my point of view there was a period of optimism. Within the Division there was some cynicism because change happens and new management

structures are formed, but the life of the scientist didn't change very much was the perception.

*Was there a feeling of a new message being sold at this time?*

There was a feeling of a new message that was being sold that CSIRO was being reformed with a new mandate to have business driven research. The message to me was we'd finally understood the Birch idea of CSIRO being an applications oriented research organisation and that our research should have some direct economic benefit to the country. I stayed in that job until Dave left and then I became the Chief of the Division of Chemicals and Polymers and I stayed in that job till 1999. So the first thing I should say thinking about the Division of Chemicals and Polymers, it became clear to me that the research across the field of organic and physical and polymer chemistry was really going to affect not only the chemicals and plastics industry but also industries across the Organisation.

For example, if we were doing work on biomaterials the polymers that could be useful in the body, then we probably needed to work closely with the Division Biomolecular Engineering who had expertise in tissue engineering, they were in our Institute, but we also probably needed to link up with the Division of Human Nutrition and the parts of the organisation that were to do with other human health areas. And if we were working with companies doing crop protection chemicals then it made no sense for us to work completely independently of the Division of Entomology that after all knew a lot about insects and insect physiology and biochemistry, or the Division of Plant Industry that knew a lot about growing crops.

So it didn't take me very long to think that simply being a Division of Chemicals and Polymers saying that we were working with the chemicals and plastics industry probably had some limitations. You may have been there at the strategic planning meetings that we had; we in a sense broadened our idea of what the Division should be doing. So that was an interesting thing.

*Did you feel empowered by the organisation to get on with that?*

The answer is yes. I didn't think I was empowered by the Organisation, I think I thought that I was the Chief of the Division, I could do whatever I thought was the best thing for the division. You remember that sometime in 1990 Colin stepped aside as the Institute Director to become the Chief Executive of Sirotech and I became the Acting Director of the Institute. I think it was 1990 to 1991.

*That's what you say in your CV.*

## **Acting Institute Director**

Yes. So that led me to interact strongly with the Executive and it was at that time that Garrett had taken on the job of Planning and Policy Manager in the Institute, and with John Stocker we worked very closely in the research priorities exercise. When I became the Chief Keith Boardman was still the Chief Executive, so it was during the time that I was the Acting Institute Director that John Stocker started thinking about research priorities. My

experience with McKinsey and in particular with people like Ian Elsum and Andrew Pik and Garret Upstill, I think that we did a pretty good job in helping John Stocker develop the national research priorities exercise framework and Garrett and I spent quite a bit of time going around Divisions talking about that when I was the Acting Director and Garrett was the policy planner.

*And then that was used to guide CSIRO's triennial planning for the three triennia starting in 1990 was it?*

Yes. The 30 percent external earnings targets came around about that time and built up in the early '90s and I said to many people it was some of the most interesting time of my career because it forced me as the Chief of the Division to go out and actively talk to businesses. That was the period when we formed the strategic alliance with DuPont about the development of controlled radical polymerization. I became very actively involved in what was then the ACIC, then became PACIA and then Chemistry Australia it's called itself now, but I was part of that group of people and I remember going to Canberra with the Chief Executives of various companies to argue with the various ministers about industrial policy to do with the chemical industry.

## **Back to the Division**

So a part of that interaction, I as the Chief of a CSIRO Division was thought of as being an integral part of the lobbying activities anyway of the chemical industry. The 30 percent earnings target gave me very good experiences in dealing with companies and trying to understand their needs. My links with DuPont were very good because DuPont itself was a company that had planning issues similar to CSIRO in a way that they had a vast capability in research and development which they had to decide where were they going to put it. I had a good understanding of the way they went about deciding what was good and what was not. So for example in crop protection chemical they said you've got to aim to have a compound 100 times more active than the market leader. That wasn't in our thinking before that.

*Is that per dollar in cost of creation or per gram or per litre -*

100 times more active in terms of dose effect.

*They wanted it small.*

You had to be able to make a compound that cost much the same but was 100 times more - so they'd probably sell it to the farmer at more price but it would be much more active so it would take over the market.

*You'd get the same result by having something which is the same strength but 100<sup>th</sup> the cost.*

Yes. And they also explained to me that in this area, so in pharmaceuticals and crop protection chemicals, activity is what you're after, not the cost of making the material

because once you got the activity they were confident that some other smart chemist in their organisation would devise a method of making it cheaply.

*And any production costs are not a large part of the price anyway.*

No. So that was a very good learning for me and I think that the period from when John Stocker was the Chief Executive was a very interesting period because he came in as a breath of fresh air, invigorated the organisation. So it was a very exciting time to be part of CSIRO.

*Can I go back to a point Terry raised, the attitude of people in your staff, the chemists in the division, was this cultural change threatening to them or did they welcome it? How did they respond?*

I had a very good lot of leaders in that Division, so Ezio Rizzardo and Brian Bolto, Tony Priestley, Greg Simpson, Neil Furlong, Albert Mau, all these people had a very good understanding of the need to connect to industry. So I think that the Division had quite a good atmosphere of people. I think that we were all working towards the same goal.

*And that doesn't happen by accident, there are many Divisions where the Chief might've had the right ideas but – mm, that's good.*

I think that you don't want to underestimate the effect of the bank project on developing that. So through a period from 1968 to whenever this was, 1989, we'd had demonstrated to us through the bank project that working together with an outside customer was very rewarding and that if we could try to reproduce that it would be very good. Also during that time was the start of the Cooperative Research Centre program and the division of chemicals and polymers was very active in the CRC project in the sense of the centrality of chemistry to a number of projects.

That was when we got into biomaterials with the contact lens project, the CRC for Cardiac Technologies for the pacemaker leads and the polyurethane project, and then the famous R&D syndicate projects where we were very much involved in the project to develop antiviral agents through the Macquarie Bank funded R&D syndicate project. So those were exciting times for the Division because we could see, particularly in the contact lens project, that working with a company that knew what it was doing could be very valuable not only to produce great science but it also was a very good commercial outcome.

*And like the bank project it produced money for the organisation to employ and get equipment and travel and all that stuff.*

Yes, and CIBA Vision turned out to be a very competent company in turning the science into a commercial product.

*And apart from the Bank which was a government organisation did you get –*

Division of Chemicals and Polymers got a significant amount of money from private companies, sometimes leveraged by commonwealth money.

*And were all these companies multinationals as opposed to local?*

Almost all of them were multinationals.

*So that's where the money was, that's where the forefronts were –*

Yes.

*So good to work with.*

Mm. NuFarm is a multinational company based in Melbourne, that was one of the companies we worked –

*NuFarm is an exception isn't it, they actually had money even though they were Australian.*

And we worked a lot with ICI, which during that time became a local company.

*There's an interesting story there as well.*

We worked a little bit with Dulux in the polymer project, and we worked with Boeing. Part of the Boeing project there was some activities to do with the development of carbon fibre reinforced polymers that the division was involved with. It was also that time that we decided to build a pilot plant facility at Clayton where –

*That was interesting wasn't it, yes.*

Where we could take developments to the next stage and that was a successful venture. Greg Simpson was very much involved with that.

*How much did that cost roughly?*

Can't remember Terry.

*Many millions?*

No, no, less than a million I would've thought. That came from some of the money we got from the bank project.

*Perhaps we could invite you to talk a little bit about the research achievements of the Division during your time there and the key people who deserve a special mention?*

There are a number of things that the Division did. The Dunlena project was in the end unsuccessful but did produce a wealth of papers and experience and so on and patents in crop protection chemicals. Andy Leipa, a great organic chemist, Kevin Winzenberg, Noni Johnson, leading organic chemists who worked on the Dunlena project and produced a large number of good compounds, unfortunately none of which went into commercial production. Many of them got into a stage three of negotiation. Paul Savage came as a scientist at that time and has gone onto lead that area of the organisation now. So that was in the organic chemistry part.

In polymer science we were very lucky to have the DuPont Strategic Alliance which gave us external money and allowed Ezio and his team to pretty well do fundamental research in controlled radical polymerization and that was work with San Thang and Graeme Moad and when I was the Chief I contributed to those projects. The computational chemistry work around the kinetics of polymerization, I was part of that project. I think that clearly was the major scientific achievement of the division because Ezio may well go on to win a Nobel Prize for that work.

*So that was the RAFT technology.*

Yes, that turned into RAFT. I'd gone before RAFT was invented –

*We're back at 3:15 with the interview with Tom Spurling.*

I was just saying about the scientific achievements of the Division of Chemicals and Polymers. Without having any records in front of me, the - I've mentioned the organic chemists, the Dunlana project, and the work of Andy Liepa, Kevin Winzenberg and Noni Johnson, the polymer work of Ezio, San Thang and Graeme Moad. We had quite a strong Physical Chemistry Group - a spectroscopy group, in a way - led by Albert Mau.

As some of - as you know, Albert was very much involved in the bank project, in the development of a tertiary security device, which I can't really go into. But it was an extremely good device which is still being used in banknotes. In that respect, we recruited Gerry Wilson, who is now a leader in the - and future manufacturing group - of the Manufacturing Group of CSIRO. Gerry Wilson was a physical spectroscopist from Melbourne University who came and worked on various banknote security issues, as well as now working on organic photovoltaics.

The Physical Chemistry Group was very much involved both in the bank project and other projects, security projects, related to that, but also in helping understand some of the issues to do with the control of radical polymerisation. There's a very good paper including Albert and me and Ezio as authors on that.

The other group in - another group in the Division was the Water Group led by Brian Bolto and eventually by Tony Priestley and Neil Furlong. Neil Furlong came from the surface chemistry tradition of the Division that started with Bill Mansfield, and so he was interested in a whole range of aspects of surface chemistry, particularly to do with development of surfactants for various industrial and cosmetic applications.

The Water Group was the - came from the Don Weiss tradition of looking at water treatment technologies, water and sewage treatment technologies, and there's a big investment in SIROFLOC, which was magnetic particles to treat sewerage. That was a very good project but never really had commercial application. That was simply the use of magnetic particles without any polymer connected to it.

A development of that was MIEX, a magnetic ion exchange resins project. MIEX came directly from - if you trace the origin of MIEX, directly from Don Weiss' original idea of sticking magnetic particles in ion exchange resins. Neil Furlong and his group - Matt Ballard

and others - and Tony Priestley worked to develop MIEX. MIEX, I think, is commercialised by ICI or Orica, and I believe is still being used around the world.

That was the Water Group of the Division. We had - they were the four main - four or five main programs of the Division.

*Tom, just following up on that, has that been written up or should it be written up as in effect the history of the Division? Like one of these rolling capability statements -*

I think a rolling capability in water treatment in CSIRO would be a very interesting project, because it involves not only the Division of Chemicals and Polymers but other parts of the Organisation.

*What about the other things that you've talked about in the last little bit?*

Well, organic chemistry clearly is - would be a candidate for the - the bank project we've written extensively about -

*Yes. It's done. I'm just wondering whether there's any big un-written up areas -*

I don't - well, I think organic chemistry has been very well written up Claude Culvenor and Dave Collins and other people, to do with the phytochemical project. But following that, it hasn't been - not much has been written. Organic chemistry, synthetic organic chemistry, is a key skill in any organisation and you - because for any materials applications, you need somebody who knows how to make things, and that's what organic chemists do. I think I've got the main parts of the Division there.

*Any history of CSIRO, this is a very important area of science, industry and all that sort of stuff. I mean, a chapter would hardly do it justice.*

Many of the - a number of the key achievements of CSIRO listed in the organisation's publicity involve synthetic chemistry.

*To the extent that the Division produced annual reports, would a lot of this be in the annual reports of the Division?*

The Division of Chemicals and Polymers never produced annual reports. We produced one and -

*That's right.*

- somebody at head office said it didn't have enough - it was too dry, didn't have enough people, so produced another that had a lot of pictures of people and their activities, and someone at head office told me that it was too self-indulgent, had too many pictures, so I never produced another one.

*You did produce annual photographs, which I thought were marvellous-*

We produced annual photographs.

*Wonderful tradition.*

Yes.

*But moving on from the Division, is there anything else you -*

*I guess the other thing is at this stage, there's the other dynamic of you being a chief among other chiefs working in an organisation that's changing and, of course, John Stocker left. I think it was 1994, was it? Then we had an interim period.*

John left in 1995, I think -

*95. Then we had an interim period and Malcolm McIntosh took over. You could talk a little bit about the dynamics of being a Chief at that time, and also how you interacted with the successive Chief Executives.*

When I became the Chief, I was introduced to the Meeting of Chiefs, which they called - which is called the College of Chiefs. That was a strange organisation because there was no mechanism at the time for the Chiefs to have a good interaction with the Executive. The Chiefs met together and talked about this or that, and probably had some good ideas, but I think that in the end, John Stocker decided that it was counterproductive having two groups meeting, talking about things; one with responsibility and the other without the responsibility. He's started meeting regularly with the group of Chiefs and I think that worked quite well.

*Successive Chief Executives -*

The - I think that amongst the Chiefs - I mean, I remember distinctly that some were more interested in wider policy issues than others - Jim Peacock and Ron Sandland and to some extent Adrian Williams from Petroleum Resources, I think it was called by then, and Brian Tucker, and then Graeme Pearman - but some of the Chiefs weren't very much - they were much more interested in their own patch, so it was quite an interesting group. John was quite good at bringing them together, I think, hence the College of Chiefs ended up being disbanded and we had a meeting with the Executive.

*Then you also were Chief during a period of successive Chief Executives?*

Then we - a number of people, and I think - and Roy Green was one of the members of the Executive who thought that the rationale for having the Institutes had run its course. The institutes were industry-oriented Institutes where the Directors had a vested interest, in a way, in maintaining the integrity of their part of the organisation, whereas a number of the problems, particularly that Roy was encountering in his environment portfolio, clearly needed the resources of the organisation to look at.

In my opinion, as I said, issues to do with crop protection chemicals required our Division of Chemicals and Polymers to work closely with the Division of Entomology, which we started to do with John Oakeshott. Whether we worked - we knew John Oakeshott. We didn't really work closely with him until after the rearrangement. It was probably time to rethink the Institute structure and that - I think the Board probably thought that - Roy Green thought of

- and after John Stocker left, we gave the opportunity to have that rethinking of it. I think you were partly involved in that too, when we came up with the Deputy Chief Executive model.

*That review, you were part of?*

I was part of a group that was led by Bob Frater that developed the details of it. I think there are other - a Board subcommittee and other people were probably thinking about it simultaneously, but I think the group Bob Frater led that included Jim Peacock, me, Ron Sandland and Adrian Williams developed detailed proposals for it. I think of it as the Frater Review, Roy Green thinks of it as the Green Review, but I think that we did the - some of the detailed work in conjunction with people like Garrett, Andrew Pik, Ian Elsum, and Jenny North, was it? That was a time when it seemed to me that the organisation needed to rethink its role again, probably - it wasn't very long before - after the previous one.

*Why did it need to rethink its role?*

I think that it was because the nature of the problems that CSIRO's being asked to look at, like the Port Phillip Bay studies and - off the top of my head, that's what I can think of. In my case, the development of compounds for agriculture required working across the organisation. The second thing I thought was that it could - in the old days, the organisation could afford, if it needed to, for example, to have an NMR, nuclear magnetic resonance, facility in a number of divisions. But money was getting tight, the cost of equipment was getting much more expensive, so the organisation could only really afford to have a world - one world class chemistry Division.

If you wanted to do good chemistry connected to plant industry or tissue engineering or something, you couldn't build up that capability in Canberra and Sydney; you had to - we had it in Clayton so that we needed to work out ways where we could use that across the organisation, and I don't know that we've worked - the organisation's ever worked that out entirely satisfactorily. It's worked it out a bit by divisions in Canberra working closely with the ANU to use their chemical facilities, so that's probably a good use of national resources, but it does splinter the activity within the organisation.

That's what I thought that we needed, to rethink that a bit, and the notion that the - at the Executive Committee meetings, the Directors had an incentive to make sure that their institute got the resources, whereas for the benefit of the organisation, the resources probably needed to be shared across the organisation. How you resolve that, I don't know.

*We've got about ten minutes left, Garrett. Should we ask the LIPI question now?*

*I guess the only - the last one was - reflections of the Malcolm McIntosh era.*

I'll just tell you - you haven't got this on your list of questions, but it was during that time, the State Government of Victoria had had the scheme that eventuated in the Biomolecular Research Institute. The State Government decided that it would invest money in science in Victoria and it put money into various institutes. One of them was the BRI, the Biomolecular

Research Institute, where Peter Colman was both the Chief of the Division of Biomolecular Engineering and the Director of the BRI.

That worked all right until Peter decided that there was possibly a conflict of interest in the two roles and he should step down from being the Chief of the Division to become the full-time Director of the BRI. Then came - what process should we use to decide what was going to happen? Should we keep that Division as a separate Division or should we look at merging it?

I argued with Bob Frater, who was the Deputy Chief Executive in charge of us at that time, that both our Divisions were - especially Biomolecular Research, the Division of Biomolecular Engineering, but we were both relatively small compared to other Divisions. The task of getting external earnings, particularly in the Biomolecular Engineering Division, was becoming more difficult, especially as some of that group had gone off to the BRI.

We argued, Peter and I, that maybe we should combine the Divisions and form what then became the Division of Molecular Science. Bob agreed to that and we became the Division of Molecular Science. I was appointed the Chief of the Division of Molecular Science and we had a process for - quite a good process, I think, for merging the activities of the two areas, where our expertise - we were already working together on the CRCs, the biomedical - biomaterials-related CRCs, and we started to work together on development of new pharmaceuticals. Out of that came the spinoff company, Starpharma, which is still going today and producing dendrimers for drug delivery systems mainly.

That brings us up to the appointment of Malcolm McIntosh. Now, Malcolm McIntosh came into the organisation after we'd arranged the - after the reorganisation. The matrix system had been thought up and organised. I think that he was the Chief Executive when the change actually took place, but it had all been planned before he came. He was very supportive of that and he was very supportive of me, really. I had annual review meetings with him that always went very well.

At that time, I'd been the Chief since 1989 and I was getting to the stage in the late 90s where I was thinking to myself that it was probably time for me to try to do something else. I'd argued strongly over my time that you don't want to be the Chief for very - for a long time, so I needed to think of what I was going to do next.

The opportunity came for the project that was going on in Indonesia, which our Division was part of. The Division of Chemicals and Polymers had worked with the - Trevor Redhead and Roy Green's Environmental Projects Office proposal to do the Management System Strengthening project at LIPI, the Indonesian Institute of Science. I was familiar with that project and I was familiar with the fact that it wasn't going very well.

## Indonesia

There were some problems with the implementation of the project and it - I indicated to somebody that I wouldn't mind doing that, and then I think I was at a dinner. I think you were actually at the dinner, Garrett. I said to this - to someone at The Windsor Hotel, farewelling someone. I mentioned in passing that I wouldn't mind doing that. On Monday

morning when I got to work, I got a phone call from Malcolm McIntosh, saying, "Come up and see me. I hear you want to go to Indonesia." I did that and he persuaded me to go to Indonesia.

*How was that experience?*

Well, it was - I mean, I was then - this was in 1998. I was coming up for my 58<sup>th</sup> birthday. Our children had all left home, or at least they were independent, so Heather and I went up to Indonesia. It was an absolutely marvellous time. We enjoyed that. Given the restraints and - resource restraints and the nature of the Indonesian public service, I probably did a pretty good job.

I was very much helped by Gary Knoble and Bob and Jane who came up; Jane Crowther and Bob Marshall, who came up and helped us run leadership development programs. Gary Knoble did that. I had Tim Healy, was an extremely good contributor in helping develop strategic planning methodologies for LIPI, which I think they probably still use to some extent. I got people like Jack Steele to come up and look at - help with biomaterials. I had a whole lot of people who came up.

Peter Francis from Francis Abourizk Lightowlers made very good contributions in IP management for them. We had a big investment in IT development, which didn't work as well as it should've because of the - not particularly because of our fault, but because of the restraints of the Indonesian public service and the general lack of infrastructure in IT in Indonesia. But other than that, it was a very interesting time of my life, I think, and I was very grateful to the Organisation for sending me up there.

That was the time - I'd been to India on a visit when I - I was the President of the Federation of Asian Chemical Societies at one time. I'd been to India in that capacity. When I got there, the person in the CSIR who was helping run this meeting got my card and saw that I was Dr Tom Spurling, Chief of the Division of Chemicals and Polymers. He said - he realised that I - he thought that I was much more important than he'd thought before he'd seen my card, and he arranged for me to take a day off the FACS meeting to go to Pune to see the equivalent CSIR India chemistry set-up. It was there that I met Ramesh Mashelkar. Ramesh Mashelkar was the chief of that area of CSIR, and I gave him - I came prepared for some gifts so I gave him a commemorative \$10 banknote.

That was in 1990 - 1989 to 1991 that that event occurred. Fast forward to 1999. I come to LIPI and I get told two or three weeks after I got there that the World Bank Group was coming, and they were almost certainly coming to close down the project, which was a bit of a surprise to me because I'd only been there for a short time. Anyway, I learnt that the World Bank person who was coming - I don't think I did learn it until he actually came. The leader of the World Bank Group who was evaluating our project was none other than Ramesh Mashelkar, so we came to - I prepared for what I - I said what we were going to. We'd learnt our lesson so CSIRO was now going to do this or that. As soon as Ramesh Mashelkar realised that he knew me, that I was the one who'd given him the \$10 banknote, everything was okay.

*The banknote project succeeded yet again -*

I've remained quite friendly with Ramesh Mashelkar ever since. He's now a Professor at Swinburne - an Honorary Professor at Swinburne University.

*It's now 3:42 and we're terminating this section of Tom Spurling's interview.*

*Well done Tom.*

*Thank you. This is the 8th August, 2017. This is a recording for the CSIRO history project: Dr Tom Spurling. And this is part two of his oral history recording. Present in the room are Tom Spurling, Garrett Upstill and Terry Healy. And the last time we interviewed Tom, in April, we finished up with Tom being at LIPI in Indonesia, and Garrett had - will start off today's session with some follow-up questions in relation to LIPI. You don't need that.*

*Thanks Terry. Tom, looking back at that time, what do you see as the significant outcomes of the LIPI project?*

The LIPI project was called management systems and strengthening, and really it had three quite separate but interrelated components. One was developing the IT system within LIPI. The second one was developing ways of planning and prioritising research projects. And the third one was leadership development, so how did the organisation prepare its leaders. The IT one was only partially successful, because the organisation itself really didn't have the resources to develop a modern IT system. So it was constrained by the lack of infrastructure within the country. So in order to connect up all the various sites of LIPI, you really needed a much better network, like Australia has AARNet.

When CSIRO started developing its internal IT connections and so on, it had AARNet to rely on. But LIPI had nothing like that. And it was also constrained by the rules of the Indonesian public service, which meant that it couldn't really develop its own accounting systems and so on. So we were some help in that, but probably not as much as we'd hoped. Prioritising research, I think, was reasonably successful. So we developed systems like the CSIRO national research priorities exercise. We got them to find out who their customers were, and to do research that was going to benefit the Indonesian economy. So I think that was quite a useful part of the project. And we persuaded them to have a centre for innovation. And the centre for innovation is still going, and that's a sort of like Sirotec - in some ways like Sirotec was.

But helping the other parts of the organisation develop their commercial - commercialising their research and prioritising the research. So I think that was probably as successful as it could be, given the financial constraints of the organisation, and the various constraints that Indonesia has in its industrial development. So, for example, when we asked Toyota - we had a lot of discussions with Toyota Manufacturing Operations Indonesia about what influence they would like to have on the Indonesian National Standards Laboratory equivalent. And they said they had no interest in that whatsoever because they simply used the Japanese system.

And the third aspect of the project was leadership development, and that was where Bob Marshall and Jane Lowther and Gary Knoble were very good really. And they developed a system of leadership development. And we had a number of intakes into that. And the

people who went through that program typically have become leaders in LIPI. So I think that was a successful venture. So I think that given the constraints of the Indonesian public service, and the constraints the organisation has in lack of actual resources, I think the project probably did all right. Of the projects that World Bank had - I think there were five projects that they funded - we were the only one that lasted the distance.

*Well done.*

So I think we probably did all right. And, as I mentioned last time, we nearly didn't last the distance because they were unhappy with the way that CSIRO was dealing with them. One thing that might be of interest is that - or two things that taught me something there. One was that when I got there, I'd been - as you know, I'd spent a lot of the time working with DuPont both in their automotive coatings division and their crop protection chemicals division. And so I rang up my friend Russ Bellina in DuPont and said I was there. "Indonesia is the world's most biodiverse country. Don't you think DuPont might have some interest in working with us to see if there are any natural products that might have biological activity for various either medicinal, pharmaceutical work or crop protection chemicals?" And he said he'd come back to me.

And a couple of days later, he sent an email. So his people had looked up the world of - science citation databases, couldn't find LIPI. If they weren't there, DuPont weren't interested in working with them. So that told me that excellent science is an essential part of a publically funded research organisation working with large multinational companies. The second thing was the people in CSIRO in the Boeing project said Boeing had asked, "How can we get stuff in - We know that Indonesia's got some aircraft industry in Bandung. How do we get information there?" And I made some inquiries about bandwidth from Jakarta and Bandung, and they couldn't. There was no capability of getting data from Australia or Seattle to Jakarta to Bandung. So infrastructure plays a very important part in international science.

*I might just go on to the other one, given we're going to talk about your time subsequent to CSIRO. Could you just perhaps talk about your involvement with CSIRO following your return from Indonesia, and before leaving to take up a position of professor of science, engineering, innovation at Swinburne in 2003?*

## **Return to CSIRO**

So when I got back from Jakarta, I didn't quite know what I was going to do. When I had left, Malcolm McIntosh had assured me that there'd be some job for me on my return. But by the time I returned, he had already died, and Geoff Garrett was the Chief Executive. And Geoff Garrett had his own people, and he didn't want me. So he suggested that I could find some other job somewhere, or I could stay in CSIRO and do whatever I wanted in research. So Annabelle Duncan was the Chief of the Division of Chemicals and Polymers - sorry, of the dDivision of Molecular Science. And she said that I could come back and be a scientist at CSIRO, and I got the title Principal Advisor at CSIRO Molecular Science.

In some ways, it was a sinecure. I didn't like it very much. I actually did quite a bit of work with Graeme Moad on polymerization kinetics at that time. But I must say that I did have

some trouble getting back to doing mathematics at the level that I was doing before I went to Indonesia. So in that time, Geoff Garrett had the science forum, I think it was called, and I became a member of that. And I did some work for Geoff Garrett in developing people's applications for the centenary fellowship program. So around that time, the government had these fellowships, and CSIRO people were eligible to apply. And I did some work in that, and I think that the organisation did quite well in those. And I also did some work with Andrew Pik and Linda Butler at ANU on looking at citation analysis of CSIRO.

But it was at that time that Kerry Pratt was at the Deputy - or I think he was the Pro Vice-Chancellor Research and Development at Swinburne. And the Director of IRIS, the Industrial Research Institute Swinburne, had left the organisation under a cloud, and the Vice-Chancellor, through presumably from Kerry's influence, rang me up and said would I like to come and spend some time as the Director of IRIS. It was a three-month appointment to see what we could do, while they found another Director. So we had an arrangement then with Swinburne from July of 2002 where I was seconded to Swinburne. So Swinburne paid CSIRO my salary and so on for me to come here.

After a while, I worked out that it would be better for everybody if I left CSIRO and came here. And so I resigned from CSIRO after my birthday, which is 24 December. I think I resigned from CSIRO in January of 2003, and I became the Director of the Industrial Research Institute of Swinburne, and Professor of Molecular Science here. And that was very good for me because I was able to use any experience I had at managing research in this new institute.

*Tom, Terry here. Before you get too far into Swinburne, because we actually want to spend a little bit of time at Swinburne, that period when you came back from LIPI and worked in CSIRO as Principal Advisor, you interacted with Annabelle, and you also interacted with Geoff Garrett. We're interested in your impressions of Geoff Garrett, and his role as Chief Executive of CSIRO, and what were the implications of that for CSIRO in its long-term future. Have you got anything that you would like to say about those interactions with Geoff Garrett and your experience of him?*

Geoff Garrett was a very active person. So my interactions with him - after the initial interview, where he said that he didn't want me to be in a senior executive position in the organisation, I didn't actually have much to do with him as a manager. I had quite a bit to do with him in this science forum, and in the activities relating to the fellowship. So he was very keen for me to take some part in that. So I was supported by him in that. So my initial reaction to him was that he was too intense for me to - he was a very intense character. But I got on quite well with him in that limited role.

*And his vision? His vision for this science forum, did you understand it and support it?*

Yeah, I think that he wanted the organisation to excel in science, and I think that the way that the organisation had to - the way that he had the chiefs onshore to term appointments and the way that he had to get a lot of extra money in meant that there was some conflicts between his desire to have maintained excellent science and his need to get money in. I think that my impression was that he wasn't as interested in relations with companies as I thought that he should be. So I think that that was the time when the organisation - because

the economy itself was booming, the organisation got a lot of money from the Commonwealth Government to do various contracts: the Murray-Darling Basin contract; the work on climate change.

And there was a whole range of contracts that the organisation got from the government, meant that it could maintain its external earnings without the need to interact with companies as much as it had to do in the 1990s. And so I think the organisation lost a bit of its -

*Engagement with industry.*

- engagement of industry during that period. I think the evidence shows that during that period, it did maintain quite a good scientific reputation. And so his interest in good science, I think, meant that the organisation did maintain its scientific credibility.

*Any final comments on CSIRO before you come back as a Board Member?*

Well, I think I've mentioned this in a couple of articles that I've written about CSIRO. I had two experiences of leaving the Organisation and coming back. The first one was when I went into Gareth Evan's office and came back, and the second was when I went to Indonesia. I didn't actually leave CSIRO but I left my position and came back. I don't think that the Organisation does that terribly well. But you could argue that somebody like me, a senior person in the Organisation, ought to be able to find my own way back. But in neither case did I find that a very congenial experience. So if the Organisation wants people to have experience outside, like being seconded to companies or something, it really needs to do better in taking them back; otherwise there'll be no incentive for people to go.

## **Swinburne University of Technology**

*So this is not really about Swinburne, but it's been a very important part of your life. So could you reflect on your roles at Swinburne which are still current, and the implications of that, particularly for CSIRO? In other words, there's always a tension between the priorities for universities and CSIRO's priorities. And have you witnessed any of that in practice while you're here?*

So Swinburne as the Director of IRIS. IRIS at that time was an independent - well, it was a research institute, and the Director reported directly to the Vice-Chancellor. It got its money from external contracts, ARC grants and industry grants, CRCs and that sort of external money and company money, and conducting some courses. When I got there, it had a debt of \$2 million or something, and it had no way, really, of repaying that debt. It had no way of repaying that debt because research typically costs universities. Universities tend to not get money for the principal investigators. So the salaries of the principal investigators tend to have to be paid by the university. So the money that comes into the university typically doesn't cover the cost of research.

And, secondly, IRIS was getting some of its money from providing masters courses in engineering and so on. But it didn't make enough money from that to do it. To some extent, 9/11 saved the IRIS a bit because Indian students stopped going to America, and came to

Australia. And IRIS got a big boost in its enrolment of Indian students during that time. But that didn't last long enough. So with a number of other people in the university, particularly Dale Murphy, who was the Deputy Vice-Chancellor. A few of us worked out that it would be better if these research institutes were much more closely integrated with the teaching part of the university.

It seemed to me not to be a sustainable model for the university to take money from the teaching activities and give it to research activities without any sort of interaction between the two. So I was the Director of IRIS from 2003 to 2004. But in 2004, the University reorganised from its schools and research institutes into faculties, and the research institutes were brought into the faculties.

*And can I just check with you? There's a lot of pressure in Australia and elsewhere for universities to, in effect, gain enough money from industry to sustain themselves. In other words, the conduct of research contracts should, if anything, be subsidising teaching as opposed to the other way around. Is IRIS something which sheds any light on how possible that is?*

IRIS never by itself raised enough money from research to cover its costs.

*And is that something which is an ongoing problem for universities trying to do that?*

I'm not an expert in university finances. But my understanding is that the university relies for its major source of income from teaching.

*Yes, and the government subsidy that comes with that.*

Yes, and research tends to cost the university money or, at best, breaks even.

*And this is an even more speculative question: is the university any better at getting research money out of industry than CSIRO might be?*

Well, IRIS was quite good at getting industry contracts. A lot of its contracts came directly from companies. Some came from CRCs and some from ARC linkage grants. But Swinburne had a good reputation with companies, especially companies in that time in the metal manufacturing industry. So Swinburne had a good reputation. Is it better than CSIRO? Probably not, because in CSIRO you could - the CSIRO divisions could put senior researchers full-time or nearly full-time on an industry contract; whereas universities typically had to do this by having students or people who weren't working full-time on the project because they had other duties.

*But IRIS was not an example of full-time researchers?*

Well, they were full-time researchers except for having to conduct the courses that we did - had to do, the masters courses to raise the money. So they weren't full-time researchers. Some of them were, but a lot of the people in IRIS weren't. They were doing some teaching.

*Thank you.*

So the university was very organised and into faculties. And I became the Dean of the Faculty of Engineering and Industrial Sciences. Once again, my understanding was that I was the Dean until the university could readvertise. My job was to get the faculty established, and the university would get a more permanent person to be the Dean. So I stayed as the Dean for 18 months or something, and then retired from that position. And then the Vice-Chancellor at the time was Ian Young, and he said to me that he was very happy for me to stay on in the university to do whatever I wanted to do, and for me to look around and see who I wanted to work with. So it was then that I looked around, and I thought that it was a good idea for me to become interested in this innovation study. And so I talked with Michael Gilding, who was the director of the Centre for -

*[inaudible]*

He was a Professor in the Faculty of Life and Social Sciences. But he had his own centre, which name I've forgotten, but I can remember it: the Centre for the Study of the Social Impacts of Science. And so I started working with Michael Gilding after I stopped being the Dean of Engineering, on a half a day a week. Then I got a job as the Chief Executive of the CRC for Wood Innovations, and I stayed in that job until its end in 2008. And then I came back to the Faculty as part of Michael's centre. And then the university reorganised in 2013, and I became the - or 2014 I think. Michael became the Executive Dean of the Faculty of Business, and then Faculty of Business and Enterprise, and then the Faculty of Business and Law. And I went over with Michael into that Faculty.

In 2014, he persuaded me to become the Director of the Centre for Transformative Innovation, and I did that until we appointed Beth Webster as the Director, and I'm now still in the Centre for Transformative Innovation in the Faculty of Business and Law.

*And just summarising your experience at Swinburne, it's been a happy one for you?*

It's been a very happy experience for me. Swinburne's been very kind to me, really. It's allowed me to learn about innovation. It was during that time that I wrote the book *The Plastic Banknote* with Dave Solomon. And Swinburne supported me during that period of time. So it has been a very good period of my career.

## **The ACOLA projects**

*And did that lead to your role in helping out the ACOLA report on the role of science, research and technology in lifting Australian productivity?*

Yeah, I think the answer to that is yes that my experience in this University has helped me in the work with ACOLA. This was the ARC project securing Australia's future, and I was on two working groups. The role of science, research and technology in lifting Australia's productivity is number four in that series. And I was also in number nine, which was looking at the role of international - an international comparison of what other countries do for supporting science and innovation. I was appointed to those committees because I was a fellow of the Australian Academy of Technological Science and Engineering; not particularly because I was at Swinburne.

*But while we're mentioning it, what's the significance of these ACOLA reports? With the wisdom of hindsight, not that - they're still pretty recent, but -*

I think that they were reports commissioned essentially by Ian Chubb when he was the Chief Scientist. And so they went to the Office of the Chief Scientist, and then to the Prime Minister's Science Council, and then the successor to that, which is the Science Council. I think that some of the recommendations have been adopted. Some of them haven't. So like all advice that people - these are documents that are giving advice to the government. And governments typically take some advice and don't take others. So I think that it was a worthwhile - I think the whole securing Australia's future projects has been worthwhile. I think there are 13 or 14 of these studies. I think enough of the recommendations have been taken up for it to be worthwhile.

*Judged a success.*

And it's an ongoing - it'll be an ongoing process of looking at other activities.

*Well, I'm going to tempt you here. Looking at the spectrum of advices that government has been given over the last decade or two, would this be up there as amongst the most important?*

I think it would be up there as pretty important advice. I think the advice the government was given, the ASTEC reports that set up the change in CSIRO in the 1980s were very important reports. But these, I think, were up there with that. These are not reports about structural change; they're more reports about policy changes. But I think they would be up there with them.

*And so comparing the Productivity Commission and its reports with this sort of report -*

I think the Gary Banks Productivity Report in the 19 -  
'99.

- '99 I think was a very, very fine report. But I don't think any of its - very little of its recommendations were taken into account because it occurred at the time of a change of government. So I don't think that that report was very influential. I think it was a very good report.

*And did that inform this series of reports?*

It certainly informed that series of - it informed my input into that series. I mean the main recommendation of this report is that science and innovation policies in successful countries have a longevity that isn't the case in Australian public policy.

*We're going to move now on to CSIRO board. Anything else that you want to talk about from Swinburne or -*

## **Federation of Asian Chemical Societies**

FASTS?

Beg your pardon?

*So there was the other club - you were also -*

Okay. So -

*- Secretary of FASTS, weren't you?*

Yes. So I can't remember exactly how much we talked about this in the first interview, but I have spent a lot of my spare time in professional societies. So I think that we mentioned that I was the President of the Royal Australian Chemical Institute. And while I was the Chief of the Division of Chemicals and Polymers, I was the President of the Federation of Asian Chemical Societies. And I have maintained this interest in scientific affairs in the Asia-Pacific region throughout my time. So I was the President of the Federation of Asian Chemical Societies from 1989 to 1991. And that was quite a useful thing for me to have done that when I went to Indonesia, because I was known to the chemists in Indonesia from that period as a successful chemist in my own right, and as also somebody who has been involved in that region.

So I'd met the Chairman of LIPI in my capacity as the President of the Federation of Asian Chemical Societies. So when I got back from Indonesia, I maintained an interest in the Chemical Institute and the Federation. And at that time, the RACI in - I think it was in 2006, I became the Federation of Asian Chemical Societies. So when I came back from Indonesia, Greg Simpson, who was the Deputy Chief of the Division, he was becoming the President of the Royal Australian Chemical Institute. And it became clear that there was going - that it was possibly a chemist turned to be the President of the Federation of Asian Chemical Societies. So I agreed to become a candidate for that, and I won the election to become the President-elect of the Federation, and that was in 2004.

## **Federation of Australian Science and Technological Societies**

So in 2004-5, I was the President-elect. And then 2006 and '07 I was the President of the Federation of Australian Scientific and Technological Societies. And that was an interesting time for me because that was the time of the - in some ways the decline of the Howard government, and the rise of Kevin Rudd, and the election of the Rudd government. So the FASTS had quite a lot of discussions with the government and the opposition about what should be the future of Australian science policy. And in addition to that, as the President of the FASTS, I had a position on the Prime Minister's Science Council, and that itself was quite an interesting experience for me because John Howard, as the Prime Minister, took a very active interest in science and technology.

And I think while Jim Peacock was the Chief Scientist, and John Howard was the Prime Minister, I think that was a very productive period for the Prime Minister's Science Council because I think Jim had a good relationship with the Prime Minister, and also with the various Ministers for science that he had to deal with, Brendan Nelson, Julie Bishop, and particularly with the Minister of the Environment at the time, who was Malcolm Turnbull.

And John Howard himself, he was a very curious person. So he wanted to understand things.

*Including climate science at that time.*

Including climate science at that time.

*And he changed his mind, I think, as a result of science advice.*

Well, we believe that the presentations that were made on water - first of all on climate science and then on the effect of the change in climate on water supply in Australia, I think that that had a great influence on John Howard -

*The presentations at the -*

- at the Prime Minister's Science Council. And I was on that because I was the President of FASTS.

Yes, it's still, even to this day, a very important issue in Australia.

Yes.

*And it's one where the science is actually, if you like, not sort of black and white. It's got to be accumulated over time in its predictions, and all sorts of difficult stuff.*

Yes.

*But, yet, it's crucially important.*

Yes, if you've got - I'm happy to talk a few more minutes about this because I think it's an interesting idea - interesting how governments get advice on science. So the way that the Prime Minister's Science Council was structured during that period, I think from its beginnings under the Hawke government, but particularly developed during the Howard government, and it was that the Prime Minister's Science Council had officials at it, so the secretaries of relevant departments and the chief executive of the agencies and so on. So the Chief Executive of CSIRO was an ex officio member of it. It had some people who were appointed - so Fiona Stanley I believe was on it as a distinguished scientific contributor - and it had other people who were there by virtue of their role.

So the President of the Academy of Science, the President of the Academy of Technological Science and Engineering, and the President of the Federation of Australian Scientific and Technological Society were members of the Prime Minister's Science Council by virtue of their position. The Rudd government changed the arrangement over time so that the Prime Minister's Science Council became not a representative body so much as an appointed body. So the government appointed people to be on this council, and the incoming Abbot government maintained that. So the top advisory body is a nominated body. So people are on that by virtue of their personal position as leading scientists or leading people in industrial science or something or other.

So which is the better model? In my opinion, the former model is better because (a) a person who is there like I was or like the President of the Academy, if the government wanted to know something, the President of the FASTS or the President of either academy could easily, through their own organisation and networks, assemble groups who could get that advice quickly. And the way that Jim Peacock operated as the Chief Scientist was if we wanted to know about water, for example, have a presentation of water, then we very quickly could assemble a whole lot of independent people who could quickly develop a paper about this issue.

And I think that worked very well because scientists, if we were - I've done this myself. So I was the chairman of this working group. You ring up people and say, "We'd like you to help us develop this paper for the Prime Minister." Everybody - all scientists in Australia says, "Oh, yeah, I'll do that" because it's -

*Prestigious.*

- a good opportunity to influence. Whereas people who are there by their personal positions can't - they can do that -

*Can't command that resource.*

But they don't have as easily access to resources as the other people did. And the way that those bodies operate has to be a bit different to the way that a representative body operates. So I thought the model that existed in the '90s and the early 2000s was a better model.

*Good.*

And see this SAF - the Securing Australia's Future - was a way of trying to overcome that. So the government gave money to the ARC to develop these papers. I think they gave \$10 million to the ARC to develop that, whereas the previous one cost the government almost nothing; just travel expenses.

*Sorry, just a couple of questions. The way that the Howard style PMSEIC was structured -*

And the Hawke - Hawke-Howard.

*: - yes - had the risk of turning into a Tower of Babel with a lot of people around the table with different backgrounds and different views. Did that happen?*

There are two parts to your question. One was there are a lot of people - one was: was it a Tower of Babel? The other one was there a lot of people round the table with different views? There were certainly a lot of people around the table with different views. A good chairman like Jim Peacock managed that very well. So there was no - I didn't get the impression that this was a disadvantage, having so many people round the table with different views. Other people thought that it was a problem. But I personally found that you - typically what you're talking about at that level are complicated issues, and you do need to have a range of people with different views so that you get all of the aspects of it. And we

had some very economists on that meeting who were able to put in ideas that the scientists probably didn't have.

*And the role of CSIRO, having been back in the '40s the principal advisor to government on matters scientific, sort of gradually shrinks back into a minor role. Have you got any comments about that in the context of the history of [PMSEIC] and other advisory mechanisms to government?*

So CSIRO was at the table at [PMSEIC] but also the head of the ARC, and the head of NH and MRC. So all the major government bodies that had government funding were represented around the table. CSIRO - once the organisation had a smaller percentage of the government funding, the other agencies and universities and so on who were increasing their proportion of government funding did need to have some say in the direction of it. So I'm not sure that I can add anything to your question just except to say that when CSIRO was the major recipient of government funding in science, it was the major voice. When it wasn't the major recipient, it wasn't the major voice.

*And just a follow-up question: the representatives of CSIRO on [PMSEIC], how effective were they? Were they listened to as sort of a very important voice, or just one of a number?*

Well, I think they were listened to as important voices. In the meetings that I had, both when the ministers were there and when only the officials were there, I don't think that any particular voice was thought to be more important. I think it was a meeting. My recollection of these meetings was that it was a meeting where the meeting was aimed at resolving issues, rather than -

*Exerting influence.*

- exerting people's influence. And, you see, Jim Peacock was the Chief Scientist. He was a CSIRO -

*Man through and through*

- person. But a very good chairman.

*And who did you observe from CSIRO in that context.*

Well, Geoff Garrett was the CSIRO Chief Executive

*And was he across the issues?*

Yeah.

## **CSIRO Board**

Now, I think if it's all right with you, we'll move on to your period as a board member of CSIRO. Would you like to - excuse me just a moment. We're going to pause?

*We've got about three or four minutes left on this - on the recording.*

*Can you pause it, please? So are we still on? Yes, we are, looks like.*

*Sorry about that.*

*So Board meetings? Sorry, first of all, Board appointment. So how did you come to be a member of the Board of CSIRO?*

Well, during my time as the President of FASTS, I got to know Kim Carr pretty well. So he knew of my interest in CSIRO, and I think that he'd read various - whether Kim Carr himself had read it, but that various people had read the papers that Garrett Upstill and I had written about CSIRO. So we'd written those papers about the role of the organisation and a bit of the history of the organisation. And so I think that Kim Carr thought that I would be quite a good Board member of CSIRO because I came to it with some knowledge of the organisation. So knowledge of some of the policy issues, and probably, to some extent, my background as a member of the Victorian branch of the ALP.

So he rang me up pretty quickly after the government was elected, and said that he wanted to appoint me to the Board of CSIRO. And I said that I would do that. And it took a few months for that process to go through. So I think I got on to the Board in May of 2008. And I think the interesting thing was ministers, when they first become ministers, don't consult the organisation about board appointments as much as they should. So I think that my appointment to the board wasn't one that was discussed between the Minister and the Chairman. And so John Stocker was a bit surprised when he was rung up to say that I'd been appointed to the Board. But I think he was quite happy after he got over his initial surprise. Anyway. So that's how I got on to the Board.

*And then your experience on the Board?*

I think that I was - I don't know this but I was probably the first person to come on to the Board who had spent a career in the organisation as a scientist.

*Other than the Chief Executive, yes.*

Other than the Chief Executive. So John Stocker was obviously on the Board. He'd been the Chief Executive. But I don't think he'd had the long experiences of being a scientist in the Organisation as I had had.

*No. So Boardman was the only one.*

Yes.

*Sorry. Your story.*

Well, Boardman was on the board as the Chief Executive. I was on the board as a part-time director. So a slightly different role to being the Chief Executive. Anyway, so I came on the board and I - well, with John Stocker, the both of us had come back on the board after being out for a while. But I think that John and I had some discussions about this, and there were two observations that we made: that, to some extent, there'd been a huge amount of change but, on the other hand, everything seemed to be much the same as it was before. So

while the organisation had changed, when you went down into the laboratories and talked to people, many of the same issues were around as were when we were back in the '90s as John was the Chief Executive, I was the Chief, and, in the early days, when I was a scientist. So that was an interesting observation that things change but they stay the same.

*Yes, things changing including, for example, the structure at the top.*

Yes. But the science keeps going on.

*But reality at the bottom is that -*

Yes.

*It's dictated largely by the profession experience and priorities of people, particularly if they have to publish.*

Yes. So the issue that I saw, and I think that I possibly failed in making it change in this, was the issue that I spoke to you about earlier when I was talking about the changes when I came back from Indonesia. The organisation, it seemed to me, had become far too dependent on the Commonwealth for its external earnings. So it had become a one-customer organisation, to some extent. It had let the interaction with the private sector decline, rather than build up. So in the end of the 1990s, I think the organisation's links with the private sector were building up. But they stopped during that period in the 2000s. And the organisation had a lot of money from the Commonwealth.

And the problem with that was that when the Commonwealth started not having money - so at the time of the budgetary problems brought about by the Global Financial Crisis - the organisation lost a lot of its money from the Commonwealth, and had to struggle again to get links with other sources of external earnings. The second thing that I noticed was the following. In my experience as the Chief of the Division of Chemicals and Polymers, and then Molecular Science, was the way to do top science and have good impact in applications and industrial impact was to plan research that you had some path to impact or path to commercialisation.

So not to think of the work in CSIRO as being divided into two - one, your CSIRO research and, number two, commercial research - but have your research priorities in divisions aligned to what the customers of that research might want. And you found that out by talking to them. And how to do that is, of course, quite complicated because you have to do it in a way that doesn't compromise the excellence of the research that you're doing. But you have to have some compromise about - in some areas, you've got to do research that might have more immediate application. And the second complication that it did require the use of appropriation funds on research that was going to be useful to industry.

The model that had been built up in the 2000s was that any work that was done with companies had to be fully funded by the company in some way. And the way that you got research that was relevant to industry was quite contrary to the notion that any work that you're doing with industry had to be fully funded by them because you had to then, in some

way, separate these two parts of the organisation's work. And I think that, in the end, it was not good for the organisation.

*And would you attribute that to any particular individuals?*

Well, I don't know how it built up but it clearly built up during Geoff Garrett's term as the Chief Executive. And it may have come about because of litigation and some - I don't know - some notion that the organisation took a risk by doing what I was advocating. So the organisation became a bit risk-averse about having agreements with companies.

And Mike Whelan? Did you think he had a role in that?

Well, Mike Whelan - he was very influential in protecting the Organisation from risk. So that was his role, and he did it very well. So I think that was my impression. And I think that the Chief Executive of CSIRO has two strong roles: one is to keep very good contact with the government, but the other role was to keep good contacts with the leaders of industry or encourage his next level to do that. And I think that the organisation in the 2000s got - the easy money from the government meant that that second one declined a bit. So one of the tasks of the board is to appoint the Chief Executive. And during my time on the board, I was actually involved in the appointment of two chief executives.

So when I got on to the board in 2008, Geoff Garrett's term was coming to an end, and we were in the middle of the process of appointing a new one. So that was the appointment of Megan Clark. And Megan Clark had the - one of her tasks was to rebuild the links with industry. And I think she did that pretty well.

*Any comments on Geoff Garrett, as you only saw the end of his term, to how well he did the job of Chief Executive?*

Well, I think he did the job of connection to government very well but he did that, I think, at the expense of connection to industry.

*Well, a general question, Tom: joining in the board - when was it? - in 2000 and -*

Eight.

*- eight. Was there a feeling the organisation was on track or off track? What were seen as the challenges at that time?*

I think the Board saw as its main challenge at that time reconnecting the organisation to the private sector. So I think that the Board - John Stocker and Eileen Doyle and Terry Cutler and Doug Rathbone and I - I think we all were very keen to get the commercial reality of the organisation much better understood so that connecting to the private sector was a big issue for the Board.

*So how would you measure that in terms of the earnings, in terms of the achievements or in terms of the kind of the informal recognition through the existing links to industry?*

All of those things. So getting more of the external earnings from the private sector is a measure of that. But getting recognition by the private sector of the value of CSIRO, and getting various impact of the organisation's research recognised by the private sector. I think the other issue that the board had was the internal management of CSIRO from the Geoff Garrett era was the matrix system. So the flagships and the divisions, and the way that the various parts of the organisation were interacting with one another, and the complications that that meant for the life of an individual. And that was where my knowledge of the organisation probably helped me a bit because I could talk to people in various divisions about their activities.

So a scientist that I knew very well explained to me how his time was allocated. And because the Division of Molecular Science had to get its money from the flagships, he, as a senior scientist, his time was divided into about five or six projects in two or three flagships. And that meant that he didn't have much real time to concentrate on a particular project because his time was divided so much. And the other consequence of that was that when the crunch came, a project in a flagship could afford a certain number of people. And so a Chief Research Scientist was often too expensive for the flagship to employ. So you didn't necessarily have the best people in the organisation working on the project.

The composition of the project depended too much on the availability of funds from the flagship. And that didn't seem to be a very productive way of running the organisation. And the board, in a sense, urged Megan to change that. But Megan was very cautious in restructuring the organisation. So I think that a Chief Executive comes in probably needs to be careful in changing things too quickly. But I think that Megan probably was a bit slow in changing things, but did towards the end; had the restructure that is now what the organisation is doing, where the management of the external earnings and - you know, the flagship sort of interaction with the outside world and the science is now consolidated once again in the business units.

*And, Tom, there's been many discussions about the role of chiefs in CSIRO; chiefs in the traditional sense. Was there any discussion at Board level about the importance of Chiefs, and how to get them appointed? Or was that sort of pushed down to management and invisible to -*

Well, I think that when Megan became the Chief Executive, she had the Chiefs appointed for a sensible term. So she reversed the three-year -

*And the actual selection of chiefs?*

The actual selection of Chiefs wasn't the board's role, and I don't think it ever was. So the Board didn't have any say in the selection of Chiefs. The Board probably didn't have enough say in the selection of the next level: the Directors. I think the Board didn't have much say in that.

*Despite the directions - you remember the directions that were given by the board to the Chief Executive?*

Yes, anyway. So I think the Board had quite - during John Stocker's term as the Chairman, he introduced the notion that the Board should get to know the scientists better. So we had quite good interaction with divisions on a sort of regular basis when we went around to different sites to have board meetings and talk to scientists. When Simon McKeon became the Chairman, he continued that and was very keen on visiting sites and for the board to get to know the internal activities of the organisation better. I think that when I came on the Board, Eileen Doyle was on the Board and John Stocker was on the board, I think that we were surprised that the board had little knowledge or interaction with occupational health and safety.

So the organisation's occupational health and safety record wasn't good at the time. And when Megan became the Chief Executive, she'd come from the mining industry, and had clearly a much greater interest in this. And I think that she was quite surprised that, at the Board level, we didn't have much good information of that. And I think she transformed the organisation's approach to that, and one of her legacies was that the organisation is a much safer place to work than it was when she started.

*So any other reflections, for example, on the role or - sorry - the performance of the Board in relation to CSIRO versus government? How did Board members, and particularly the Chairman, relate to ministers and departmental officials?*

I think the relationship of the Board to the Minister depends a bit on the Minister as well as the Board. So we had quite a lot of interaction with Kim Carr when he was the Minister. He would come to Board meetings, and I think he interacted with us from the point of view that he had a good idea what he wanted the organisation to do. He was very keen on - he'd say that you have to remember what the I in CSIRO stood for. So he was quite interested in the activities of the Board. He was also quite a strong advocate of science excellence, and was interested in the performance of the science excellence report. The next minister we had for a while was Chris Evans, and I think we had very good interaction with Chris Evans.

He wasn't the minister for very long. But he came to a couple of Board meetings, and took the opposite view to Kim Carr. So he would come and say, "I know nothing. I'm here to learn." And he was very interested in it, and had an encyclopaedic knowledge of Australian industry; had been an employment minister. So he had good insights into what companies might need from the organisation. And I think if he'd stayed on as the minister, would've had a good influence on the organisation. We then had a couple of - there was a turmoil in the Rudd-Gillard government, you remember. So we had Chris Bowen as the minister for a short time, and then Craig Emerson.

But neither of those ministers were there long enough to have great influence. And then when the Abbot government came into power, the Minister was Ian McPherson - Ian Macfarlane, sorry - Ian Macfarlane. And he knew a lot about CSIRO from his time as a minister in the Howard government. And he also came to talk to us, and was keen to support the organisation. I left pretty soon after that.

*And the role of the Chairman?*

Well, I think during the time of the Rudd - towards the end of the Rudd-Gillard years, the shadow minister for science in the Abbott opposition was Sophie Mirabella. And the Chief Executive and the Opposition Spokesman didn't get on at all well. And I think that this coloured the organisation's links with the opposition. So in my experience as the Chief when Peter McGauran, for example, was the opposition spokesman, the government of the day was quite happy for the Opposition Spokesman to visit the site. And the government and opposition facilitated each other's knowledge of the organisation. And I think that took place over a number of years, and a number of governments and oppositions.

So in the time of the Abbott opposition, Sophie Mirabella made really no attempt to find out about the organisation, in fact was hostile to the organisation. And I think that that coloured the way that the organisation prepared for the change of government, and also linked with the new government, and also the bureaucracy. Because there was a lot of tension around about that period. So I think that affected the way that the Chairman interacted with the government. Also the government itself was - during Simon's time as the Chairman, we had about five or six ministers. So a very interesting period.

*Yes. We're wondering whether we've exhausted this topic.*

Well, I think we probably have.

## **Science Industry Endowment Fund**

*Is there anything you want to mention that you think we haven't dealt with across the whole lot?*

Well, let me just say that during the time that I was a member of the board, as you know was a time when the organisation was involved in the WiFi litigation. And so some of the Board's time was taken up in that getting advice from Terry Healy and others about what we should do. So that was a tremendous learning for me because I'd never been involved in such high stakes litigation in my life. And so I think the Board had to deal with a lot of issues in there, and probably did that pretty well. And I think that the setting up - I think the decision to donate money to SIEF was an important part of the Board's activity at the time.

When the Board agreed to donate \$150 million of the proceeds of the WiFi litigation to the Science Industry Endowment Fund. And I was very happy to become part of the SIEF Advisory Board, and then spent quite a bit of my time as the Chairman of the Expert Panel that was given the task by the trustee to advise her and then him on the way that the trustee should distribute the money to research projects and infrastructure. And I think that we probably did a pretty good job in that. Some of the projects we funded have been highly successful. Some may be successful in the future. I don't think we've funded anything that's been a failure. I think our infrastructure funding of the centre in Perth - the resource centre in Perth - has been a great success in bringing together CSIRO and the universities in Perth in a very much a combined activity about servicing the resource industry in that state, and in Australia.

And the building up of the biological industries - biomaterials - not biomaterials industry so much as bio-devices industry in the Clayton precinct has also been a good investment in

linking CSIRO Monash and Monash Hospital activities - Monash research activities in equipping - increasing the ability of those research groups to devise instruments and devices that people need. And also get them tested before going into the next commercial phase has been - I think that was a very good SIEF investment. And the investment in building up links between the ANU and CSIRO in the planned industry in Canberra is also a good investment of this SIEF money.

And I think the third aspect of that SIEF funds, the smallest aspect was in the promotion of science, which was done basically through giving the John Stocker Fellowships and other funding of post-doctoral research activities, I think that also has turned out to be a very good investment in science industry collaboration.

*And do you see the SIEF exercise as complementary to CSIRO?*

I think the SIEF exercise has helped to build up good links between CSIRO and other parts of the innovation system. So many of the projects involved CSIRO, a university and some company interactions. So I think that's been complementary to the organisation. It's also built up equipment. So Australian investment in scientific equipment may not have kept up with some other countries' investment. And SIEF has helped do that. A good question is whether the organisation should invest more in philanthropic donation. Should SIEF continue as a vehicle for philanthropic donations to scientific research? When the Prime Minister of the day set up SIEF, his second reading speech said that he was setting up SIEF because he knew that there were a whole lot of wealthy individuals waiting to have a vehicle to donate for science. But, in fact, nobody ever did.

And I think it's an interesting - a question that should be further examined, whether CSIRO should use SIEF more aggressively to get private philanthropic donations for particular projects. So I don't think anyone's just going to give money to SIEF to be generally spent. But a project like, for example, what should we be doing - what research should CSIRO be doing to mitigate climate change in the agricultural industry, for example? There could be well be philanthropists who want to do that. Or saving the Great Barrier Reef is an area of scientific research that seems to me to be open to philanthropic donation.

## **Innovation in Australia**

*And just based on your experience in CSIRO but also in Swinburne about innovation, et cetera, what's your impression of where we are and where the future lies in Australia with private industry and the growth of globalisation and China? Is there going to be a significant private sector with an interest in the kind of science that CSIRO has traditionally done? Or is manufacturing in effect something which is going to be more and more marginalised?*

So I think that there's a merging of manufacturing and services. So a successful Australian company is Orica. And Orica is an example of a company that has merged manufacturing and services. So it provides a service to companies around the world in blowing up land - an explosive service. So if you want to make a mine in Brazil or somewhere, Orica will go and make the mine for you. And it uses manufacturing - it has large manufacturing facilities of ammonium nitrate in Australia. It has very good IT services that come out of Australian

research. So it understands the geology of the region that it goes into. So it has a business that's built on the integration of science and technology and providing a service.

So I think that that sort of model is the model that Australia might use. So, for example, if you're having a - not that we necessarily do this in CSIRO. But just let me give you an example of a pacemaker. So if you're a firm that is providing a pacemaker, then you not only have to make the device, but you've got to provide an ongoing service to the patient who gets that advice by monitoring it and making sure that it works, and providing to the medical profession that service. So that the doctor who says, "I'm going to implant something in my patient's body" knows that the firm that he's dealing with to provide that is a firm that's going to provide that service.

And in order to do that, you could do that sort of thing from Australia. There's no reason why an Australian firm can't do that. In fact, Telectronics was one of the first firms who were doing something like that, and the -

*Bionic.*

- bionic ear. It is an example of a firm that provides - that has combined manufacturing with providing -

*Full service.*

- a service. So I think that that is an area that an Australian industry will be able to get into. And that's why I think the bio-device precinct around Clayton is a very important investment by SIEF. And the resource centre in Western Australia is another example where Australia is going to succeed by having service and provision of resources combined like the Orica model. What about, say, car manufacturing? Are we going to be able to do that? Well, I think the plastic mirror example in South Australia is an example of where Australian manufacturing may be able to be part of the manufacturing industry, not necessarily by manufacturing full cars, but manufacturing some parts of a car. So the -

*Mesh component.*

- plastic window is manufactured in South Australia, I think, but is on Fords and other high-end - in the luxury car market. We used to have a manufacturing of leather car seats. But I don't know that we have that now. But those sort of things are areas where Australian manufacturing and Australian agriculture could combine in order to make products for the automotive service. For example, Boeing Australia supplies some of the moving parts that drive Boeing aeroplanes. I think every Boeing aeroplane that flies has got a part in it that's made in Fishermens Bend. And they do that by successfully integrating Australian technology with the needs of the Boeing Aircraft Corporation.

So I think that we do need to think about the way that Australian innovation is going to be part of manufacturing systems, even if we're not necessarily making whole - we don't make whole aeroplanes or whole cars. But we can still contribute to that. We also have this enormous capacity in Australia in medical research that is not - we don't necessarily get enough return for that from the pharmaceutical industry. Where we have the capacity to

develop new pharmaceuticals, but we don't have much track record in doing that. So I think that the government through its purchasing power of pharmaceuticals, research organisations like CSIRO and the medical research institutes, probably need to work more aggressively in getting commercial outcomes from that research. So my opinion is that we'll give up the notion that we're going to manufacture things at our economic peril.

*Well, that seemed to me to be a very optimistic and hopeful note upon which to conclude. Are we done?*

*Thank you very much, Tom.*

Thank you.

*A rich history. Thank you.*

*Thank you very much.*

[END OF TRANSCRIPT]