



COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

**HOUSE OF  
REPRESENTATIVES**

STANDING COMMITTEE ON PRIMARY INDUSTRIES AND  
REGIONAL SERVICES

**Reference: Development of high technology industries in regional Australia based  
on bioprospecting**

WEDNESDAY, 4 APRIL 2001

CANBERRA

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**HOUSE OF REPRESENTATIVES**  
**STANDING COMMITTEE ON PRIMARY INDUSTRIES AND REGIONAL SERVICES**  
**Wednesday, 4 April 2001**

**Members:** Fran Bailey (*Chair*), Mr Adams, Mr Andren, Mr Horne, Mr Katter, Mr Lawler, Mr Leo McLeay, Mr Nairn, Mr Schultz, Mr Secker, Mr Sidebottom and Mr Cameron Thompson

**Supplementary members:** Mr Griffin and Dr Washer

**Members in attendance:** Mr Adams, Fran Bailey, Mr Schultz, Mr Secker, Mr Sidebottom and Dr Washer

**Terms of reference for the inquiry:**

To inquire into and report on the following areas, with particular emphasis on the opportunities in rural and regional Australia:

- the contribution towards the development of high technology knowledge industries based on bioprospecting, bioprocessing and related biotechnologies;
- impediments to growth of these new industries;
- the capacity to maximise benefit through intellectual property rights and other mechanisms to support development of these industries in Australia; and
- the impacts on and benefits to the environment.

**WITNESSES**

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**Committee met at 4.40 p.m.**

**CURRAN, Dr John, Assistant Chief, Commonwealth Scientific and Industrial Research Organisation**

**HIRSCH, Dr Mikael, Biotechnology Coordinator, Commonwealth Scientific and Industrial Research Organisation**

**WELLINGS, Dr Paul William, Deputy Chief Executive, Commonwealth Scientific and Industrial Research Organisation**

**CHAIR**—Welcome to this public hearing of the inquiry by the House of Representatives Standing Committee on Primary Industries and Regional Services into the development of high technology industries in regional Australia based on bioprospecting, bioprocessing and related biotechnologies. This is the second of our hearings. On Monday, Biotechnology Australia and AFFA appeared before us. This evening we have CSIRO. Although the committee does not require you to give evidence under oath, I should advise you that the hearings are legal proceedings of the parliament and warrant the same respect as proceedings of the House itself. The giving of false or misleading evidence is a serious matter and may be regarded as contempt of parliament. We have received your submission. If you would like to make a brief statement or some opening remarks, I welcome you to do so.

**Dr Wellings**—CSIRO would like to make some opening remarks. We welcome the opportunity to present our submission and to appear before the committee. Many of the issues involve significant scientific challenges, but require broader engagements with the community and industry. We see that as a real nexus which this inquiry is going to help close for us. In developing our submission, CSIRO noted that there are many other relevant policy initiatives currently being debated. There is a risk that the inquiry would focus on some specific issues without being linked in to some of those other debates. For example, we are conscious that there is an ongoing inquiry on access to biological resources in Commonwealth areas and we would like to table CSIRO's submission from March 2000 that we made to that committee because it contains some additional information.

Our key message is that we would like to leave behind a big picture level statement on the need to manage the connectivity between a whole range of technology fields, particularly in biotechnology, and to develop a broader ownership of the need for visionary strategies and solutions to make that connectivity. By and large, we believe that it is up to industry and market mechanisms to drive this forward. The role of government is facilitating. We endorse the national biotechnology strategy as the Commonwealth's response to these needs. We are also working with several state governments on specific initiatives, mainly around infrastructure. Secondly, as biotechnology is developing within a global business system, it is important that we as a nation take into account what is happening outside Australia when considering opportunities for regional Australia. For that reason, we think this inquiry, in part, is about thinking globally and acting locally.

**CHAIR**—We have heard that somewhere before.

**Dr Wellings**—Indeed. But if we do not get a good understanding of the global drivers and what the major institutions are doing in the international private sector, I think we run the risk of becoming slightly uncoupled as a nation on this issue.

Our submission centres around a flow diagram, reproduced both in our executive summary and on page 11 of our submission, in which we outline how five key biotechnology areas interact and are interdependent in terms of delivering economic benefit from the use of Australia's biodiversity. Those five key areas are: biological informatics, biological prospecting, biodiscovery, bioprocessing and bioindustry.

It is important that we recognise that, within the research and commercial environment that we operate, these terms of reference have a quite specific meaning to us. We are aware that many other submissions have adopted a broader interpretation about what is meant by bioprospecting but, for the purpose of clarity and avoiding the confusion that already exists in this area, we suggest that the committee adopts the framework that we have set out. We believe that would add clarity to the national debate.

We have built our submission around responding to the first two terms of reference for each of these five areas, with some general commentary on the latter two terms of reference—and we might come back to that—and we present a total of nine recommendations to the committee, four of a more general nature and five of a specific nature, relating to various fields of biotechnology.

In terms of how to position Australia's opportunities in a global business system, we should recognise that we cannot hope to be leaders in everything that we do; rather, we need to be smarter as a nation—and not just the CSIRO—in putting together the right team to address the right niches where we can position our activities to have international leadership or excellence, and can offer intellectual property positions that will be attractive to both the research community and industry partners from throughout the world.

It is therefore a matter of careful selection of core capabilities. We believe that we should maximise various strategic advantages, and in our report we identify three. The first is that Australia has an extraordinarily rich biodiversity from which to work. The second is that the innovative and efficient primary industry sector, which already has most of the infrastructure in place, could grow raw carbon feed stock or materials for manufacture of new products. We already have much of that in place because of the competitive nature of that sector. The third is that the nature of our research and development system is such that it can support an innovative industry sector. We think that we are preconditioned in some ways to do some niche activities around the terms of reference of this committee.

To achieve some of those things we need to overcome what we believe is a perception that the primary industry sector is predominantly 'old economy'. We think that that is actually not a very helpful set of terminology, given the range of opportunities that still sit in front of us. We need to enhance the collective leadership of the industry and support the broadening of their vision, and to address the limitations in critical mass, skills and collaborative links between operators in the science system and various industry systems.

Some specific issues for each area include access to data and the provision of skills for bioinformatics—we have elaborated on that in our report—and maintaining a national momentum on the issue of access to biological resources in supporting bioprospecting, but we would also address any impact on the new access regimes that are being proposed on other areas outside the scope of this review, such as research collections and conservation values. Those issues, in part, are set out in the submission which I tabled earlier.

Thirdly, we need to identify niches for biodiscovery projects of strategic value to Australia, and support major initiatives on genomics and other molecular biology research, especially those that span human, animal and plant sciences. We need to enhance pilot plant facilities to support biofermentation; we see that as a missing technology node in the country where we could make some selective investments. We need to continue public awareness attention about the opportunities in bioindustries.

Finally, we appreciate that it is early days in the deliberations of this committee, and we would welcome the opportunity of returning to your committee if there are specific technical issues that you would like us to speak to later as your report reaches a penultimate draft.

**CHAIR**—Thank you very much indeed. I would like to put on the record our appreciation of our visit, on which Dr Curran very ably took us around and gave us an introduction to this whole area into which we are now inquiring. I thank you for your previous efforts for us and also for the opportunity to tap into your expertise at a later stage.

I will start our questioning this afternoon by getting you to develop more of what you made much of in your submission—developing the niche and tapping into these core capabilities. Governments of all descriptions do not ever like to be put in the position of trying to pick winners, and what you are saying to us is almost code for that. It is a challenge that we are all going to have to face in the future and, while I accept part of what you are saying in your submission—that we have expertise in some areas and we have natural advantages, and that that would lend itself to developing these niche areas—can you just flesh this out a little more for us and give us a little more of your insight into why it is important that we concentrate in the niche areas? In looking at that, is the national biotechnology strategy assisting in this process?

**Dr Wellings**—I will make a start and then pass over to my colleagues. I think one of the issues for us is making sure that, down the pipeline, Australia has the national capacity that we have imagined in our review in order to actually underpin the development of particular industries. So we are saying that, if we are going to move into bioprocessing and bioindustries, and the national capacity down this chain, in biological informatics or bioprospecting and skills are not there, any strategy will be fatally flawed in the long term.

The picking winners part is about making sure that the technical part of the national innovation system has got key institutions—CSIRO, the universities, AIMS; all those institutions—with the right capacity to deliver into the scientific and technical pipeline. We are not rushing out saying, ‘We should invest in industry X ahead of industry Y,’ because we do not believe that it is CSIRO’s position to make that recommendation. That is a market based issue. I think the important part of our message is about getting the balance in the national capacity down this pipeline. Mikael, do you want to make a comment about the national biotech strategy?

**Dr Hirsch**—Just before we get to that, I think we fully realise that we all have limited resources and it is not in any way, shape or form an expression of a wish to say that we need to be specific about what we are good at, rather than to try to lift the bottom level up so everybody can jump in and jump out. So it is about being strategic. The diagrams we put in the submission to you include some specific terms and technologies, many of which are actually in place. We do have a lot of links in this but we are not necessarily consciously connecting them. We might subconsciously connect them and there might be specifics in these things.

In terms of the national biotechnology strategy, we believe it is in fact a supporting framework. It may take a while before it develops the nuances which can give more specific directions for areas where we might have some specific niches. CSIRO would, of course, like to believe we are very good in specific fields but it is not for us to do that. It is really a matter of where the national capabilities are and ensuring that all research agencies and industries work together to identify those. We put some of that stuff into the development of the national biotechnology strategy and we will support that as it progresses.

**Dr Curran**—I believe one of the issues is creating the critical mass in whichever area the market decides we should be going. I think that is the challenge. I do not think any one agency can move forward on its own, particularly if you move into areas like drug discovery, et cetera, where you are dealing with the top five companies in the world. To be competitive, we have to bring our resources together and focus rather than try to pick winners.

**Mr ADAMS**—So public policy for us is getting our institutions up to speed, with the resources they need, and with the training and the people coming through to make sure that we are on top of that. Then we need to take control of Australia's resources in a regulatory way and engage with the private sector. Is that correct?

**Dr Wellings**—Can I give one example to illustrate that? If you look at the field of biological informatics, the sequence codes—the genomic codes—that people are now looking at across all sorts of organisms, not just humans, is growing at something like 13 per cent per annum. If we do not actually have national capacity that can chase something which is growing that quickly, we are going to drift backwards as a national science system. We tried to resolve that issue this year. There was a cooperative research centre around that was going through the department of industry. We put together a group of research institutions mainly to say, 'Could we build a CRC around a very rapidly breaking domain of science that was a very new field?' Six years ago, people were not talking about biological informatics. The CRC got knocked out very early on without going to full interview on the grounds that it was not coupled to the marketplace.

Within the terms of the CRC program, that was most probably the right decision because the terms of reference for CRCs are about a route to adoption. But the problem for CSIRO and the universities is that, where there are rapidly breaking domains that link into this sort of system that we are talking about today, it is very difficult to put together the resources to position Australia strategically. There is no program in any of the Commonwealth departments that you can go to to ask how we get into breaking technology domains and position Australia for the future. I think that is an interesting comment about how we have pushed things like the CRC program to be more industry focused and left behind the technology development areas in which you might well want Australia to have domains of capability for the future.



**CHAIR**—Just picking up on that one issue, in your submission, you talked about the need for a national strategy for bioinformatics. How would you go about doing that?

**Dr Curran**—If you look at the major research agencies or funders—the ARC, the NHMRC and CSIRO—and you look at what they are saying needs to be done in informatics, they are saying exactly the same thing. The medical area is just one field of application, while agriculture and the academic community are two others. We all have a set of core needs around informatics, but there are different end points. We all recognise that. So those conversations have been had. What seem to be missing are the simple mechanisms to bring that all together. What is the vehicle which allows these different agencies to respond rapidly and form a joint relationship on a particular technology—in this case, informatics? Those dialogues have been ongoing. We have not yet identified a simple vehicle to achieve those things. It is that issue of competitive granting versus core funding versus—

**Dr Wellings**—Something to satisfy Treasury.

**Dr Curran**—Yes.

**Dr Hirsch**—I think it is also a matter of appreciating where the competition lies. In Australia, we are very good at competing between states and between organisations and so forth. This is actually a global issue we are dealing with here. Therefore, if we are to have a place in the marketplace, we need to act as one and deal with that environment using the strength that we have. That requires us all to be sitting around the table in Australia, which is inherently sometimes difficult. We heard earlier about the CRC, and the strategic intent behind that was to get the players to collectively form the consortium or whatever which is required to take us forward with it.

**Mr SCHULTZ**—This seems to be a national problem on anything and everything that we do in this country. Are you saying that we have the natural ability and the scientific skills to undertake certain things which we do on a state-by-state basis, but we do not share the information on a national basis to gain the emphasis that we need to make us competitive internationally?

**Dr Wellings**—I think that is true. If you look at the scale of enterprises, markets and population in Australia, we are fundamentally different from other nations. This is off the top of my head, so the figures may not be right. Two-thirds of American business R&D takes place in companies with more than 10,000 employees. In Australia, two-thirds of our business R&D takes place in companies with fewer than 500 employees. That tells you that public research-intensive institutions—such as our top universities, the CSIRO, ANSTO and AIMS—play a critical role in the pipeline of doing the longer term basic research and capacity building that enhances our industries. In North America, a lot of the basic research is happening in Bell labs and places like that, which are private sector laboratories.

It would be nice to think that ultimately we will have companies that employ 10,000 people, but it is a demographic issue. You then have to look at the structure of the innovation system at the public end that says, ‘How do you build capacity in some of these really important niche areas?’ I think you could go down this list of core capabilities in the table and ask, ‘Where are the missing technology nodes? How do we actually make sure that we have a strategic plan for

each of these areas—that is, informatics, biofermentation and all those sorts of things—to put together the value chain that leads to the industry?’ Until we do that, everything else is hypothetical.

**Mr SCHULTZ**—Is that compounded by our states’ geographic isolation from each other? The sheer size of our continent must play some part, in my view, in restricting us from interchanging and working together as freely as we ought to. Is my observation accurate?

**Dr Wellings**—That is right in part—historically, that was certainly true. Modern technologies are helping enormously. If you go around CSIRO labs you can find the Internet on everybody’s desk and videoconferencing on every major campus. In theory, there is a lot more interoperability between institutions and between geographic centres. In practice, because we are human beings, we still need to meet each other from time to time to exchange ideas and build relationships.

**CHAIR**—There is still the spirit of competition.

**Dr Wellings**—We are adapted to throwing rocks at each other across state boundaries rather than acting as Team Australia trying to build a particular—

**Mr SCHULTZ**—Sadly, that is the case.

**Mr SECKER**—Most of us, apart from the chair and Dr Washer, had probably never heard of bioprospecting before we came onto this committee. If I am wrong in that, please correct me. Our problem is trying to work out and understand the issue—and I think we are doing that, because we have had very good briefings from you and others—but the nub of it is that we have to come up with some sort of public policy. I have my concerns about going down the regulation path; I would need a lot of convincing before we start trying to bring in regulations. You say that we need to be Team Australia. I am not sure how we can achieve that with the disparate types of state ministers whom we have to try to bring together.

**Dr WASHER**—With the Constitution.

**Mr SECKER**—Also, we have to try to bring the different institutions to work together, because they have all got their own little problems. Can you see a way around this? It is great to say that this should happen, but how do we, as a public policy committee that is trying to come up with some recommendations, achieve the outcomes that we are looking for?

**Dr Wellings**—There are ministerial forums on industry and innovation. The Joint Advisory Group, which took over from the old Commonwealth-state advisory mechanism for industry ministers, comprises the secretaries of state development departments plus their Commonwealth analogues, and people like the chief scientist or people who chair innovation committees around the country. That group could be used quite effectively to say that there are particular areas like bioprocessing that need some additional emphasis and to try to get some collective view from very senior state officials about how collaboratively to build those activities and to showcase Australian technology overseas. Some of those issues are built into the recently published innovation statement *Backing Australia’s Ability*. There are resources for international showcasing, but it was not clear to me how those resources are going to be used effectively to

draw together the domestic capacity before we go overseas. Once you get overseas it is actually quite easy to present the Team Australia face, but getting the right team to go in the first place is slightly more difficult.

**Mr SECKER**—And again, as a policy group, that is what we have to try and achieve. I am not knocking you but, after that answer, I am still not quite sure how to do it. The other point I wanted to bring up, and I am trying to avoid any political bias, is that I think the innovation statement should help. Are there areas in the innovation statement and policies that we could change to make it even better, apart from basically increasing it? Are there other things that we can do in the innovation statement type policy you are making to improve it?

**Dr Wellings**—CSIRO is highly supportive of the fact that we have moved off and we now have a national debate in and around innovation and knowledge development, and we think that is a critical issue for the country. So anything I say in answer has to be predicated by that. My memory of the innovation statement is that, for every \$22 that we are spending on research, we are spending \$5 on commercialisation and \$2 on skill development in small businesses and new enterprise development. I do not know what the logic was to actually have that ratio of spend of 22 to five to two across those three major components. I suspect, had I been king for the day, that my ratio would have been slightly different. The tilt is very heavily towards excellent basic research in the \$22 end rather than research which is actually fine research with a route to adoption. I think that the long-term issue about how we make sure there is a flow-through of research through that pipeline has to be part of a national debate. It is absolutely essential that we do basic research in our universities and key CSIRO laboratories, but we do need to understand what the route to market is, and I am not sure that all of the initiatives in that statement—

**Mr SECKER**—It is an interesting point, but I am not quite sure whether governments per se should actually get involved in marketing. It might help to be there as a resource in the marketing. It was actually identified in a previous submission that we were not quite big enough in our private companies to often gain the benefits out of this for Australia. But then, does government come in, pick winners and say, 'Yes, we'll get involved in the marketing'? I am pretty dubious about the government itself getting into marketing.

**Dr Wellings**—We might have a slight misunderstanding in the language. I am not saying the government should be involved in marketing; I am saying that the science that we do should have a route through to the marketplace and so—

**CHAIR**—And there is the commercial application of the research.

**Dr Wellings**—The commercial application of the research or the community uptake of the research or whatever.

**Mr SECKER**—Commercial appraisal rather than marketing.

**Dr Hirsch**—That comes back to the reason why we drew the flow diagram in our submission. This also relates to the picking of winners. Individually, each box has some elements about it and, individually, you could possibly find winners within them. But it is the link between them which might be the weak part. We also appreciate that a lot of the

understanding of the specific terms of bioprospecting might be limited in the non-research community.

In order to get the flow through to economic benefit and growth, you need to actually look at the whole as a whole. You might have research and resources pumping into the streams of various things and, at the bottom, out flows commercial growth and application, but some of that may never get there or whatever. It is about trying to manage the totality, not just the bits and pieces. One of the fundamentals behind the innovation statement is the term 'connectivity' coined by the Chief Scientist. We have to try to understand how these things hang together rather than spend lots of money this year in whatever technology is involved. It is probably a matter, over time, of building the capacity within the national biotechnology strategy to better articulate where the various balances should be.

**Dr WASHER**—In terms of government investment—and we will take 'government' as state and federal; some states are better at investing than others—to get the best outcome per taxpayer's dollar spent—and I preface my question by saying that we are short in certain areas such as bioinformatics—would it not have been better to build an infrastructure like this as part of that investment for people to access, rather than some of the types of funding that we have done now?

**Dr Wellings**—My understanding of the initiatives is that they are sufficiently flexible that that could still happen. For example, there are proposals for centres of excellence in biotechnology. From memory, there is about \$48 million allocated to that initiative. You could, in fact, build three national networked centres of excellence, rather than bricks and mortar infrastructure, in informatics, genomics and structural biology to build an assemblage of the skills across the nation with access to the right machinery and the right technical skills.

There is a current call for major national research facilities in the range of \$5 million to \$60 million, which essentially are for consortia to come together and then get matching funds from the Commonwealth pool. We are already seeing proposals for proteomics and genomics facilities and so on that could add value nationally to this sort of capability development.

In a sense, some of the initiatives have been written in such a way that they are sufficiently plastic to allow for consortia to come together. It is a question of policy whether we should have had an initiative called biology informatics or a flexible, competitive pool mechanism against all other ideas, and then, if the informatics option got up, we could say that it was a truly excellent proposal.

**Dr WASHER**—Biotechnology Australia was asked what they would do with that money and they did not know. The problem is that if they do not know what to do with the money—basically that is what they said—

**CHAIR**—I think they are waiting for us to tell them.

**Dr WASHER**—Precisely—that is my question. What should we do to identify our lack of infrastructure in this country? I do not mean infrastructure in terms of railways, bricks and mortar, but that is how they opened the Wild West. I cannot see any difference to the sciences; it is just new pathways. With bioinformatics we are talking about the infrastructure of a different

concept. How should we channel state and federal money to facilitate access to those pathways by scientists, businesses, et cetera, so that we can make this a country of winners? I asked that question of Biotechnology Australia and they did not know. I am asking whether you could give us some ideas. I do not know either.

**Mr ADAMS**—The submission is not too bad.

**Dr Curran**—If we go back to the diagram on page 3, I am pretty convinced in saying that this is not a unique insight. Every state development agency has the same model in their business plan, and everybody is investing between \$10 million and \$100 million. The trouble is that everybody is trying to do the complete picture. Nobody is sitting around the table saying, 'If you do that bit, we'll do that bit; let's work together that way.' That brings us to the model of how we make people do that—you create the incentive which says, 'If you work together, there is a bonus for you.'

**Mr SCHULTZ**—Can you give us a practical example of an embryonic process that is occurring at the moment and that places the states in the position that you just described?

**Dr Curran**—Bioinformatics is straight pool. I was involved in that cooperative research centre. Queensland, New South Wales and Victoria have invested heavily in that area—they have got regional initiatives, which we call regional nodes. Perth is developing one right now. Adelaide will not be far behind. The model was a simple one, which said, 'Why don't we then focus on what we all need? We need to share the core capabilities and pool the resources into that one.' Everyone said, 'Yes, that is a fine idea.' My argument is that we needed a modicum more investment to say, 'Let's make it happen.' As it is, probably most people are saying, 'Since we can't get to that next stage, we will just have to develop our own, anyway. We will have to be self-reliant.' That is sad. That was an opportunity missed. We are still working towards that goal and there is actually a major national facilities bid in towards that end. To use a sort of crude expression, it is like, 'How do you herd cats? You put down a bowl of Whiskas.' The bit that is missing is that little bit extra which says, 'It's in your self-interest to work together because here's your bonus payment.' And it does not need to be much more.

**Mr ADAMS**—What area was that?

**Dr Curran**—That was informatics. The same would be true of, say, an area like plant genomics where people are investing very heavily in different locations.

**Dr Wellings**—As a nation, we have not learnt to do joined up writing on these sorts of issues.

**Mr ADAMS**—It has taken a couple of hundred years on railways.

**CHAIR**—That is true. Does not this whole model you have given us really raise the key question of access? That could be access initially to identifying the potential source, which could be a spider in a cave down in Tasmania; it could be a sponge on the Barrier Reef or whatever. It could be the data and then the cooperative research depending, again, on sharing and the access to the data. That, of course, raises questions of the ownership and then who gets the benefits. It is a huge issue.

**Dr Wellings**—That, again, is why we tabled our other submission because that links back to the Voumard report that was commissioned by Minister Hill on access to biological resources. If you cannot get through that bottleneck and actually put in place a set of mechanisms that allow the public benefit institutions to keep operating and allow a proper flow-through to commercialisation to happen, then you can rip off the whole system. I mean, it would be a tragedy, for example, if you ended up with a set of recommendations on access to biological resources that said X per cent of the returns have to go to the landowner as an up-front condition, because that actually denies any recognition that the development of some product from a biological resource could take one of several paths through the commercial chain. And it does not recognise where the risk expenditure actually takes place in the commercial process. For example, if we found a spider in here and said, ‘Okay, there is a venom in it that is useful for some drug design,’ we know that the real costs are going to be in the phase 2 drug trials and that it will cost millions of dollars before it ever gets to the market. It is highly likely that a major Australian pharmaceutical company or a transnational corporation would be taking all that risk. It would be impossible to negotiate up front that X per cent of the net revenue would flow back to the discoverer of that spider.

**Mr ADAMS**—If we start off with a mining lease, the owner of the land does not gain very much. The lease is taken and the risk is in exploring for, and finding, the gold.

**Dr Curran**—In the submission there is a chart which shows the various stages of scale-up that you need.

**CHAIR**—You talk in your submission about a nationally consistent permit scheme. Can you tell us a little bit more about that?

**Dr Curran**—In terms of just a pure process, it would be nice if there was a one-stop shop in terms of collecting the permits. That is probably the less critical issue.

**CHAIR**—That presumably would have conditions for access as well. I just wonder how you could ever reach a national, universal, consistent scheme that could cover all of those.

**Mr ADAMS**—Why have permits at all?

**Dr Curran**—That is why I am less concerned about that because if you fill in another form, that is just filling in another form. It is not too onerous as long as you understand how the system works. It is the barrier to entry for other people. CSIRO and the state departments know how the system works so it is actually quite easy for them to do that. A private company coming in may be frightened off. That is one level.

The bit that concerns me more is the issue of placing an appropriate value on that resource, and I am not sure that it is shared knowledge across the country. What is a win in a particular sample—say, a potential lead drug? What is that really worth and how would you place a value on that resource early on? I am not sure whether that is a known item. Technology valuation is very difficult. It is a very tricky area in which we are pretty well underdone in Australia. It is a specialist area of expertise and very few people in Australia are able to do it. That is the biggest challenge. If the resource is made available, you cannot pull it back. Once it is out and

available, you cannot pull it back and say, 'Sorry, we did not mean to let you have it under those terms; we appreciate now that it is worth an awful lot of more.' It does not work that way.

**Dr Hirsch**—A related issue is that the wonderful spider that we discussed might occur in three different states, and the three states may have different approaches to how you put values on it, how you get it, who owns what and so on. From a pragmatic point of view, it becomes rather complicated when we as a national organisation try to operate across that.

**CHAIR**—I raised the issue because you raised it in your submission.

**Mr ADAMS**—This issue is worth exploring, as Patrick said. If somebody goes onto his farm and takes something or wants something, does he commercially sort something out with them there and then, or in the public interest do we come in and take it? For example, fish swim between state boundaries. There are a lot of those issues. Who is putting their minds to those? There must be great minds doing things.

**Dr Hirsch**—The issue of fisheries is particularly difficult. We have talked with Environment Australia as they progress the Voumard recommendations. At sea, when you put down a net, it might scrape the seabed or it might pick up some fish. Depending on whether you catch something on the seabed or in the water, there are two different jurisdictions involved. The moment you pull up the net, it becomes an ex-situ collection, as it is called, and therefore, if taken to the extreme that you need to have a permit for these things, the moment you discover what you do not need and chuck it overboard—and you might be in another jurisdiction by the time you chuck it overboard—you might have another collection. Mechanically, there are quite a number of difficult issues. And, of course, what is a native fish if it swims in different states and all over the world?

**Dr WASHER**—Environment Australia has jurisdiction to work this out under Robert Hill's portfolio—is that correct?—on this type of lease or whatever we set up for accessing biological materials, and that would be on all Commonwealth property. The big issue is what would happen if it is not on Commonwealth property. It would be a problem for them to address. How far have they gone in addressing these issues? I have not read this article on the progress of this, but is there a place in the world where they have addressed this issue and that we can plagiarise, copy or take some similarity from?

**Mr SECKER**—It sounds like a good study trip.

**Dr WASHER**—The Americans may have addressed it.

**Dr Curran**—In a country like Costa Rica, which is a single state, it is quite straightforward—the government says it is this way and it is done.

**Dr WASHER**—Is it working, though?

**Dr Curran**—It worked very well, yes. That was a major centre of bioprospecting for a number of years. You can argue that the companies effectively mined it and then moved on, and that is why there is a great deal of interest in Australia. We are unique. One feature—there is a reference to this in the submission—is that many of the species are found only in Australia. If

you go to Costa Rica, you can go all around the different islands and get the same thing. You come to Australia and 85 per cent of it is only here. It is a unique resource. That mention of Costa Rica and people losing interest was because people picked the low-hanging fruit, they got some benefit out of it, and so why would they hang around any longer? It is a finite resource in the sense of how much interest there is in commercial development, because you do not do the hard stuff; you move on to the next, hopefully more fertile, ground.

**Dr Hirsch**—There is a related issue to which I am afraid we might be harking back. Environment Australia has come forward with one model in the Voumard report. If you were a private company wishing to set up operations in Australia, you would look carefully at where you could do that in the easiest way. Therefore, you may have a system for Commonwealth areas and you might have answers for state areas and so on, and it tends to get rather confusing for companies. They may not necessarily follow the rules or whatever, I do not know.

It means, of course, that if you are chasing specific resources, as they do with certain collections, and as we in fact do ourselves, the lack of access to even a central repository where the rules are makes things rather difficult. In the case of entomology, where there is a bioprospecting project going on, in order to operate nationally, John Curran had the arduous task of working out what the different permit systems are in different jurisdictions in which the research program operated. I believe—and John may correct me if I am wrong—that there were about 40-odd permits to be obtained for operating a particular research program. Some of these permits were pretty straightforward.

**CHAIR**—I think he made us aware of that.

**Dr Curran**—I may have overemphasised that!

**Dr Hirsch**—The difficulty, and we raised it before, is that because people have seen large profits being made, there might be an undue expectation about what could be made. Some of these permit schemes, as far as I have had a look at them, suggest quite strongly that you need to say exactly what you will find, and we are sometimes talking about a scientific expedition to go and find a new plant, or whatever, when you may not know what you are going to find at any point in time. It is difficult to have one size fit all in all these things. Keep in mind that we operate also as a research agency in addition to doing some bioprospecting. In order for us to do our research, we do need to go and do discoveries in the field. It makes the operation of it sometimes difficult.

**Mr ADAMS**—Can we just get a lead on where we are in the world? How far behind are we? Do you have a measure of that to some degree?

**Dr Wellings**—This is on bioprospecting?

**Mr ADAMS**—And processing.

**CHAIR**—Bioprocessing.

**Mr ADAMS**—Where are we?



**CHAIR**—Bioinformatics, genomics—

**Dr Wellings**—I think the conversation we have had so far has focused quite heavily on the technical issues around bioprospecting—how do you actually get to an active molecule out of a piece of biota? I think there is a separate industry debate happening about bioprocessing and it would be quite useful to come on to that. I think, in terms of bioprospecting, the world has not even scratched the surface yet about what it could do and so, while it is hard to say whether Australia is ahead or behind, the one thing that you can say with some degree of certainty is that nearly every nation is at the bottom of the S-curve of discovery.

**Mr ADAMS**—So we have a great opportunity.

**Dr Wellings**—We are all sitting with the same sort of opportunity. The Australian opportunity is particular, because 80-odd per cent of our biota is endemic. There is a lot of it. We have got eight per cent, or whatever it is, of the world's biota in this country and so we are the only developed country in the world which is mega-diverse. You have to go to Indonesia and Brazil and places like that to find other mega-diverse countries.

**Mr ADAMS**—I am not familiar with the term 'biota'.

**Dr Wellings**—Basically, it means all living things.

**Mr ADAMS**—And 'biodiversity'?

**Dr WASHER**—That means that they are diverse—different.

**Dr Wellings**—Yes. And biodiversity is used to apply to ecosystem, population and species, all the way through to the molecular issues. It is an omnibus term that covers anything from the gene through to the ecosystem, whereas biota tends to refer to the diversity of species that are there.

**Mr ADAMS**—Thank you.

**CHAIR**—Let us move on to bioprocessing. If I could just ask a fairly simple question firstly, you do mention public awareness in your submission, and in your opening statement you referred to the new age of many of our primary industries. How would you address the challenge, when many of our own government departments indicate to us that they do not see primary industries in terms of the new age technological development? It is on the public record that AFFA, when they were with us, spent a lot of time talking about bush food when we were wanting to know about new bioprocessing opportunities in regional areas. We did not feel that bush food fitted that high technology end of primary industry. There does seem to be a fairly large challenge there. If government departments seem to be struggling with that concept, how on earth is the general public to become aware of these things, or are they more aware than some of our own departments?

**Dr Curran**—One of the challenges, if you go to that end of bioprocessing, is that it is very new everywhere in the world. One of its biggest proponents is DuPont. They are currently building the first two plants. It is not as if there is a whole industry base around the world and

we are looking to see whether we can play catch-up. The reality is that, at that end of the business, the game is only just starting. You can imagine the capability in Australia with our very effective agricultural primary production. We produce some of the cheapest Xs, Ys and Zs. For example, with sugar, if you see sugar purely as an energy resource to grow into microbial fermentation, we would be competitive because we have highly efficient industries.

What we do not have is the answer to the question, 'What would you then ferment?' That is the next challenge. The answer is that people are exploring those boundaries right now around the world. What feedstock would you want to produce to go into manufacturing of polymers? The reality is that, if you try hard enough, you will find a bacterium that will produce any sort of polymer you ever wanted to manufacture a product; they exist. If you can grow them cheaply enough, you can make polymers without needing to access petrochemical feedstocks. That is the sort of game plan that a number of the large companies are just embarking on.

It is an unclear answer around the world, even with the people at the forefront. They are exploring the boundaries now. Some of the things they plan to produce are very early products to feed into manufacturing. They are not particularly sophisticated. You often hear people say, 'Ethanol is a good one as a replacement for petrochemical feedstocks.' That is true. In the submission you see things that DuPont are doing about early stage feedstocks into polymer production for fibre production for textiles. How far can it go? Can we get in on the ground floor rather than trying to catch up?

**Dr Wellings**—There is a reference on page 28 of our submission to the long-term vision of DuPont. It states that 25 per cent of its revenues in nine years time will be from non-depletable raw materials such as carbohydrates. That is actually saying that they are going to grow particular types of crops that they can then put into a zero waste, zero emission loop back into their plants to produce particular products.

**CHAIR**—Are these likely to be genetically modified crops?

**Dr Curran**—They could be. In the model that they are actually using, they are growing straight corn as a feedstock for the modified bacterium that does the conversion step. So it is a genetically modified bacterium in a closed environment, in a fermenter. They use the corn as the feedstock into that.

**Dr Hirsch**—We could use things like sugar. What are we producing out of the town of Mackay? We are producing white crystalline sugar in nice paper bags for supermarkets. What if a whole cluster of industries around the town used the sugar as an intermediate product for some subsequent development? Is it just cheap sugar or is it actually pharmaceutical molecules or whatever coming out of there? Perhaps a vision and paradigm shift are necessary here.

**Dr Wellings**—If you look at the size of DuPont, 25 per cent of its revenue within nine years to make that change actually says that our primary industry sector needs to be intersecting with those major multinational corporations that are looking to make that shift in how they are going to get their products into the marketplace. The CSIRO is not qualified particularly to help you with that, but there are people from DuPont in Australia—Leo Hyde, for example, who is the director of R&D—who are absolutely articulate about what they are trying to do on this issue. I think the committee would benefit from approaching Leo and seeking some feedback from him.

I am sure that he would be interested to do that. Leo Hyde is based in Melbourne. But what I do not have is the mind map that says which other major corporations are moving off and which are the boutique areas that we could move into. That is where the real returns for Australia will be. If we focus on bioprospecting and assume that there will be a cure for AIDS under every saltbush in Western Australia, we will be sorely disappointed. This is the main game in town, and it is about a structural change in a number of major industries and using quite different feed stocks to arrive at novel products that they want to give us as consumers in 10 years time.

**CHAIR**—And these could be located within regional areas?

**Dr Hirsch**—That is exactly right. And that is where the disconnection comes between the axis and the industry. It may be that we do find a saltbush in Western Australia, or wherever, which will do some wonderful things for us. But these days, we would extract the gene and then we do not need the saltbush anymore. We can put the gene into a bacterium that can make the wonderful chemical or pharmaceutical from sugar or anything. Unless you actually either have control of the whole business chain or understand where the shifts occur, and then build in both of them, you might lose it anyway. If it is just a gene, you can export the information in the gene. The knowledge is the important thing, not the plant itself.

**CHAIR**—This raises the impact on the environment. In your submission, you are very positive about this and you say that there do not necessarily have to be negative impacts at all.

**Dr Curran**—I will give an example. We were talking about industrial bioprocessing—that is, producing products in various ways. If you look at the environmental and bioremediation sides, genes that can clean up pesticides were found in Australian insects and in Australian microbes, and they have been isolated. They can be used to produce enzymes that can be used to clean up pesticide residues on fruit, in run-off water or whatever. That is the relationship between CSIRO and Orica. The important point is that you have got to the point where you have a GMO producing the enzyme, but you never release the GMO, you release the enzyme product, so you are not releasing a genome into the environment. But because it is an enzyme, it is a catalyst. You need tiny quantities. Where you produce that is almost immaterial—it is wherever you have a relatively small-scale fermenter. I cannot remember exactly where the location of choice will be right now—I think it is in Melbourne—but it does not really matter; it is where you had the fermenter.

**Mr ADAMS**—It is not a blast furnace?

**Dr Curran**—No. You need the ability to brew beer, in effect.

**CHAIR**—It is like high-tech moonshine.

**Dr WASHER**—You could do it at the back of a house.

**Dr Curran**—But you would produce an extremely valuable product that is very low volume, and it would make an awful lot of sense, if you were trying to clean up water run-off from cotton, to locate the production there.

**Mr ADAMS**—A bacterium was used to create copper in the copper mine in Queenstown in my electorate, but there was talk about it being used with wood fibre—crunching it up to make pulp. It is an endless application—this is just the beginning.

**Dr Curran**—As a nation, we are quite advanced in biomining and bioremediation. It is the industrial side of bioprocessing that we are really scratching our heads about. What difference could we make? That is when we point back to where we have the natural attributes which say that we could make a big difference, but where would we focus?

**Mr ADAMS**—That is going to be a strategic issue.

**Dr Hirsch**—In scientific articles today there are a lot of wonderful ideas, and a lot of them will never come to fruition but, 10 or 15 years down the track, some of them may well do so. A lot of work has been going into extracting spider genes and putting them into goats to make milk with special fibres in them so you can make silks. All that is just hypothetical—pipedreams, perhaps—but there might be an element of truth in it. Do we want to be in that game or not?

**Mr ADAMS**—The laser was such an example.

**Dr Hirsch**—Yes. These things are there, and we should be ready to capture them when they are there. Some of them may be a matter of producing a GMO crop which might produce an oil or starch or whatever which today may be unacceptable for a lot of jurisdictions for good reasons, but it may be that we can address the specific issues from a technical aspect at least to overcome some of these concerns. There may be great market opportunities—certainly, there is a lot of work going on around the world—and some of them may or may not be GMOs; it may be a matter of using the technology to identify a specific gene, or it may be in a bacterium already, from which to produce new chemicals.

**Dr Wellings**—That is the link with bioprospecting. The vast majority of worldwide bioprospecting involves collecting an organism, screening molecules in that organism using various combinatorial chemistry techniques, finding molecules that have particular properties and then throwing away the wild animal that you have and actually saying, ‘Can I now synthesise that molecule using traditional chemistry and actually build that molecule so that it then leads into a new drug or something like that?’ Australia is not actually going to be able to sit right across the value chain that goes all the way from the organism to the palatable pills that you buy in a jar in a pharmacy. However, we might actually be able to say that there are some niches that require to be near to the points of collection and elucidation of what the active molecules are so that we can actually be part of the value adding chain in that pipeline of activity.

**Mr ADAMS**—But we will have to get some control over crunching up bugs and material so that the information is ours. We have to have a regulatory regime which says if you go against that you will get crushed.

**Dr WASHER**—So I guess what you are saying at the end of the day is that we will see more and more—we would think anyway—specialised things like crops, et cetera, for purposes that are designer made. They have nothing to do with say, eating, but are used in terms of manufacturing or processing for plastics or oils or whatever. That is the great point about value

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adding. To summarise, we cannot take the land mass of Australia and put it somewhere else. It has a big land mass and it can grow a lot of crops so it seems logical that we utilise that.

Just to extrapolate that a little further, there are mining and agricultural concepts that we can do this with. This applies to mining and the clean-up processes I think you mentioned, and also to some of the new leaching and extraction process which are also involved. That is not an old-world economy. There is the possibility of a great new-world economy if we keep progressing it. What is your opinion of states that put blanket bans, with no rationality, on the progress to planting out these types of crops?

**Dr Wellings**—This is specifically in relation to the GMO concept?

**Dr WASHER**—Yes. But if we had a mutant crop that was not genetically modified, I am sure that they would have to ban that too.

**Dr Wellings**—I think there are always mutant crops out there. I think in any population of organisms, there are always going to be mutations and outriders in the population. In fact, we have exploited those outriders for producing novel horticultural products. For example, we have all eaten radishes in our salads. The radish, as we buy it and use it now, is a construct of French horticulture in the last 200 years. No-one knows where the modern radish came from because you cannot actually go back far genetically to work out what the origins of wild radishes were and how they were bred together to produce what was essentially a greenhouse construct in some part of France.

We think about that quite happily—in fact, we do not even think about it any more, we just eat radishes. I think there is an important social debate to be had about people's certainties of the risks associated with genetically modified organisms. CSIRO would not say that citizens are wrong and you should just foist any old crops into the system and that people should then just live with that. I think there is a real social dialogue with any technological change. A hundred years ago, the motor car was seen as a radical departure in the forms of transport and there were long public discussions about the loss of horses and carts and the transition to cars, people walking ahead of cars with red flags and all those sorts of things. And that was part of society's understanding of risk.

The reality is that a great many people have died in cars over the last 100-odd years, and we have come to a conclusion that the benefits of having those sorts of motorised vehicles outweigh the risks for individuals. Somehow we have made that transition. I think there is a real issue in Australia, and in other parts of the world, about getting a proper dialogue on what the community understanding of risk is. Risk is composed of two parts—the hazard and the probability of that hazard happening. We can all focus on the hazard quite quickly—for example, smoking is dangerous—but most of us cannot focus on what the actual probability is about whether it would be dangerous to us as individuals, and so that is why you see all sorts of responses. So I do not think CSIRO is ever going to be in a position that says one state's decision is bad and another state's is good. I think we are going to be a position of saying, 'How do we build public confidence and public understanding so that there is a proper social discussion about how the technology is taken up?' That is our preferred position.

The other thing I would say, as part of that, is that CSIRO receives its funding on a triennial basis. At the last triennium, which started a year ago, we made a new \$2 million investment to look at the ecological risks of genetically modified organisms, and we have set up a specific program amongst our biodiversity researchers, not our industry researchers, to try and elaborate some of those environmental risks and provide input for places like Biotechnology Australia and these sorts of committees, in order to say, 'How do we build understanding of those risks?'

**CHAIR**—Do you see a risk in the public with a number of end products from bioprocessing, and that that could lead to confusion and create the same level of fear as exists in regard to the genetic modification of crops?

**Dr Wellings**—I think that is an interesting question. All of us go to the supermarket, all of us buy soft cheeses; nearly every soft cheese that you buy in Australia is a product of bioprocessing, and nearly every one of those cheeses has a genetically modified bacteria somewhere in the production chain that gives you the Australian camembert or whatever cheese you are buying. None of us ever thinks about that as an issue unless we have particular allergies to the fungi or the bacteria that are used in the cheese process.

**Mr ADAMS**—Is beer similar?

**Dr Curran**—Certainly in Europe it is; I am not sure if it is in Australia.

**Dr Wellings**—But I think there is a risk that if we got it wrong we could confuse the public's certainty about bioprocessing with their uncertainty on genetically modified organisms. It is a fragile thing, and I think we could break it quite easily if we wanted to.

**Mr ADAMS**—They got mad cow disease mixed up with genetically modified food. That is what is going on at the moment, and it is just crazy out there; it is just absolute rubbish.

**Mr SECKER**—In one letter to the paper, we had thalidomide confused with genetic modification.

**CHAIR**—You made a very telling point in your submission about the vision for these high-tech industries for the future and, in particular, in the regional areas. You have touched on a number of aspects that I think would achieve that—in particular, the targeting of niche development. Are there other aspects to achieving that vision for regional areas that we have not touched on that you think could be achieved?

**Dr Curran**—A comment, which I think I have made before, is that, for example, with the issue of petrochemical feed stocks, if we looked, as a nation, at what our position needed to be in regard to accessing raw materials—petrochemicals or their substitutes—then in the long term that would drive us in certain directions, and that would start bringing in the focus. So do we really need to find alternative ways of producing certain polymers? If the answer is yes, then that sets a certain train of research endeavour and commercialisation in place. If the answer is no, and we are confident that we will rely on always having access to petrochemicals, then why would you pursue that other path? Those broad things which say, 'At the end of the day, we need to be self-sufficient as a nation in X, Y or Z,' could directly impact on how we then start developing these technologies.

**Mr ADAMS**—You used the word ‘polymers’—just give me a run-down on that, will you?

**Dr Curran**—Polymers are any chemicals which involve long chains. Starch is a polymer; the way it is gooey and stretches is because it is a polymer.

**Dr Wellings**—So it is the same unit replicated.

**Dr Curran**—It is the same unit replicated over and over again. The fabrics of many of the materials that we use are in fact polymers, so polymers are a very common structure of a chemical.

**Dr Wellings**—Yes. You break down plastics and so on.

**CHAIR**—Are there any other points that members want to make? Are there any areas that we have not covered in our questioning that you would like to raise with us?

**Dr Wellings**—John raised an important point in his last statement, which is about having a line of sight on resource availability in Australia. My memory of oil discovery in this country is that it is a long time since we had a major field discovered, so at some point oil will run out on current rates of use. We have more gas at the moment, but 20 years after the oil runs out the gas will start to be depleted. We can say with a degree of certainty, in the absence of a new discovery, that a very large balance of trade issue will open up for Australia, and we know roughly what that will cost the nation.

Some of the bioprocessing issues about how you use things like corn as a substitute for hydrocarbons in producing novel products that we want might be part of the resolution for us as a nation about how we deal with that balance of trade gap. I think that is a bit of analysis that I cannot do in my head—and I am not an economist; I am not qualified to do that in my head, anyway—but it is an interesting question for the committee as to how to resolve where the bioprocessing industries as new boutique areas might actually be able to backfill on major resource shortages for the future. That is a long-term strategic and visionary issue.

**Dr WASHER**—There are some really good stories coming out of this—as you say, in the discovery of enzymes and things like that, and also the environment. One of the problems in any new science—and I am talking not only about genetic modification but any new science—is that there is anxiety that often comes from so-called environmental groups. The story is that, very often, new science is very good for the environment. The clean-up of oil spills, sulfide soils, pesticides, et cetera—all those nightmares that we have—is sorted out by new science. I am not just talking about genetic modification, I am talking about new science—finding new bacteria, novel enzymes or whatever. Is there any way we can get across that message to promote new science, which is part of encouraging bioprospecting and all these types of things in investment? Who would we address to get that? Would we go to Environment Australia? Are they up to that at the moment to do that for us?

**Dr Wellings**—There are two or three routes into that. On the one hand, CSIRO has a national awareness program, and we put out regular stories and have science briefings. Many of you will have been to our lunchtime science briefings that take place once a month. One of the things that we could do, for example, at the end of this process is to have an assemblage of stories that

talked about where the new bioprospecting and new bioprocessing technologies are taking us. I do not know whether we have ever done that as an organisation. There would be many other war stories that we could tell in terms of where we have made investments and where we have made discoveries.

The other group that has some resource is Biotechnology Australia, which is a whole-of-government meeting ground around biotechnology, and they do have resources for national awareness. Again, it should be possible for that group to do some analysis about where the opportunities are and what Australia has delivered in some of these areas—because they are all embryonic—to date and where they might go in the future. There are a couple of pathways within existing programs.

**CHAIR**—We would be particularly interested if you were to hold a seminar like that. It would be excellent.

**Mr ADAMS**—We are also interested in scientists talking positively about this. The debate is very one-sided and very—

**CHAIR**—It is very new.

**Mr ADAMS**—It is new, but the debate is very limited without knowledge. We need people who have authority to say things within the debate, to build up some knowledge out there in the public arena, to give it some credibility.

**Dr Curran**—One of the challenges too, which we have all experienced again today, is the use of certain terminology. We try and have very specific meaning, but we drift too when we are probably meant to be closest to it. We try to communicate that in fact there is a large amount of bioindustry which is nothing to do with genetic modification. It is nothing to do with bioindustry per se; it is actually just using biological resources to our own ends. When we start with food, do we have a problem? No, we understood it fully. Unfortunately, we use an interesting set of constructs carelessly.

**Dr Hirsch**—The chair referred earlier to moving the debate, but also to making sure that the entire population is with the debate so that it goes forward. So it is not just the science boffins talking about how wonderful it is and how we can solve the problems of the world, but rather a general awareness on the receiving end of what it actually means. I think there is an enormous task. In my own little mind, I was quite disturbed to hear what you said about Biotechnology Australia when they were asked questions about where to from here.

**Dr WASHER**—Not as disturbed as I was.

**CHAIR**—We were fairly concerned as well.

**Dr Hirsch**—What it means to us is that there is an information gap in the bureaucracy we deal with.



**CHAIR**—I think the seminar is an excellent idea and you should invite AFFA and Biotechnology Australia and make sure that they are all there. We have exhausted our formal questioning. I thank you very much indeed once again.

Resolved (on motion by **Dr Washer**):

That, pursuant to the power conferred by section (a) of standing order 346, this committee authorises publication of evidence given before it at the public hearing this day.

**Committee adjourned at 5.57 p.m.**