TRANSCRIPT OF PROCEEDINGS

MEDICO-LEGAL SOCIETY OF VICTORIA

"SCIENCE AND AUSTRALIA'S FUTURE"

by

PROFESSOR PETER DOHERTY

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PROFESSOR DOHERTY: Thank you very much. It's a pleasure and somewhat of a challenge to address this group.

I've come to the realisation, slowly in fact, that winning the Nobel Prize is in fact a life sentence. Not only is it a life sentence, the punishment increases for good behaviour, because you get asked to talk more. If I really give a very bad talk this evening you could see there's some motivation behind it. Penny and I returned to Melbourne last July and I'm now spending most of my time at the University of Melbourne, but still commuting backwards and forwards to Memphis, Tennessee because we still have a small research lab running there

Winning the Nobel Prize of course is somewhat of a surprise; you get a call at 4.30 in the morning some time in October telling you that you've now joined a different club that you didn't really expect to be in, and that really does change your life. I've always wondered how, when the call came about the Nobel Prize, you would know that it was real, and it wasn't one of your young associates who would be perfectly capable of doing something of that sort. In fact you know it's real because within about ten minutes you're getting calls from Reuters and talkback radio in Bogata, Columbia and all sorts of strange things are happening to you.

My Swiss colleague, Rolf Zinkernagel and I won the Nobel Prize (in 1996) for work that we had done at the Australian National University in 1973/'74/'75. The Nobel Committee is pretty conservative and they like to wait a while to make sure that it's not "wrong". Ours

was not the longest. The longest "wait" for a Nobel Prize was actually by Paden Rause, who had to wait 50 years, so he was pretty decrepit by the time he got it of course.

Why did we win the Nobel Prize? What we discovered was how the "cellular" immune system works. I work on immunity to infection. I think most of you are familiar with the idea of antibodies, that float around in the blood and "grab hold" of invading organisms that cause infective disease. These are the circulating or "humoral" immune system . You're probably a little less familiar with the "cellular" immune system but it's actually tremendously important because that's the immune system that's involved in arthritis and multiple sclerosis and all sorts of virus infections. The "workers" of the cellular immune system are the white blood cells, and the category of cells that I was studying, the CD8 or killer T lymphoid cells "turn on" on to kill the virus-infected cells. Viruses can only grow within living cells. One virus particle may get into a cell, and millions of them come out. If the process is not stopped more and more cells become infected and more and more damage is done. Eventually if it is not stopped the infection kills the host. These killer T cells "bump off" these virus-producing cellular factories before they can produce too much infectious material. We discovered the way these things work. These "killer" cells know to go to the virus-infected cells, for example in the lung infected with influenza virus, because, when the virus infects the cell, it changes some major proteins, that characterise "self" on the cell surface. (These are the

same proteins that are involved in graft rejection. If we transplant a kidney from one individual, A to another, B, B will recognise the kidney of A as foreign and if not given appropriate treatment to suppress the process, will reject the kidney of A.) So what happens in us is that our own ”self” proteins,, which we've learned to tolerate during development, are modified so that the body now thinks they’re foreign. That discovery completely changed the way that people look at the cellular immune system. and of course now a great deal of research has burgeoned out of that.

We knew it was a major discovery at the time but the reason the Nobel Prize took so long was because a lot of the molecular detail had to be worked out and this was largely done by other people.

I start from time to time to write a book about this. I mean the latest one is called "A Beginner's Guide for Winning the Nobel Prize". One of the messages is "discover something right at the beginning and then let everybody else do the work, and then you'll get the credit" and that's the way the Nobel Prize works actually, it's for a discovery. It was a big surprise, in a sense, winning the Nobel Prize. We knew that we were “in the frame” for it and had been for some years, but we did eventually get there.

We had been living in Memphis, Tennessee, for eight years where I was running a research laboratory at St Jude Children's Research Hospital, which is a fantastic institution. It was started by Danny Thomas, an American comedian. He was a Lebanese Catholic who made his initially was a comedian and then went to Hollywood,

appeared in some pretty bad movies, and started a production company which produced television shows like Gilligan's Island, Mr Ed and others. Danny was a devout Catholic and when he was in Chicago doing very, very badly he prayed to St Jude, who is the patron saint of hopeless causes (and immunologists) and said that if his career turned around he would do something in the name of St Jude. Some years later he had succeeded, quite spectacularly in financial terms, and went to his Bishop in Chicago and said "What should I do? I've made this vow and I want to carry it through". His Bishop suggested, "Well, go to Memphis, Tennessee, there's great poverty there - and start a children's hospital".

So he did that. He went down there and talked to some contacts he had been given, and found that they were totally uninterested in having a children's hospital, they already had two: one for blacks and one for whites. But a haematologist called Lemuel K Diggs suggested they start a children's research hospital. They started this little institution with $300,000 in 1972, the year I graduated from university, in fact, and it now has a budget in excess of $300 million a year and until very recently, until September 11, was raising something like $300 million a year in public subscription.

I'm not talking about research grants, I'm talking about public subscription. That gives you some idea, I think, of the wealth and extent of philanthropy in the United States. It truly is extraordinary. This little hospital was the first to really get the solution to childhood acute lymphoblastic leukaemia, which is one of the reasons why it raises so much money.

The prize put me in a different context. Though we'd been in the States for eight years, and though I'd left Australia thinking that I probably wouldn't work in Australia again for various reasons to do with resources and so forth, I was still an Australian citizen and as such I was claimed again by Australia as an Australian Nobel Prize winner. The prize is announced in October and awarded on December 10, which is the anniversary of Nobel's death. In fact the year we got the prize was the 100 years after Nobel's death. We had come out to Australia for ours son's wedding and the Prime Minister invited senior Australian scientists to Parliament House to celebrate this Nobel award. That was the first time, I think, that a lot of Australian scientists and a number of politicians were actually brought together in some sort of general context and I think it also caused John Howard to realise that science was something that he could take an interest in, and he has in fact been reasonably supportive of science. We're all aware that this present government has been very much - at least initially - very much a cost-cutting government trying to get public spending and so forth under control, but they have increased funds for science over the years partly due to some very, very intensive lobbying efforts. We're yet to see what they do with the universities. The universities have had a pretty rough time of it but, of course, we're waiting to see what Brendan Nelson's report will actually bring down.

We went to the fantastic Nobel Prize ceremonies in Stockholm, a week of parties, dressed up in white tie

and tails. Most of the people who win the Nobel Prize are, of course, a bit on the ageing side so that the Swedes are always glad when everyone actually survives the week and they don't have to put anyone in hospital. It's an academic occasion, in fact, run by the students from the university. You will know the pictures of the King, as a guest of the Nobel Foundation, awarding the prizes. We were invited to the palace and it was most interesting meeting the King or "the Kong" as they call him. .

One needs to remember in relation to the Nobel Prize that science prizes are a bit dubious anyway in a way, because anything that's done in science is the effort of an enormous number of people - people that interact directly, and other people that feed into the system. We all stand on the shoulders of many other people.

But the fact of it is the Nobel Prize is the one thing that puts science on the international calendar every year. It's part of the international media circus and attracts the attention of the media and gives a certain legitimacy and a right and an opportunity to talk about science and the values of science. Nobel's wish, I believe, was to promote discussion and focus on the sort of activities that we think of as promoting human wellbeing and peace.

At the end of 1996 which was the year we won the Nobel Prize we were looking forward to an extraordinarily intense year ahead. Everybody says that when you win the Nobel Prize your life is completely taken over for about two years. I was thinking this year ahead is barely survivable and then on Christmas Eve - I

got a call saying "We've just made you the Australian of the Year and we want you here on Australia Day". So I said "Well, that's very nice but could I put it off for a year" and they said "Not if you want to come back here at all, mate", so to speak.

So the next year we travelled round the country, we had to go to all the capital cities and I used that to talk up the values of science, education and the things that I care about a lot, because I think these are enormously important. And the point I was trying to make is that there is a culture of creativity. There's a culture of high knowledge that now is actually driving a great deal of economic development. I was very familiar with this because as senior United States scientist, (I had been working in the US off and on for 20 years), I was on a lot of committees and a lot of scientific advisory boards for biotechs. I was very much involved in that culture and could see the way it worked. Universities, are by Australian standards extraordinarily well funded, both in terms of research funding and in terms of the funding of the universities themselves. They have many more sources of funding than any Australian university does. But the discoveries that are made in basic research labs and universities, often in the medical research labs, are taken to commercial development really quite quickly, and there is a rapid flow on to what was a very vibrant and vital biotechnology industry.

The biotech sector is still pretty vibrant and vital in some senses but it's a lot tougher than it was and, of course, the whole financial situation at this time is very, very

difficult. However if you look at the evidence from American research universities, like MIT, you will find that there is enormous earning associated with the generation and exploitation of this intellectual capital, and its translation it into commercial reality. Many of the little companies fail. If they succeed their fate is often to be bought up by big companies.

Many of the big drug companies are now not doing that much of their own research, they're relying on this very vibrant, very flexible small company-type sector which comes straight out of the universities to provide the intellectual capital and the discovery that they will then take on to product development. It's still a very intriguing - a very exciting area but, as with all financial matters of the moment, it's somewhat depressed. Maybe if we could stop going to war we could perhaps go back to something like it previously was.

I talked a lot about this in that year and I was also put on a number of other things by our friends at the Australian Broadcasting Commission. They gave me the opportunity to appear on Margaret Throsby's program, I think some of the other media programs and to appear with Roy and H;, the program "Club Buggery" wasn't one that actually was seen in the United States, at least not by me, so that was an interesting experience and, as I recall, we got - due to my veterinary program - on to some very intense discussions about sheep.

I went round the country singing that song for that year, met a lot of terrific people. I'd been fairly annoyed when I left Australia because I was in Canberra, (and that's enough to annoy anybody). Travelling around

the country and meeting a lot of people, talking with them and seeing what they were doing and the efforts they were putting in, I really got a much, much more positive sense of our country and had my spirits considerably lifted by it.

It so happened that I'd signed on with the Australian Society of Medical Research, which is a lobby group of relatively young medical research workers They've been very effective in lobbying for medical research over the years and I'd signed on before the prize to come the following year and do a publicity tour for them. Soon we were coming back to Melbourne for three months every year.

We used to stay in the old chaplain's flat at Trinity College. It was no longer inhabited by the chaplain but it's an old building and there was this button on the wall and always felt if you pressed it the Holy Ghost would be summoned or something of that sort. I learned a little more about the trails of power in Australian society. Trinity College, for instance, has a lot of very eminent alumni.

The question is for us, I think, how we can build this culture of science and creativity and translate that into economic development that will help the future of the country. Obviously, Australia is to some extent - is in many ways, I think, in quite a difficult situation. We have 20 million people in a country that is exactly the same size as the United States. That is, we have a little bit over half the population of California and we have, I think, an economy that's about half the size of that of the State of California, which is one of the

major economies. With that economy we have to maintain our country, we have to defend it, we have to build roads and transport immigrants on to offshore islands and all those sorts of essential things that you have to do in a modern society. It's a pretty tough charge and paying for all that is not easy and I think the battle for dollars in Canberra is always a pretty difficult one.

We also have a very different political system from the Americans. Our political system is rather closed and secretive compared with the US system. It can act more effectively and more quickly often but it's not nearly as open. If we're talking about medical research budgets in Australia, the medical research budget is decided, by the National Health & Medical Research Council which is the administering funding organisation within the Federal Government. It's discussed, obviously, with the Minister and the Minister has to go into the cabinet room and try and get that money out of the discussion process.

I think John Howard decided he wanted to see more money spent on medical research. He used his friend and colleague, Peter Wills to conduct a major enquiry which Wills did, he interviewed many, many people, and that was able to give the then Health Minister, Michael Wooldridge, who was very effective at least for the research community, the ammunition that he needed to battle for an increase - in fact a doubling of medical research funding in the cabinet, which happened several years ago. So medical research funding has been on the up and up and the funding has been improving. We're still nowhere near the levels that there are in the United States but I don't think we can expect that. This

is simply not as wealthy a country and there are simply not the people around with those enormous amounts of money. Even now at St Jude we have people coming to us and saying "We would like to put money into your institution" and they just want to spend some money on something that they think is highly worthwhile. Often they want to be moderately involved in it.

There's a culture in the US of the person who makes vast amounts of money reasonably early in life and then they spend the rest of their life basically giving it away, which was very nice for medical research. This may change because George W Bush has essentially abolished the state tax, so whether it will be so attractive to actually give money for research in that context is not so clear.

As you're probably aware, Australia has for many, many years batted well above its league in medical research. We've done well. We've had a lot of pretty significant discoveries here. We haven't always done our best capitalising on those discoveries. The challenge for us is really to do better in that context and some of the states have taken this up in a big way: Queensland has been very supportive of the biomedical research enterprise and of course we have in Victoria the strategic technology initiative.

A lot of the aims behind these initiatives are to bring research to commercial development, to get people working together. The research grant funding schemes of the Federal Government, the Co-operative Research Centres, the National Health & Medical Research Councils are now very much oriented towards networking people,

getting groups of people working together, getting the most effective research, use of research dollars. It's being done intelligently and it's being done well and it's being done critically. I think, get very good value for our research dollars.

There are difficulties and the question is how we overcome those. The difficulties are really translating the research funding into economic reality. There's a problem with lack of investment funds. There's a developing venture capital type effort here, but it's nothing like in the US at this stage. There's a problem that many large industrial concerns in Australia have actually gone backwards on their funding and research. This is to do, I think, a lot with the way the stock market is operating, but there's much less investment in research from the industrial sector in Australia than there was many years ago, which is very discouraging, especially as for some types of research it's very important to find research partners.

There are good examples of how medical research, or research in general, is in fact an excellent investment for the company. This morning I was at breakfast at the university staff centre where the Minister, Kay Patterson spoke and the occasion was the launch of a joint activity between the American Juvenile Diabetes Foundation and the Australian Government for an international diabetes vaccine research effort, a very intriguing and challenging initiative in fact. And so we had people from the United States and one young woman from Bristol in England who was involved in evaluating these programs. While I was there I'd happened to run into Ian Frazer, a

long term medical colleague from Queensland. Ian is a Scot who came to Australia to work at the Walter & Eliza Hall Institute. He later on moved up to Queensland. And Ian was very interested in the papilloma viruses, the wart viruses. In the 1980s we began to realise that the human papilloma viruses - there are several types of them - venereally transmitted of course - are causing cervical cancer in women. Ian, who is a very practically minded person and a good infectious diseases physician as well, set out to try and make a vaccine against the papilloma virus. In 1990 he and his colleagues patented a vaccine approach, nothing that was tremendously original or rocket science, but they had their own particular bit of intellectual property cut out. The vaccine depended on making virus-like particles that look like "empty" viruses and with an adjuvant it works as a vaccine. The funding of this development was from the Australian National Health & Medical Research Council competitive research grants, and also some funding from the Queensland Cancer Council. Ian then talked to people at CSL who became interested, then put together a Phase 1 trial and then I think they did a Phase 2 trial as well. A Phase 1 trial is very straightforward, it's a safety trial of 10, 20 people who receive the vaccine to just see that it doesn't kill anybody. Then Phase 2 is a little bit like that too, but you inject a large number of people and you can look to see whether there's any efficacy. Things were looking interesting from the Phase 2 trial and CSL then took it to a large American drug company, Merck. Merck essentially decided that this had potential and they bought the royalties to it, They have

a royalty agreement to bring 5 per cent of the profits back to Australia. The matter is confidential and Ian can't tell me but Merck doesn't take on any sort of drug unless it's going to be worth at least a billion US dollars a year. Merck has taken this little vaccine and put it through a Phase 3 trial with 60,000 people, and the results have been spectacularly successful. The level of protection is near to 100 per cent for the virus types in the vaccine.

Many women - and young men of course, (because with a venereal disease there has to be two halves, doesn't there,(we know that because we're doctors and lawyers) get infected really quite early. In fact in England a colleague at Cambridge University who works on the papilloma virus told me at a meeting that I was at where Frazer also happened to be that they had done a survey in young women coming to Cambridge University from school and they found that most of them - almost all women in fact were papilloma virus negative and within two years I think 90 per cent were papilloma virus positive, so that says something about contemporary life in Cambridge colleges.

There's a window there where you can protect young women against this disease and so the trial that was done was incredibly successful. What does that mean? It means if it's a billion dollar a year drug, they've got to protect it for 16 years, they're getting 5 per cent, that will bring back to Australia, just on the basis of royalties, something like $A100 million a year. What was the level of investment for that? Well Ian calculates that as far as his lab was concerned between 1990 and 2003 certainly

considerably less than $10 million, add another $10 million for CSL then you're talking about $100 million a year investment return on essentially a $20 million investment, and that return coming back to the country for 16 years.

Even if we sell off discoveries at a relatively low level there's still a potential for enormous earning and enormous benefit to Australia.

As I said, the governments have seized on this. - Another example in Queensland is Mark Von Etstein who with Peter Coleman and Graeme Laver developed Relenza, the drug that blocks the influenza virus.

Now This is a spectacularly successful drug too and it will stop influenza in its tracks. The market for it has not been very good. My influenza virologist colleagues have been greatly deploring the fact that we haven't had a major influenza epidemic although of course, influenza kills a lot of people that means the market has been down, so Glaxo-Wellcome who took up this drug has not been very interested in it.

Another problem of course, with modern medical research, is that there has to be a market out there for a particular drug. The ideal market for a drug of course is something that you have to use and use repeatedly over and over and over. The ideal drug is an anti-arthritis drug or something like -that, that you take all the time and the drug company makes lots of money.

Von Etstein, who developed Relenza set up a glyconics research institute in Griffith University, which is on the Gold Coast near Southport, just north of Surfers Paradise. Glyconics is the study of carbohydrates, is

an extraordinarily complicated and difficult area of biological research using fantastic computer modelling systems.

As I often do when I visit research institutes here or in the United States, I talk with the graduate students. Von Etstein had about 20 young graduate students sitting round the table, all switched on, all bright, all enormously enthusiastic, all focusing on drug development in this area, an area where this Australian group is as good as, or probably better than just about anything else in the world.

There are good things happening here, but we have to keep the momentum going. We have to keep the funding there, we have to make sure that the bench capital is available and above all we have to make sure that our universities remain really strong. This is one of the things that's worrying me considerably at the moment because resources for universities have been very constrained.

The university in Australia I think fills a very, very special role. It's the one place in society where there has been truly open discussion. It educates most of us. But for some reason we don't really love all our universities all that much. In America it is a "right of passage" for kids to go to College. It is a very intense experience and they look very fondly to the university. That is reflected in the fact that years later when they become enormously successful and they make a lot of money they give money back to the university and they support the university very strongly.

We don't get a lot of that sort of thing here. I think if you do get that in a university it tends to be

the people who were in residential college that will feel loyalty to their college. The people who are very strong in supporting the university are actually the people who were in set courses, like veterinary science or dentistry or medicine where everybody came in together and they stayed together. They may have been whittled down considerably, as they were at the University of Queensland where the philosophy was you took in everybody and then you failed 50 per cent at the end of the first year. But they stayed together, so there was that sense of cohesion, which I think has been lost at many of our universities.

Another thing that worries me about our universities is that I think children are forced often to make decisions too early in their schooling about which direction they will go at university, whether they will go towards arts or towards sciences. We all know of bright young kids who will do science/law and so forth, but they're rather the exception than the rule. In the American university system they go to college and they will take something of arts and something of sciences. The Americans are very committed to the idea of a liberal education, a broad education. And then of course the professional courses come after that four year basic education system. It's a slow process of education but often it's a very good one in the better institutions. In the bad institutions of course they learn nothing. Many American kids go through college and remain totally unscathed and that's not untrue of our universities here.

With respect to our universities, there's a lot of talk of course of the top eight, but I've travelled

around the universities, and I've been to some of the - what one would think of as quite minor institutions, institutions that were pushed up from technical colleges, generally in rural environments. Most of those places have at least one or two really good things going on. The University of South Queensland, for instance, which was a technical college, has a tremendously good distance learning program. They have students off in Saudi Arabia and Asia and so forth, they've been doing it a long time and they're extremely good at it. They're now getting extremely good at doing web-based learning. They're finding that people, particularly mature age students, are defecting from full-time courses to use their web-based learning programs. The universities are very innovative in that respect.

But I would say, as educated people and as people who care about our society, we really need to do more, to provide more support for our universities.

There I think I'll leave it and if you've got questions I'll be very happy to discuss anything you'd like to talk about. Thanks.

MR ATKINSON: Tony Atkinson. You were trained as a scientist and that's obviously your love. How do you compromise that with your obviously very busy life in administration and trying to get money out of politicians and things like that?

PROFESSOR DOHERTY: I think at the moment I'm more a talking head almost than anything else. The fact of the matter is that all senior scientists take on a role of raising funds, keeping a group together. At the time I won the Nobel Prize I was administering a million dollar a year

research operation and many people are administering much bigger operations.

As you become more senior in any activity, to some extent, the basic raison d'être becomes compromised. Many scientists have an active life in science of about ten years and then they tend to end up in some more administrative role. I'm a bit unusual in the fact that I'm still running an active research laboratory after 40 years. But, of course, I spend time talking with the young people who actually do the experiments. They can do an experiment ten times faster than I can. I'm at the time of life where the neuronal changes, the protein-folding disease and so forth has got to the stage that I can't remember whether I've added one thing to another if someone interrupts me. We run teams; my current team here is of six people and my team in the States is about four or five. We operate by email but it's all compromises as time goes by, yes.

MR COURT: John Court, I'm a physician. I was wondering if you could comment on the inter-reaction of getting funding from the various areas of competitive research grants. How you would advise people who have a good idea and perhaps the way they should go.

PROFESSOR DOHERTY: Well, of course, a lot of the research funding goes to research labs that have established over a considerable time a good track record and grown. The way that the National Health & Medical Research Council is putting a lot of its money now is into substantial groupings where you have a number of independent strong scientists who are working together and networking and this is actually very good.

Raising research capital for commercialisation and so forth is not really my area. I may talk about this with great enthusiasm but without much knowledge. One of the things I've just got involved with is the redevelopment of this Bio 21 initiative which has been reborn in a somewhat different form from its original form and I'm going to be getting a little closer to that.

In the States it's much more straightforward. There are a lot more people out there to go and talk about raising money if you want to commercialise an idea, but it's not something that I'm all that close to. Research funding is still a lot easier to get in the States. In fact the American National Institute of Health Research grants can be competed for internationally and we have people who have not had that much success in getting funding here, who have actually got American money and are working here. So that's been quite a big resource.

The grant systems everywhere are very tough and very competitive. If they're funding 30 per cent of the applications they're probably funding all the good science. At the time I won the Nobel Prize in '96, the National Institute of Health I think was running at about 17 billion, it's now 27 billion. This is something like $US100 per head of population. I think our budget is probably about $300 or $400 million, something of that order, and so it's about $A20, $A30, $A40 even for head of population.

QUESTION: You mentioned that you thought industrial research had in some ways gone backwards in Australia over the last number of years. Could you give any examples of the

sort of research which was more actively being conducted in the old days than now?

PROFESSOR DOHERTY: I have the impression that there was an enormous strength in mining research. I don't know to what extent that still continues. And, of course, we've seen enormous constraints put on CSIRO, its funding has been considerably cut. It's been very innovative in some areas and it's been to some extent reborn, which is good. But there's been a tremendous shake-up in industrial research internationally too.

What's been happening with the big drug companies is that they've all been amalgamating and we're now down to about three or four major drug companies and it seems that some other drug companies that were very substantial may not even survive. That has involved a tremendous rationalisation of the research effort. I think, they're moving more towards actually getting the research from the little innovation-type companies. For instance, a big Austrian company has put it hundreds of millions of dollars just on the ground in Harvard University so that they have people at Harvard where there is an enormous faculty and a tremendously active research enterprise. Harvard University, by the way, has 8,000 faculty members, so you can imagine what the dynamics are like and then you've MIT next door.

We can do well, I think, in research-based activity when we identify niches and we go after them. We have to do things that are internationally viable.

CHAIRPERSON: In relation to our particular situation and relative particularly to the United States in terms of our relatively small population, our relatively small

economic base and not necessarily that same history and culture of philanthropy or, indeed, the capacity in terms of input for research, is it inevitable, given our bright young scientists and researchers that there will be, of necessity, a continuation of a brain drain that I suspect you were, indeed, part and parcel.

PROFESSOR DOHERTY: Yes, we do train more - or we have for a very long time trained more good scientists that we can absorb and, of course, Australian scientists are very much in demand. One of the delights of coming back here is realising just how good the quality of young graduate students and young scientists is in our universities. They're extremely bright and extremely pragmatic and they're in a lot of demand in the US and if they come back they have to come back into a situation where they have to gradually grow up their independence, whereas in the US often they can establish independence very quickly. Many Australians would like to come home. But we have currently one million Australians outside Australia. That is five per cent of our population is outside the country and a lot of those include some of our most innovative and exciting people.

If I look at Australians who might win a Nobel Prize I'd say they're more likely to be in the United States than Australia at this stage. So it is a difficult call. It's not just Australia that's been draining brains to the US, it's also Europe. One of the things that's been a big turn off in Europe for biological scientists, particularly, is that the Germans in particular brought in extraordinarily rigid anti-gene technology laws. That drove a lot of people out to the

U.S. At this stage the US is being more realistic about animal experimentation and gene technology. We didn't have a lot of trouble with animal liberationists in Tennessee.

Sandra Hacker. I'm interested in the issue of intellectual property. Melbourne University has a very generous intellectual property situation and it's different from some of the other research institutes in the state. To what degree does the availability of the generosity of intellectual property regulation within research institutes influence young people in terms of which institution they choose, and what sort of research they're likely to undertake?

PROFESSOR DOHERTY: I actually think that those sorts of issues have very little influence on where people go to do research. Particularly young research scientists go where they can explore their ideas and they can get the resources to do the type of work they want. It really is very much an intellectually driven activity and the problem would often be to actually get them to commercialise something. That's one of the things that people have had to work on here.

It's not so much a problem in the United States because I think Americans seem to be born more with a business brain. I mean they're selling lemonade on stands by the side of the road from the time they're five. It's been a different culture. From what I've seen so far, a lot of the commercialisation tends to come more from people a bit further up the ladder who are trying to support a much bigger activity. We've got some very successful operations going. Neurosciences Victoria

I think is spectacular. Colin Masters, who is a key person in that, has some extremely interesting work under development.

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