Cynulliad Cenedlaethol Cymru
The National Assembly for Wales

Y Pwyllgor Menter a Dysgu
The Enterprise and Learning Committee

Dydd Mercher, 21 Mai 2008
Wednesday, 21 May 2008

Cynnwys
Contents

Cofnodir y trafodion hyn yn yr iaith y llefarwyd hwy ynddi yn y pwyllgor. Yn ogystal, cynhwysir cyfieithiad Saesneg o gyfraniadau yn y Gymraeg.

These proceedings are reported in the language in which they were spoken in the committee. In addition, an English translation of Welsh speeches is included.

Aelodau'r pwyllgor yn bresennol
Committee members in attendance

Christine Chapman	Llafur Labour
Alun Davies	Llafur (yn dirprwyo ar ran Jeff Cuthbert) Labour (substitute for Jeff Cuthbert)
Gareth Jones	Plaid Cymru (Cadeirydd y Pwyllgor) The Party of Wales (Committee Chair)
David Melding	Ceidwadwyr Cymreig Welsh Conservatives
Sandy Mewies	Llafur Labour
Janet Ryder	Plaid Cymru The Party of Wales
Kirsty Williams	Democratiaid Rhyddfrydol Cymru Welsh Liberal Democrats

Eraill yn bresennol
Others in attendance

David Caldwell	Cyfarwyddwr, Universities Scotland Director, Universities Scotland
Yr Athro/Professor Maher Kalaji	Pennaeth yr Adran Gemeg, Prifysgol Bangor Head of Chemistry, Bangor University
Yr Athro/Professor David Knight	Athro Cemeg Organig Synthetig, Prifysgol Caerdydd Professor of Synthetic Organic Chemistry, Cardiff University

Swyddogion Gwasanaeth Seneddol y Cynulliad yn bresennol
Assembly Parliamentary Service officials in attendance

Dan Collier	Dirprwy Glerc Deputy Clerk
Dr Kathryn Jenkins	Clerc Clerk
Ben Stokes	Gwasanaeth Ymchwil yr Aelodau Members' Research Service

Dechreuodd y cyfarfod am 9.01 a.m.
The meeting began at 9.01 a.m.

Cyflwyniad ac Ymddiheuriadau
Introduction and Apologies

[1] **Gareth Jones:** Bore da. Croeso cynnes i chi i'r cyfarfod hwn. Fe'ch hatgoffaf i ddiffodd unrhyw ffonau symudol neu ddyfais electronig arall. Yr ydym wedi symud y dodrefn o gwmpas heddiw er mwyn hwyluso'r sesiwn fideo gynadledda. Nid oes angen i unrhyw un gyffwrdd y meicroffonau. Nid ydym yn disgwyl ymarfer tân felly bydd rhaid i ni gael ein tywys o'r adeilad dan

Gareth Jones: Good morning. Welcome to this meeting. I remind you to switch off any mobile phones and any other electronic devices. We have moved the furniture around today to facilitate the video conferencing session. There is no need for anyone to touch the microphones. We do not anticipate a fire drill so we will have to be led out of the building under the guidance of the ushers if

gyfarwyddiadau'r tywyswyr os bydd unrhyw argyfwng. Mae'r cyfarfod yn ddwyieithog ond bydd yn uniaith Saesneg pan ddefnyddiwn yr offer fideo gynadledda. Mae clustffonau ar gael ar gyfer clywed y cyfieithiad o'r Gymraeg i'r Saesneg ar sianel 1, ac mae sianel 0 yn chwyddo'r sain. Bydd cofnod o'r cyfan a ddywedir yn gyhoeddus.

there is an emergency. The meeting is bilingual but will be in English only when we use the video conferencing system. Headphones are available to receive the interpretation from Welsh to English on channel 1, and channel 0 will amplify the sound. There will be a record of everything that is said publicly.

[2] Yr wyf wedi derbyn ymddiheuriadau gan Huw Lewis a Jeff Cuthbert. Mae Alun Davies yn dirprwyo ar ran Jeff. Mae Alun Cairns wedi anfon ei ymddiheuriadau hefyd, a chredaf y bydd Kirsty Williams yn ymuno â ni nes ymlaen.

I have received apologies from Huw Lewis and Jeff Cuthbert. Alun Davies is deputising for Jeff. I have also received an apology from Alun Cairns, and I believe that Kirsty Williams will join us later on.

9.02 a.m.

Tystiolaeth i Ymchwiliad y Pwyllgor i Gyfraniad Economaidd Addysg Uwch
Evidence to the Committee Inquiry into the Economic Contribution of Higher Education

[3] **Gareth Jones:** This is a videoconferencing session. I hope that we are linked up with David Caldwell, the director of Universities Scotland. Can you hear us, David?

[4] **Mr Caldwell:** I can hear you, and I hope that you can hear me.

[5] **Gareth Jones:** Yes, we can; we have a connection. Thank you, David. It is good that you are giving us your time in this way. We are all looking forward eagerly to having an exchange of information with you this morning. We are very grateful for your paper, which we have all read. The format of the session is that you will give a presentation for around five to 10 minutes, and then there will be an opportunity for us to ask questions. Are you happy with that?

[6] **Mr Caldwell:** I am very happy with that. I will probably take no more than five minutes, at most, in order to allow as much time as possible for questions.

[7] **Gareth Jones:** Thank you, David. We will start with your presentation.

[8] **Mr Caldwell:** The first thing that I wish to say is that I am very pleased to have this opportunity to give evidence to your committee. My only regret is that I cannot be in Cardiff with you. Unfortunately, I had an evening engagement in Edinburgh yesterday and I could not get away in time. So, we have to make the most of the video-conferencing facility. I warmly welcome the opportunity to give evidence, because it seems to me that one of the real benefits of devolution is that we are able to learn from each other. I have learned a great deal from talking to colleagues in Wales and I think that there is a lot that we can learn in Scotland from what you have been doing in Wales. I welcome the opportunity to contribute to your inquiry, particularly as it focuses on an issue that we, in the Scottish universities, have considered to be of particular strategic importance.

[9] In the last few months, we have been heavily engaged with the Scottish Government in talking about the economic impact of universities, which we believe is really very considerable and takes a variety of different forms. One important aspect is, quite simply, that

universities are very big businesses in their own rights. They are large spenders and they are very large employers. Typically, in most of the cities where universities are located, you will find that the university is either the largest employer or one of the largest employers and, of course, it goes far beyond that. Among the service industries in Scotland, the universities are one of the biggest foreign currency earners for the country. That is really a tremendously important and growing factor. They are also the seed bed for the development of the highest level skills and innovation, on which we are convinced that the future economic prosperity of developed countries crucially depends.

[10] The way that I put it is that there is an economic choice for countries like Scotland and Wales to make. They can either take what I would call the economic high road or the economic low road. The low road is one on which you do your best to compete on price and try to keep costs as low as you possibly can. The difficulty with that approach is that many countries are developing very rapidly with lower labour costs than we have. We have already seen the export of unskilled and semi-skilled jobs, on a very large scale, to these rapidly developing economies and, increasingly, we are seeing the export of the more skilled jobs as well. That process is going to continue. The low road, in my view, does not really offer a future. The alternative is the economic high road of high-level skills and innovation. If we carry on simply doing the same things that we have always done, others will learn how to do them and be able to do them more cheaply than we can.

[11] The future success, particularly of small countries like Scotland and Wales, depends on continuous innovation—always finding new things to do—and I think that that crucially depends on the intellectual capital and innovative capacity that is being developed in our universities. So, in a variety of ways—I have not gone through them all because I wanted to keep this opening statement relatively brief—I think that universities have a huge economic impact.

[12] **Gareth Jones:** Thank you very much for that, David. That is the very situation in which we find ourselves as well. That is the challenge, trying to forge a way ahead that is applicable and relevant to us in Wales as yours is to you in Scotland. We thank you for that presentation. We will turn now to individual questions from Members, starting with David Melding.

9.10 a.m.

[13] **David Melding:** Good morning, Mr Caldwell. You made a very important point that, as small countries, we face very similar economic challenges and I think that there were many points in your paper that indicate evidence that we have gathered and identified in Wales. I want to ask about engagement with small and medium-sized enterprises, which account for something like 60 per cent of our economic activity and, I think, even more jobs. It is a huge sector, but we often concentrate, for obvious reasons, on larger companies and industries. You refer to Scotland's fairly low level of business expenditure on research and development—the acronym is BERD. It is exactly the same in Wales; we are well below what you would expect 5 per cent of the UK to achieve. In terms of population, we are barely hitting 1 per cent of the UK figure. There seems to be a particular problem with engaging small and medium-sized enterprises. I noticed that many of the initiatives that you have pointed towards in this paper are trying to increase the interaction between the university sector and business. You say that Scotland is doing very well in terms of innovation and novel innovation, and we have found some evidence that we have some interesting examples of that in Wales. So, it seems that we have a good higher education sector and lots of ideas. If you look at intellectual property and the achievements of various academics, there is a lot going on in the university sector, but this has not necessarily been transferred to the market very effectively and there is evidence of relatively weak interaction with SMEs.

[14] Specifically, if you look at the interface organisation, a large part of which is aimed at engaging with SMEs, it is almost like a brokering arrangement, where people can put ideas on the website, I suspect, and they may attract interest from people who feel there may be a commercial application. We have received evidence that that approach is perhaps a bit too passive, and one reason for that is that sometimes ideas that are emerging in universities have an application in the marketplace that is quite different from what academics may suppose, and so they may put on the shelf some ideas that could actually be very useful in the marketplace. So, what you need is to get business people into the universities, not just have them look at a website or whatever, or have a quarterly meeting, but have them in the chemistry, technology and science departments to really see what research projects are going on and to challenge some of the assumptions and say, 'Well, actually, have you thought that this could have a very lateral application?' You need to get interaction at that level; waiting until a more finished idea is put on a website is too late. I would like your views on that, and on whether you think that the model we need has to be one that is much more integrated at grass-roots level, where businesses and research academics are, on a more day-to-day basis, talking about the commercialisation of research.

[15] **Mr Caldwell:** You raise a lot of extremely interesting points. The first part of my response would be to say that I do not think there is a single answer to this issue. This is a very complex area. Businesses are even more diverse than higher education institutions, and it is quite right to identify different categories of business and to look at different ways of stimulating the interactions you would have with them. You are absolutely correct in identifying the SME sector as one to which we must pay particularly close attention. One of the issues in relation to SMEs is that because the majority of them have a very small number of employees, they find it difficult to release the employees for a sufficient amount of time to have very close engagement with universities, and that is why I would be a little sceptical about whether it was feasible to get a lot of people from SMEs into university departments engaging very closely with academics. The people who lead SMEs would probably say that they simply do not have the employee time to release for that purpose. Some of them may; some of the slightly larger businesses—the medium-sized rather than the small—might be able to do that. It is a good idea, which should be encouraged, but I suspect that it is not the total answer.

[16] We have to look for active ways, and not simply passive ways of doing this. Interface is good, as far as it goes; it has made a significant impact, but, again, it is not the whole answer, because it is on a relatively small scale. It helps a particular kind of SME, which has already, in a sense, taken the in-principle decision that it would like to access the intellectual resources available in universities. There are other perhaps more active steps that could be taken. An idea that is quite popular in Scotland at present is that of a voucher scheme; you would give SMEs access to a voucher that could be spent on research and development work in a university—that is the only way that they could spend it. Therefore, that would be active encouragement to take a voucher of a certain value and spend it in a university where they could get the kind of expertise that they want.

[17] I agree that it is important that there is dialogue with academics, and that, if there are commercial ideas on the shelf, they should be taken off the shelf. Academics are much more commercially aware now than they were a generation ago, and most of them are genuinely excited about prospects for commercialisation. However, we must also bear in mind that that is not their particular expertise. Occasionally, you get academics that are both brilliant researchers and have a natural aptitude for commercialisation. However, we should focus our brilliant academics on doing brilliant academic work, and ensure that the right connections are made with the people with business expertise to exploit that commercially.

[18] **David Melding:** Thank you for that helpful answer, Mr Caldwell. Your last point has already been made to this committee by some of the witnesses who have come to see us—you

have echoed that strongly.

[19] I have one follow-up question. We have had some evidence that universities tend to overvalue their intellectual property, because it is still some way off the market, but they do not factor that in. One barrier to getting ideas to the market is that, when any company—but let us say medium-sized companies—then try to work on that intellectual property, they have to pay too much for it, when it is well short of the market. Do you believe that there is a problem sometimes with the overvaluation of intellectual property?

[20] **Mr Caldwell:** There have been persistent problems with regard to intellectual property and ensuring that it is appropriately exploited. It is excellent that your committee is looking at this, because one of the most important factors in determining how universities behave in this respect is the kind of signals that they get from Government. I believe that, for a considerable time now, universities have been encouraged to increase their commercial earnings and have therefore tended to take a protective attitude to intellectual property and been reluctant to sell it at less than what they believe it is worth.

[21] I am not sure that this has always provided the best answer. There is a strong argument in favour of encouraging a culture shift in which intellectual property is made more freely available. That does not necessarily mean that universities would always hand it over, but they might perhaps be a little readier to license it to potential users.

9.20 a.m.

[22] One reason I believe universities are correct in being reluctant to hand over intellectual property is that, once they have done that, they lose all control of it, and if they sell it at a pretty modest price to a commercial operation that, in the end, decides to make no use of it, the university is not then able to retrieve the intellectual property and pass it on to someone else who might make use of it. So, there are some complex issues to do with intellectual property to which we have not yet found the optimum answer, although I think that the fact that the subject is getting so much attention now is helpful and will probably lead us towards a more balanced and sensible approach in due course.

[23] **Gareth Jones:** Thank you for that.

[24] **Christine Chapman:** It is good to speak to you this morning, David. One of the witnesses we spoke to recently told us that, for the most economically disadvantaged areas—and, obviously, in Wales and Scotland, there are slightly better areas than others as far as this is concerned—we should not be worrying too much about small and medium-sized enterprises, but concentrating on getting large companies to work with universities. He felt that, obviously, we can work with SMEs, but the priority should be for the larger firms. Do you agree with that?

[25] Going back to the issues around SMEs, have you had any success working with SMEs that are quite isolated from the most economically disadvantaged communities? My experience is that they are sometimes quite isolated because they are small, they do not always network with each other, and they can be quite cynical about further and higher education and any links. Would you like to say anything about that?

[26] **Mr Caldwell:** Again, these are interesting questions. I will start with the more isolated SMEs. The example I use is of being isolated in the sense of being remote. We have a very sparsely populated area of Scotland in the highlands and islands; about half the land area of Scotland is really quite sparsely populated. The huge majority of businesses in that area are SMEs. It is an interesting example, because it is also an area that, until recently, had no higher education institution. However, in the 1990s, the University of the Highlands and Islands

project was launched, and we now have the UHI Millennium Institute, which is on its way to recognition as a full university in its own right.

[27] That is interesting in two ways. First, it is interesting in terms of the creation of a higher education institution in the highlands and islands being regarded as a very important element in the regeneration of the economy of that area. By and large, that hope has been fulfilled. However, it has also engaged successfully with the many SMEs in the highlands and islands. There was no engagement, or rather the engagement was far more limited, until the UHI project came on the scene. It would be wrong to say that there was no engagement, because the existing universities were engaging with some of these businesses, but in slightly more difficult circumstances because they were doing it at a distance. So, it can work, despite the disadvantages of isolation and remoteness.

[28] The question of whether you should bring in large firms rather than small ones is difficult. On balance, we would like to have more large businesses headquartered in Scotland. It is slightly disappointing that we do not have more cases of SMEs that grow into large businesses. Some do, but the number is relatively small.

[29] On the other hand, one might set against that the fact that the most rapidly growing sector of the economy in Scotland, as in many other countries, is the creative industry sector. It is in the nature of many of these businesses that they are likely to remain smallish, because they are about the creativity that small, close groups of people can develop. Some will grow, but not all, and, for the foreseeable future, that sector will be dominated by small and medium-sized enterprises. That is absolutely not a problem, because it is a sector that is growing extremely rapidly and in a healthy manner. In a sense, it is the strongest growth area of the economy as a whole.

[30] **Gareth Jones:** Sandy Mewies has the next question.

[31] **Sandy Mewies:** Thank you, Mr Caldwell. That was an interesting presentation, and many of the things you find in Scotland are mirrored here in Wales and have been thrown up in this investigation. One of the things that we have been talking about is the need for the maximum purpose of ideas to be identified in academic institutions. So, you might have someone in a university with a brilliant idea for doing something, but its commercial application might be rather different from what the academic is focused on. An academic institute focuses on targets that are sometimes quite different to pushing this stuff out to commercialisation. One of the methods that has been put to us of looking at these ideas and bridging the gap, identifying possible uses for them, and then exploiting them in the best way possible, is to set up what I have consistently described as football scouts at arm's length. Football scouts go around watching football matches; these people would go in and link with the our universities, they would look at what is going on in terms of ideas, see what the commercial viability is—sometimes, it will be spot on, but if it is not, they will advise and provide a link between the idea, the institute and the market.

[32] ITI Scotland seems to me to be a somewhat similar bridge between what is happening in certain fields, getting those ideas out and commercialising them. I may be totally wrong on that—I do not know—but it seems to be a similar idea. Does that work? Do you think that you need people like this? The suggestion is that they would be successful businesspeople; the people who put this idea to us were talking about highfliers in the commercial business world, who they feel would be willing to take on this task. Do you think that it is capable of working? One of my worries is where it would sit in Government and, in particular, whether it would be buried in bureaucracy. Does ITI Scotland work in that way? What do you think of that idea, and do you have any comparisons?

[33] My other question is about the enterprise fellowship, because there you seem to be

developing individuals, and you are doing it for a year with a network of mentors. How many individuals can it help and what are the success rates? How successful is that year of support? Does the support end after that year and do you hope that they pick up everything that they need from that year? Does it continue and do people go on with their successful businesses? What happens?

[34] **Mr Caldwell:** Let me start with the final question about the enterprise fellowships. I am sorry that I have not brought the data with me, but I will be happy to send them on to the committee. As it happens, I have seen a recent report on the effectiveness of the enterprise fellowships, and it was extremely encouraging. A relatively high proportion ends up in a business development of a successful nature.

9.30 a.m.

[35] There is some similarity between that programme and the knowledge transfer partnership programme, which also tries to place an individual graduate with a business to help develop the business using their intellectual expertise. That is also generally successful. Both schemes work extremely well for the businesses that are ready to take on the enterprise fellow or the graduate, but a large number of small and medium-sized businesses are not yet confident that they would be able to make use of that expertise. So, the programme helps some businesses that are ready to take advantage, but it does not help across the board.

[36] In the process of answering, I have forgotten the first part of your question.

[37] **Sandy Mewies:** It was a question about ITI Scotland—it seems to be acting as a bridge.

[38] **Mr Caldwell:** Yes, you are quite right. It represents an attempt to do the kind of thing that you are interested in. It is probably too early to give a definitive verdict on how successful the initiative has been, but the signs are reasonably encouraging. The object is, first of all, to concentrate on a limited number of industrial clusters that align fairly well with the priorities identified by Scottish Enterprise. Then, the initiative looks at market opportunities and tries to match that with the research work that is going on in the universities, and to facilitate the taking of that research to the market. As I say, the signs are reasonably encouraging, but we must bear in mind that this initiative only started a few years ago, and the process of taking a new idea to market and then getting a return from it inevitably takes some years.

[39] **Alun Davies:** Thank you for your paper and presentation this morning. I am interested in the role of innovation in the marketplace, and, like David, I was shocked to see some of the figures in your paper about the amount of money being invested by Scottish industry in research and innovation, and therefore the role that higher education takes in providing that research and innovation for industry. I am interested in how successful the Scottish Government interventions have been in delivering innovation from the higher education sector to business. In your paper you mention the biotechnical and electronics clusters that have grown around higher education institutions in different parts of Scotland. Do you believe that interventions from Government have helped or enabled those clusters to grow around the higher education institutions, or do you believe that there has been a more organic growth taking place, without Government intervention? The second part of my question is about the different tools that the Scottish Government is employing in its interventions at the moment. You have discussed the knowledge transfer grant and the proof of concept fund, and I was wondering if you could discuss the success of those interventions, and how you think that they have impacted on the ability of Scottish higher education to provide innovation to industry.

[40] **Mr Caldwell:** They have helped a good deal. There would have been organic growth in any case, but this is a way of increasing the rate of that growth and getting greater return and value from it. Virtually all these initiatives have been successful. Quite a lot of the Government assistance has been provided through the enterprise agency, Scottish Enterprise—it manages the proof of concept fund, and it has also been responsible for investment in some of the facilities to do with biotechnology and informatics. These inputs have been very helpful and have allowed these initiatives to develop and grow more quickly and to produce more economic benefit than they would otherwise have done. I think that my answer is pretty straightforward that these have been, without exception, helpful interventions.

[41] **Janet Ryder:** Further to that, we have looked at the white rose cluster of universities around York, where they have developed the business cluster as a part of the university. It has been very successfully supporting a number of small businesses to spin out from the university, but it has also done much more in encouraging businesses from outside to seep in and use the resources within the university. What they have seen, as they have worked through businesses, is a higher growth in the take-up of human resource and professional development courses by businesses—they are working directly with the university and raising the skill levels of their employees. Do you have any experience of that happening and could you suggest any areas that this committee could profitably look at in order to raise the skill levels in businesses across Wales through connections with a university?

[42] **Mr Caldwell:** I think that it is correct that continuing professional development is going to be an increasingly important part of higher education provision; we need a lot more of it. The more engagement that we have between businesses and universities on a variety of fronts, the more likely they are to see the benefits of updating the knowledge and expertise of their employees. It is true, I think, that when businesses engage with universities in one area—it may be on the commercialisation of a piece of research—it develops contacts and encourages the development of collaboration in other areas.

[43] One very important development in Scotland in recent years has been what we call research pooling, whereby, in certain disciplines, all the research expertise of Scottish universities, where it is of national and international standards of excellence, is pooled together and the universities work together to achieve maximum benefit from it. That, too, spills over into other areas. When they start collaborating on research, they begin to see the opportunities to collaborate in teaching, especially at postgraduate level, and opportunities for collaboration in a commercial sense.

[44] One important aspect, however, is not to be too parochial in one's approach to this. Some of the really big successful schemes involve attracting inward investment from outside your own country. A particularly good example in Scotland is the collaboration of the four universities that have clinical medical schools with the Wyeth corporation. That is bringing £50 million in to Scotland and will have a very significant economic impact, as well as hugely assisting the research effort that is already achieving high standards of excellence in our medical schools. There are a large number of different kinds of opportunity available here.

[45] **Janet Ryder:** Thank you. In York, they have worked across the departments within the universities and created one central research facility, which is obviously having a huge impact on their capacity. We have also seen evidence from America in the Massachusetts Institute of Technology, where the Highlands and Islands development board has a place in the MIT research centre. You talked about not being parochial, but have you seen any benefits from such a region being at the heart of such a forward-looking research establishment?

9.40 a.m.

[46] **Mr Caldwell:** I do not know much about that particular link, but I feel very strongly about the general point that international research links are absolutely vital. The cutting edge research work is increasingly being done in international partnerships, and if you do not have international partners, in many areas, you are not in the game at all. There is a statistic that we like to use that illustrates the point very strongly. We are proud of the fact that, in Scotland, although we have only 0.1 per cent of the world's population, we generate slightly over 1 per cent of the new knowledge that is being generated in the world. That equates to doing about 10 or 12 times better than our population size would indicate. That is a great performance and we are delighted with it, but that means that nearly 99 per cent of the new knowledge in the world is being generated outside Scotland. Therefore, we need not only to work on what we are doing ourselves, but we also need to be communicating with the people in the rest of the world that are generating the nearly 99 per cent of knowledge, so that we can understand it and benefit from what they are doing as much as from what we are doing.

[47] **Gareth Jones:** Thank you, David. I do not think that there are any further questions, so, on behalf of the committee, I thank you for your presentation and the exchange of ideas and views that we have had. Thank you for sharing your expertise and also your vision of the challenges ahead and how Universities Scotland faces up to those challenges. You will have noted from the questioning and the comments this morning that there is a lot of common ground in terms of the challenges, but we appreciate that your contribution has been particularly helpful and informative to us. It is up to us to make sense of all the very interesting information and evidence that we have collated so far—that is our immediate challenge. Therefore, on behalf of committee members, I thank you and we wish you and your colleagues at Universities Scotland all the very best in the important work that you are undertaking.

[48] **Mr Caldwell:** Thank you. I have enjoyed the opportunity to give evidence to you, and I wish you every success with your inquiry.

[49] **Gareth Jones:** A final note, if I may. You made reference to the enterprise fellowship; we would be grateful if you could provide us with any information that you have on its evaluation.

[50] **Mr Caldwell:** I would be happy to send you details from the recent report.

[51] **Gareth Jones:** Thank you, David, and best wishes to you.

[52] Dyna ddiwedd y sesiwn fideogynadledda. That is the end of the videoconferencing session.

[53] We will continue the scrutiny session. On behalf of the Royal Society of Chemistry, I welcome Professor Maher Kalaji, head of chemistry at Bangor University, and Professor David Knight, professor of synthetic organic chemistry at Cardiff University. A warm welcome to you. It is good to have you here, and we are grateful that you have accepted our invitation. We are also grateful for the written evidence in the paper that you have submitted. Members have had a look at the paper, and we value its contents.

[54] As for the format of this meeting, I will ask you to make a brief presentation of five to 10 minutes, after which individual Members will avail themselves of the opportunity to ask you a few questions. Is that acceptable to you?

[55] **Professor Kalaji:** That is fine.

[56] **Gareth Jones:** In which case, it is over to you.

[57] **Professor Kalaji:** Bore da. Good morning. Diolch yn fawr. Thank you for inviting us here on behalf of the Royal Society for Chemistry. I will start by emphasising the point that we are representing not just the Royal Society of Chemistry, but science in general and chemistry in particular, here in Wales. That is important because the other learned societies are giving their evidence later, I understand, and, following some discussions with them, I think that they will provide evidence that is very similar to the material that we will talk about today.

[58] You do not mind me going first, David, do you?

[59] **Professor Knight:** Of course not.

[60] **Professor Kalaji:** You may be aware that only two chemistry departments are left in Wales at the moment: Bangor and Cardiff. So, in Wales, we are working very hard with the Royal Society of Chemistry to promote chemistry at all levels. Whether we start from the grass roots at schools, with parents, or with local industries, we try to highlight the importance of chemistry and science to all these sectors, and we engage efficiently, I believe, with businesses, whether they are big companies, multinationals, or small and medium-sized enterprises.

[61] As chemistry departments, we consult with the royal society on a variety of issues related to the industrial sector in Wales. We also engage with small and medium-sized enterprises on a number of Welsh initiatives, such as collaborative industrial research projects under the knowledge exploitation fund, and we have a large number of knowledge transfer partnerships. We have been very successful, as I explained in the brief evidence that I sent to you. We engage effectively with these industries. However, we are working at a real disadvantage, because, despite the huge effort that we putting in, with the assistance of the Royal Society of Chemistry and other learned societies, there is an issue with producing the required number of graduates in Wales. We also suffer from a large funding gap, and I am sure that all Members at the table are fully au fait with that issue and agree that there is a funding gap between the model adopted in England and that adopted here in Wales. However, I understand that discussions are taking place on that, and so, hopefully, the future for us can be rosy. However, we all have to work together, and not just between chemistry departments, or chemistry departments with HEFCW; the Assembly has to support this strongly by providing the grass-roots support for the knowledge-based economy, as you discussed in your previous evidence-gathering session. That is crucial to us in Wales.

[62] **Professor Knight:** I agree very much with that last point. In the real world, across the UK, south Wales is perceived to be very much an ex-heavy industry area. Regardless of whether that is true or perceived, we lose out to the likes of Bristol in attracting small and medium-sized enterprises of the sort that are making the money now, including those working in electronics or fine chemicals, and relatively small industries.

[63] I was always interested in the Irish model, being involved with the pharmaceutical sector, and I suppose that that has probably passed by now. Ireland is getting the likes of GlaxoSmithKline to make Zantac in southern Ireland. How does it do that? Presumably, by offering huge tax breaks, which, as a method, is irrelevant to Wales. The large companies are therefore much more difficult to get here, but, without a doubt, small and medium-sized enterprises make a huge contribution. I always look at brownfield sites, such as the sites of old mine shafts, and think, ‘You could put a factory on that without damaging the environment, and create huge benefits for employment’.

9.50 a.m.

[64] The university sector is changing enormously. A much greater emphasis is now placed

on collaborative work, by getting into teams and getting together. That does not make it any easier, although it is quite nice to talk to colleagues. However, you have to try to understand their science and they have to try to understand yours, and I think that we are much better placed to do that now. There is no doubt that we are getting more aware of the business side, although the Jack-of-all-trades element comes in, of which we have to be mindful.

[65] As has been mentioned this morning, it strikes me that there is a great need for outside advice; that is certainly identified in my department. This is about getting businesspeople who surely understand business but who must also understand the science, and do so at our level. There are certainly people who can do that, because they set up small and medium-sized enterprises themselves and know what they are doing, but we need more people who can do both. There are also academics who can do that, but they are few and far between. Perhaps you should not try to mix the two because you could end up messing up both sides of it. I was impressed with the suggestion of getting businesspeople in, but only those who understand the science, because that is what is needed. We do not need more university employees to do it because some of them—without wishing to be rude about them—do not live in the real world. They have not been out there and done it, and we need people who have been out there and done it, and who have a proven track record and would understand the science.

[66] On the other end, which we are addressing, the RSC is now aware of this issue and is responsible for a fantastically successful initiative at the moment, which I think will continue, namely CFOF, Chemistry for our Future. That is just being parochial for chemistry, but I think that it also includes chemistry, physics, biology—and I might get this wrong—and information technology.

[67] **Professor Kalaji:** It is chemistry, physics, mathematics and engineering, though not all engineering.

[68] **Professor Knight:** It represents millions of pounds' worth of funding. I am not trying to be provocative—well, I am a bit—but the usual way of things is that there is Scotland and then there is England and Wales; however, with CFOF, there is only England. The Welsh funding was left out of it and left up to the Higher Education Funding Council for Wales, which has now, mercifully, been persuaded and is receptive to putting some money into it. However, that money has been held up because HEFCW is trying to co-ordinate with the Higher Education Funding Council for England, and I am not sure what is going on.

[69] The RSC has just landed £1.25 million for England to support CFOF, and I will just explain the form that it takes. That money is spent on a number of things. For example, we are planning to set up a double-decker bus as a laboratory. Bangor has already got one. You park it in a school car park and the kids can get hands-on experience of real science, such as putting in samples, running spectra and having someone to explain it to them. It works. It is fantastic to get the lab on the road, as it were. That is partly what we want to spend the money on in Wales. It has already been done in England, so we can learn from their mistakes—at least that is one advantage of being a bit late in the game. We help teachers with the administration and pay for stand-in teachers when groups of students come in. We also put teachers in our laboratories, which makes better use of them. Teaching laboratories are a big initiative, because they are empty for half the year, so filling them with schoolchildren aged from eight to 18 is pretty good news. However, that requires money and input, particularly salaries, but that is what the money is for and it is there, so we need to ensure that we get our share of it. I think that we will, because Phil Gummett is trying hard and is supportive, despite the obstacles being put in his way, as far as I see it. He is working hard for us.

[70] Therefore, that is what is happening at the other end, and it will clearly be good for the Welsh skills base. Many people will leave, but many will stay. The greater the development of that, the better, and I am just talking about the chemistry side of things, although it also

applies to physics, engineering and mathematics. It is crucial to get that right. We are now seeing more applications from chemistry students who have a mathematical qualification. Another problem that we have with teaching science is that students cannot do the maths. However, that is improving. The more we can contribute to that and the more aware of it the RSC is, the better.

[71] **Gareth Jones:** Thank you both for a frank presentation of views and comments. It is much appreciated by the Members. We have a range of questions for you now, starting with Sandy Mewies.

[72] **Sandy Mewies:** Thank you for your presentation, which was most interesting. I want you to be a bit more frank about what you were saying about obstacles being put in the way. We are a scrutiny committee and we are taking evidence, so this is your chance to express any doubts and concerns that you may have. If you go away without expressing them, you will have missed an opportunity yourself. So, that is my first request.

[73] Secondly, I think that you are referring to the Gibson review, and to the suggestion that people create links with universities. They look at what is going on and identify the commercialisation aspect or the market value and so on. You have already said that those people would have to be carefully selected to match the institution, but do you see any other problems with that? Do you agree that it is a way forward?

[74] Thirdly, I have a question about Bangor. You set up an intellectual property panel, is that correct?

[75] **Professor Kalaji:** Do you want to me to answer first?

[76] **Sandy Mewies:** I will just finish the question, and then it is up to you to decide in which order you answer. The intellectual property panel has been going for a short time and we have been told that universities sometimes overvalue their intellectual property, which may or may not be true, but that that hampers its proper use. Do you have any comments to make on that?

[77] **Professor Kalaji:** I will start with the last point, while it is still fresh in my mind. You have spoken to Bangor University, which set up an IP panel of external expert advisers that has been operating for the past 12 months, and the panel has been reviewing our IP portfolio. I listened to the previous evidence when you discussed this with the gentleman from Scotland. I will just go around the issue a bit and then come back and answer you clearly.

[78] I happen to be very fortunate in that I sit on both sides of the fence. The research that I have been doing personally has led to intellectual property and a spin-out company, which I am partly involved in. So, I am sitting on the side of the company now, but I am also sitting on the university's side—wearing its hat, as it were. I have learned quite a lot about negotiations with the university from sitting on the company's side, but I value what the university is asking for in return. A blanket statement like 'Universities overvalue their IP' is not correct, and the matter needs to be treated on a case-by-case basis. It depends on how far down the line the IP or the information has gone, so we cannot treat one in the same way as the other. Companies understand the value of their IP, and, when you bring in a company that is an expert in a particular area, it understands how far down the line the product is towards commercialisation. I do not think that that statement is correct, and the IP discussions are to be treated on a case-by-case basis. That is very important.

[79] Research in universities is still relatively cheap compared with research in industry, which is a crucial point. If a big company wants to develop the same type of IP as a university, it has to invest large amounts of money in its employees and in its laboratories.

We use PhD students and train them at the same time. So, we produce good-value products, in the form of excellent chemists who will go on to work in industry, and we produce the IP at the same time, which is related to that work. Relatively speaking, work done in universities is still cheap and I take the side of universities here in that each case has to be discussed on its own merits. The IP panel at Bangor has provided some excellent advice, with external expert advice as well, and it is proving to be a good development for Bangor.

[80] **Professor Knight:** I agree with much of that. Certainly, collaborations with industry are relatively cheap in universities, and the spin-offs are that they get access to what is usually pretty highly sophisticated equipment. As you can imagine, if a company is sponsoring one of your students, and they ask you a question that is off the project, such as, 'Could you give me some advice on this?', what are you going to do? Would you ask them for a fee? Of course not. You tell them to the best of your ability, so you are acting as a free consultant for that time. While not wanting to build up our abilities that much, one little suggestion can save a lot of money, so it is a very useful contact.

10.00 a.m.

[81] As for getting industrialists into universities, this will be much more contentious, I know that my old boss in Nottingham would have said, 'They are going to get in my way; they are going to use our equipment when we want to use it with our students.' So, it has to be handled carefully. It is a new concept as far as I am concerned—for all of us I believe—to get industrial employees to come in and work in a university on their research projects. However, it is exciting, and I would like to see it done, handled properly, and with careful thought—let us see it start. In the pharmaceutical sector, as you may know, much of the chemical manufacture and synthesis of, say, potential drug candidates, where you need to make 300 or 400 compounds, is being farmed out to India and China because it is cheaper; it is not as cheap as was thought, but it is cheaper.

[82] What may well happen in the future is that drug companies will be almost skeletal in terms of their on-site operation—it will just be planning, and the actual science will be done in universities, and we need to be the sorts of universities that will do it. If companies want a series of compounds made, or some particular aspect looked at, or some biological testing done, they will farm it out to universities. They will do so because, that way, they do not have to pay for the infrastructure, and there is an absolute cost—they know what it is going to cost, because that is all you get; if you produce, you get some more, if you do not produce, they will go somewhere else. You can see that it is economically very attractive for them.

[83] This may be a big change in the next few years, and we need to be there, to be ready to take it on board. Therefore, getting people in from outside, from my perspective, is a new idea. I have not heard much about it in the universities yet, but perhaps we should go for it, and get it right, so that we can accommodate people. It could be a very good way of generating income for us—pairs of hands to do the research and keep productivity going.

[84] Coming back to the other point, as far as HEFCW and CFOF are concerned, we have not actually started it yet. We have had the money promised to us—we have the money, as it were—but there are attempts to try to co-ordinate it more with England, quite rightly, and have us singing from the same hymn sheet. However, it is not happening at the moment, and I am not sure whose fault it is. I was slightly surprised at a meeting at the RSC last Wednesday to be told that it is not quite there yet, despite the fact that the RSC has just landed its next 11 months' money—and it is 11 not 12, again to bring it in line with what was done previously.

[85] Therefore, I do not know what is happening—I am not in the loop—but it should be investigated. It is a fantastic initiative, and it is a huge amount of money for that sort of thing. We have been fiddling around getting £100 and £200 to pay for a minibus; this is now £1

million, or £2 million across England and Wales. It is serious money, which means that some universities—Sheffield and Bristol in particular are leading it—have a fantastic input into this general outreach principle.

[86] **Sandy Mewies:** Your perception seems to be that there are delays in rolling out the programme, but you cannot outline the specific obstacles.

[87] **Professor Knight:** Yes; I do not know what they are, or why. I am sure that it will happen, because it is being driven hard by Phil Gummett.

[88] **Professor Kalaji:** I believe that HEFCW is waiting for feedback from HEFCE on this.

[89] **Professor Knight:** Yes, that is what I understand.

[90] **Professor Kalaji:** I believe that that is one of the main reasons for the delay. However, it is not just in terms of the Chemistry for our Future programme, which I highlighted in the PowerPoint slide that I sent you; it is also that the allocation model in Welsh universities is different from that in England. I believe that our colleagues at the Institute of Physics will be presenting a paper that is related to this as evidence to the committee, so I will leave it at that.

[91] Coming back to placing industrialists in universities, the first thing that I did when I took over as the head of chemistry was to appoint an industrial advisory board. I have three chairpersons from chemical companies in Wales on that advisory board, as well as someone from the Welsh Assembly Government who is working on enterprise. They will help us to start looking at the portfolio of work that we are doing that is related to industry and assist our students in understanding the link with industry. They are doing a fantastic job for us, and that model needs to be adopted.

[92] **Gareth Jones:** On your earlier point on IP, I am not disputing whether it is valued, or overvalued, and so on, but an important point was made. You said that you were wearing two hats, and it is relevant in the sense that it is the timing of the release of the IP, or the sale of it, that is crucial, because if you hang on to the IP, then you lose that opportunity. Have we the ability within our institutions to identify clearly the time interval? That is essential, because a lot of good work and intensive research could be lost if we get the timing wrong.

[93] **Professor Kalaji:** Let me start by saying that the classical model for an academic is changing. Many academics are entrepreneurial and are interested in exploiting their science. So, things are moving on. Academics no longer just sit in ivory towers, staying in their offices and thinking about their research and drawing on a blackboard. Those days have gone. Whatever you are looking at in terms of exploiting IP, any business person will tell you that it resembles an upside-down walking stick. So, you have to invest first, and then you reach the dip and then you start seeing the return. It is a matter of how far down the dip you are. When we are doing research in a university, it depends how much investment there has been and how far down the dip you are. If you have had a big research grant from a funding council or from the European Union and are working with lots of SMEs, you may be quite close to the dip. So, giving away the IP cheaply is not fair and putting pressure on the university to release it at that point is not fair. If you are near the top, then I could see the advantage of releasing the IP quickly, or you may want to grow it organically. The colleague who gave evidence before us talked about organic growth in terms of SMEs. That is very important. It depends where you are on that dip. If you are near the bottom, the IP should be expensive, and it is only fair that the university gets the return on that investment. However, if it is near the top with something that has happened very quickly, then you need to negotiate. It needs to be viewed on a case by case basis, as it depends how far down you are. If you are near the bottom, then no way should you sell it cheaply; indeed, you should be asking for a large sum of money.

[94] **Gareth Jones:** Thank you for that. We will now turn to Janet Ryder.

[95] **Janet Ryder:** I would like to pick up on two areas. The first relates to the slide that you have given us and the work that you are doing with schools. Corus, when its representatives came in to give evidence, stated clearly that it felt that the syllabus for sciences needed to be completely rewritten from early years onwards and become much more interactive and much more exciting to spark young people's interest in science and, therefore, increase the number of students going through the system. Would you like to elaborate a little on that? You touched upon one initiative of double-decker buses, although you are obviously doing a lot more than that. Do you think that we need a radical overhaul of the sciences at very early ages, starting perhaps in the foundation phase with the beginnings of experimental play in science? Should there be a radical overhaul of how we teach science and of our approach to science in the education system? How would we do that? It would mean totally retraining teachers and doubling the number of science teachers that we have, because they are now few and far between.

[96] The other issue that I would like you to elaborate on is the amount of joint working that there is. As you said, there are two departments of chemistry now, so how much do you share resources and research, and how closely do you work together? Do we look at it as one research unit in chemistry for the whole of Wales, or are they still two distinct entities?

[97] **Professor Kalaji:** You have touched upon a range of issues that encompass the whole science policy for Wales. I will start by talking about the slide that I sent you, which details our outreach activities. I am sorry that you have it in A4 format—it is clearer in A3 and in colour. The number of science students in the UK declined until about three or four years ago. Thanks to the efforts of the Royal Society of Chemistry, supported by HEFCE in a way, in starting to push chemistry—and my colleague mentioned Chemistry for our Future—we are beginning to see a return to the levels of 10 years ago. So, the number of students who are entering university to study chemistry is nearly what it was 10 years ago, which is a big improvement. Support has been given in England, but we are working on a shoestring budget in Wales, and we work together, so when you talk about sharing funding in terms of outreach activities, you are talking about sharing peanuts. However, the personnel in both departments work very hard on trying to achieve a good effort for the amount of money that we are investing in our outreach activities.

10.10 a.m.

[98] The RSC funded a part-time position in Cardiff a few years ago and it has also given us £10,000 for the one-day release of a school teacher to come to work with us in our outreach activities, and we have achieved a miraculous number of events as a result. The trick is to excite kids about science, and not just kids but parents and industrialists—I mentioned this right at the beginning, because they must all see the benefits. In terms of working with kids, you asked about revamping the syllabus. Clearly, you have to have basic science for them to understand, it is just a matter of how to present it to them in a fun way and in such a way that they can see a future in it. We put on chemistry shows, which are theatre shows, and they are oversubscribed. Kids love them. This is for nine to 11-year-olds. We hold a number of competitions, we bring kids into the universities in Cardiff and in Bangor, and we are also supported by the north-west analytical division of the Royal Society of Chemistry, which supports science in Wales in terms of competitions and sponsoring events.

[99] It comes down to personalities. Do you want to enhance the image of science and encourage these kids to study science? You need funds for that. You cannot do it for nothing. This is what we have been doing in Cardiff and Bangor; we have been working with teachers. If you look at the diagram in the top left-hand corner, you will see that the first national

conference for chemistry teachers in Wales was held two years ago in Llandrindod Wells, and that was the first cluster of chemistry teachers coming together, not in England, but in Wales, to look at issues related to science teaching in Wales.

[100] You asked about whether we need to revamp science education and what is happening in schools. We are fortunate in north Wales—I am not sure about our colleagues in south Wales—in that most of the chemistry teachers in north Wales are our graduates, so we have a direct link to them, and with a quick phone call or e-mail, we can get them all together around a table and start discussing any changes that need to be made from our end to make science more accessible. Schools have changed the syllabus for A-levels, for example: they study certain nuclear magnetic resonance and mass spectroscopy equipment, which is very expensive. We make the labs and equipment available for them to come and have a look at and play with these instruments whenever possible. So, we work hard on this, but what is taught in the syllabus is not my area. I think that it is about making science more fun and showing these kids how it applies to them.

[101] I do not know whether any of you attended the 'science in the Assembly' seminars yesterday, but everything that we touch in our lives is related to chemistry and science. I do not know whether you put on fingernail polish this morning, but, if you did, or if you have put on make-up, if you are wearing glasses, or have a coloured jacket, it is all chemistry. It needs to be brought home to these kids that these are important examples of science, and to excite them about it. However, at the end, they have to see a career. It is no good saying that science is wonderful in Wales and that you can learn everything here, and those people then end up working in Lithuania, Poland or Italy. We need the science base here; we need to enhance it and we need the industry to support it as well. What you asked about is full of minefields, and it comes back to the issue of how we fund this, how we excite them and how relevant it is to Wales.

[102] In terms of the work that we are doing together with Cardiff, we are still two separate chemistry departments. We are the only two chemistry departments left in Wales, and we are proud of being separate chemistry departments, because, in terms of the research that we are doing, we are different entities with different identities, and we have a different emphasis. We attract different companies, different research and different funding. It is not bad but good for Wales that there is that internal competition. Having just one department would kill that competition, and we need that healthy competition in Wales.

[103] **Professor Knight:** Yes, I would agree. On the question about chemical education, how long have we got? I could go on. It is a national thing, but with this Chemistry for our Future initiative, in particular, the RSC has seriously recognised that it is up to us to go out and sell chemistry better. You know what a terrible press the word 'chemical' has—it is seen as a pollutant. Then you get products that are referred to as chemical-free. Again, how long have you got? It is pathetic. However, it is no use blaming the population—it is our fault, and we should get out there and explain this to people.

[104] We are working with schoolchildren at the moment—teachers are the converted—but we are not doing much about the public. The RSC is aware of this, I am sure, but you cannot do everything at once. We have often talked about more advertising and better campaigns, but nothing has happened yet, and we need to get together with the chemical industry to do all of that. However, there is nothing in this room that you can point to that is not related to chemistry—absolutely nothing. You may think that one or two things are not chemical, but I can assure you that they are. Chemists developed, or contributed to the development of, everything in this room.

[105] **Gareth Jones:** Christine has a follow-up question—I do not know if she will dispute that statement. [*Laughter*.]

[106] **Christine Chapman:** Just to stay with the theme of education, I am pleased that the number of chemistry graduates is rising—

[107] **Professor Knight:** It is quite reasonable, and the quality seems, if anything, to be improving.

[108] **Christine Chapman:** That is very positive. However, I am still concerned, because I have been disappointed to see a number of chemistry departments close over the years, and it is quite difficult to improve that situation. I think that many young people in particular have a generally poor image of chemistry. I know of some universities that have re-branded their chemistry courses as forensic science—although that is probably not quite the same course—and suddenly, young people are interested. It seems to me that there is a real image problem here, so it would be useful if you could comment on that.

[109] Janet talked about early years, which is critical, but my next question is about the 14 to 19 age group. Is industry making the right links on that, to demonstrate to young people the relevance of chemistry? My impression is that, although young people are often enthused by the subject, which is great, they do not always see its relevance. Are the 14 to 19 learning pathways directing them towards what chemistry can offer?

[110] You mentioned the curriculum, and that relates to my other question. I read not long ago that, because of health and safety issues in schools, children are not allowed to have as much hands-on experience. That could be detrimental to science, because it is a hands-on subject, and I wondered if you had any thoughts on that. Making chemistry relevant is the key, is it not? What more can be done to show young people the opportunities in chemistry?

[111] **Professor Kalaji:** On your last point, to work backwards, it is quite right that health and safety is being taken more seriously these days at universities. It is done for the right reasons, and I would applaud that. However, you can go too far, and this is where a balance must be struck between real health and safety and just avoiding practical work at school. That is an issue.

[112] We get plenty of help from the RSC in bringing in large numbers of children from schools to universities to get hands-on experience and see experiments being done. We consult on health and safety issues with the RSC, and it has a standard format for us to follow, which has been revised over many years. We follow that to ensure that we adhere to health and safety guidelines. It is something that we cannot get away from, and it is important.

[113] As for the issue in schools, again, you would have to speak to someone from a school, but those that I speak to tell me that there is inconsistency in the availability of laboratory space and equipment in schools. Some have better facilities than others, and their students have a better experience in terms of science. Others do not, so it is a mixture—but you would have to discuss that with someone at the school level.

10.20 a.m.

[114] On your point about the relevance to industry and how you make that clearer, this is why I said right at the beginning that the effort and outreach activities on the part of both Bangor and Cardiff universities involve our going out and talking to parents, kids and industrialists. Industrialists can also be living in cloud-cuckoo land at times when it comes to teaching in schools, and so you have to bring them down to that level and make them invest in it.

[115] At the eisteddfod that is being held in Cardiff this year, for example, the science and

technology pavilion is being run by the chemistry department in Bangor. We have been subcontracted to run it, and we have done a very good job of attracting funding from industry. You have to go out there and say to the industry, 'Look, if you want the right people in future, if you want scientists in future, you must come and sponsor these things, start talking to people and show them the relevance of science.'. Events like that are absolutely fantastic.

[116] We must not rest on our laurels because we have achieved something good. We must continue going out to schools with industrialists. We will get industries involved with the idea of the bus, which I hope will be a pan-Wales bus, and they will be able to give demonstrations, showing the relevance of science to life in general. You can talk about chemistry in terms of the environment, energy, health, security and so on, and show people how relevant chemistry is to those things. The RSC produces a fantastic DVD that it makes available to teachers who go out to schools to lecture about science. The first thing that it covers is what wakes you up in the morning—either an alarm or a radio—

[117] **David Melding:** The birds at the moment. [*Laughter*.]

[118] **Professor Kalaji:** Your birds are a chemical factory, you see. An alarm or a radio has batteries; then you will switch the light on, and the DVD covers the relevance of power to that and where chemistry is involved. You will then go into the shower, for example, and the tap that you hold is made from chemicals and the hot water comes from a plant that heats it. Chemicals make up the shampoos, lipsticks, aftershaves, deodorants and all the other cosmetics and clothes that people use every day. The DVD goes through a whole series of activities that you do every day and the kids start listening and switch on. However, people are needed to do these things, and that is where England has an advantage and we are at a disadvantage; it has funding from the Chemistry for our Future initiative to appoint liaison officers to go out to schools to lecture the kids and show them these exciting things. We do not have that.

[119] **Professor Knight:** The initiative to use chemical laboratories is better and it comes down to funding to an extent, but it also comes down to will, which we have now changed to a great extent. A large facility for about 90 students used to be empty over the summer, but that will not be the case any longer—that is going to change and it must change.

[120] On health and safety, it is such a shame that kids do not mix chemicals in schools any more, but one must be aware of regulations because we will be in court otherwise. Some schools can afford a fume cupboard, but others cannot, which is very unfortunate. Some schools cannot even afford chemicals, and, on that, at least we can get them into the university and show them the practical stuff that is relevant to everything. It is not a level playing field by a long way, but I think that the RSC has realised that these sorts of initiatives are essential because there are the haves and the have-nots. Before we had our refurbishment a few years ago, some schools that I visited had better labs than we had. Others will say, 'School lab? No, we do not do that.'. Science is almost a lost cause. The image of chemistry certainly needs to be improved. We have said that over the years, over and over again, but I guess that we have to just keep saying it and keep going.

[121] As far as Bangor and Cardiff go, there is the slight problem of the five-hour drive that is between us. Driving from Cardiff to Bangor is kind of a good way to have ideas because there is not much else to do, other than look at the gorgeous scenery and think of some nice chemical ideas. That is a physical problem, but basically Bangor is serving the north Wales corridor, and I guess that we are doing the south Wales one.

[122] The frustration is not only the closure of Swansea—I will put my little soap box up—but the opportunity that Swansea University had to create something that would have included chemistry. I think that the opportunity has now gone and that it is an absolute tragedy for

south Wales, but particularly for Swansea. To those responsible for that—well, I have no comment. However, I am absolutely appalled that Swansea not only closed chemistry—I can see why it shut it—but that it missed an opportunity to create a very spectacular science department that would have integrated a number of others. There were a number of possibilities for it, and that it has not been done—I just despair, I really do. It was a massive opportunity, and it would have been absolutely complementary for us in Cardiff; there would have been no competition—there would have been pure complementarity, which is the best way to go when we are that close.

[123] **Christine Chapman:** Who is responsible for that?

[124] **Professor Knight:** The vice-chancellor, I suppose.

[125] **Christine Chapman:** Is it the Government, industry or the schools themselves, because if young people are not thinking of doing chemistry in the first place, where do we start on that?

[126] **Professor Kalaji:** It is a joint package. You need everyone to work together, including the Government, the universities and the industry. That is crucial. There is a shortage of good quality chemists in the UK, and that is why we are recruiting overseas. This is a tragedy, because we can produce them but the funding is not there to encourage that.

[127] On the point that the Chair raised earlier about re-badging chemistry as, say, forensic science courses, and issues like this, people are beginning to see the advantages of the hardcore sciences, namely chemistry, physics and mathematics. Flavour of the month courses that are driven by television programmes—

[128] **Professor Knight:** I knew you were going to say that; I could not agree more. [*Laughter.*]

[129] **Professor Kalaji:** These courses come and go; we were at the stage of considering some of them, so we consulted locally with our deputy chief constable. We looked at the opportunities for future employment. If you look at forensic science laboratories in the UK, the number of people employed in that area is very small. If you start to produce 200 forensic scientists in Wales, what are you going to do with them? So, I think that it is important to focus on the hardcore sciences. Funnily enough, that was the message we got from the deputy chief constable of North Wales Police in our meeting with him to discuss the possibility of looking at an undergraduate course in forensic science. The jobs are not there, and the police said that they want chemists, physicists and biologists, whom they will then train in forensic science in the police academies. That was the clear message that we received from the police.

[130] **Professor Knight:** To be very parochial and talk just about chemistry, chemistry closes no doors as a basic science. You can go on to become a biochemist. I am not too sure whether you would become a high-level mathematician, but you can get into chemical physics, physical chemistry and overlapping—

[131] **Professor Kalaji:** The best accountants are chemists.

[132] **Professor Knight:** The best administrators are usually chemists, which is something that I am not quite sure I understand. Many vice-chancellors are ex-chemists, which is bizarre.

[133] **Professor Kalaji:** An ex-Prime Minister was a chemist too.

[134] **Gareth Jones:** Alun Davies's question is next, but I do not know if he is a chemist. [*Laughter.*]

[135] **Professor Knight:** I strongly agree with pursuing the core sciences, and that following trends is not a good idea. The core sciences should be growing. You can branch out and learn other things and go into other specialities, including forensic science and—to mention another of my soapbox issues—environmental science in particular, which will grow enormously. I would put a gate on the number of people going into environmental science unless they had a first class degree or a 2:1 degree, because it is so important. It is a Masters degree level science, and it is horribly complicated and difficult. If someone says that they understand an environmental principle and that they have the answer to a problem, be very suspicious. Every time you think that you have solved a problem in environmental chemistry, something else will happen. Look at the Severn barrage and the arguments that there will be about it. There is good and bad on both sides, and trying to weigh it will be difficult; it is hard science, hard politics, hard economics and so on. You need a very high class of people to go in that area.

[136] **Alun Davies:** You make me feel as if I want to drink sometimes. In terms of the commercialisation of research that we have talked about, one of the issues that you raised in your written paper was that the commercialisation unit at Bangor University will deliver a new entrepreneurial culture. How do you see this unit delivering that culture? You have already said that you see academics as entrepreneurs in their own right in an intellectual sense, so how do you see a unit of this type changing the way that a university and academics within it operate or research programmes operate?

10.30 a.m.

[137] **Professor Kalaji:** Again, this is a multi-faceted question. Academics, for a number of reasons, would first prefer to publish their results. That is important, particularly for the research assessment exercise, in attracting funding to the departments. They are keen to publish in high quality journals and so on. Some of them see the advantages, or they can see something in their research that may lead to exploitation. Not everyone does that, but some may see an opportunity for exploitation. What this unit will do, hopefully, is to bring in external expert advice and talk to or engage with all academics who are undertaking research to encourage them to discuss the findings of their research with that unit to see if something can be exploited in terms of know-how, initially, or whether it has to go to IP. It is that external expert engagement with the academics—scientists in this case—to see where the benefits of the research may lead for the university. It is actually beneficial for both sides in that it brings in more income to university and to the academic, and eventually you can publish the data as a patent or as a paper. They have to be shown the advantages of going down that route as opposed to just publishing in an academic journal. The wealth of know-how in universities is phenomenal; it just needs to be exploited by getting external advice in place to start advising the academics about the benefits of following that other route. It is essential that we bring external people in to that. There are benefits to this unit, and I hope that it will deliver by taking IP exploitation and know-how forward. Does that answer your question?

[138] **Alun Davies:** It does answer the question. I would like to briefly follow that up. Have any of the Welsh Assembly Government's interventions provided support to this sort of work?

[139] **Professor Kalaji:** I can talk from the point of view of chemistry. We have been successful with the patent and proof of concept fund, with KEF and with CIRP. We have had four patents, three of which are subject to discussion on commercialisation at the moment. The PPoC has been very useful to us, because you know that the idea is there, but you need to get over the barrier of whether it is feasible or not. The KTP has been very good, as has KEF support in going that far. Once you have gone beyond that and have spun something out, you

have the SMART Cymru phases, which are very useful as well. I am talking from experience here, because I have been through those phases with a spin-out and with the university with my colleagues and their research leading to the IP being exploited.

[140] One of my colleagues gave a talk yesterday, and discussions are now taking place with a French company and with a UK-based multinational company about the exploitation of the data that we presented.

[141] **David Melding:** I will ask a slightly direct question and focus on what higher education does for the general economy. I am not going to be rude about Bangor, because I do not know anything about Bangor University. I am a graduate of Cardiff, so I will focus on Cardiff.

[142] Many good examples have been quoted, but if someone were visiting Cardiff, they would see one of the largest teaching hospitals in Europe, thriving medicine and chemistry departments, and one of the best schools of pharmacy in the UK, and next to no pharmaceutical industries in Cardiff. What is missing?

[143] **Professor Knight:** I could not agree more. That is a very good point. What is missing is, probably, huge tax breaks to attract GSK and the like, which southern Ireland used to its benefit. We used to have Parke-Davies. We have GE Healthcare, so there is one, but it is pretty small, really. I agree, and I just wonder if this is to do with the image of south Wales, with people perhaps thinking that it is all mining and steel and big spanners down here and that the fine chemical sector does not match up with that. The heavy chemical sector might, but we do not even have that, as it is all elsewhere, in Liverpool, Runcorn, Middlesbrough and those sorts of areas. There has never been a tradition of heavy chemistry down here; it has always been iron and steel.

[144] **David Melding:** I have heard a contradiction to that, in that Cardiff is quoted as one of the top 10 small cities in Europe by the *Financial Times*.

[145] **Professor Knight:** That is something to bear in mind. We may have missed the boat, because, as I say, a lot of the pharmaceutical work is being shipped abroad. Some of us are hoping that they will get their fingers burned. Can you imagine intellectual property in China? That could be a bit risky. However, the contacts that they have in India are proving good, both on the discovery and production sides. They are making tonnes of stuff much more cheaply, partly because they do not have the same safety regulations as us—to be frank, you can save a lot of money if you can tip the stuff in the local drain. That is what goes on but it will stop very soon in India. The Indian education system is very good and many people will not wear this for much longer. Even in China, the Yangtze river is yellow because of chemicals. They suppress their revolutions in China, but they do not in India. It will cost. It is a very volatile situation.

[146] From that point of view, this might not be the best time to think about attracting too many big companies here. If you can, and if they are prepared to come down here, then do it, as long as it does not cost too much, because they might be off very soon. In my view, it is a dodgy time at the moment, particularly with how the stock market is going. Very big changes may be coming soon. However, looking to the past, perhaps you need a social scientist rather than a chemist to explain it. For example, the chemistry department in Cardiff was not that wonderful years ago; it was a good, steady department, but it was not exactly hitting the headlines. I cannot believe what has happened now—I pinch myself when I think about how much has been put into it. It has cost a huge amount of money. I think that around £23 million has been put into it, and we have raised some of that ourselves, in order to create a department that can compete with Manchester, Bristol, Nottingham and so on. If you want us to compete with Oxbridge, it will cost another £23 million and more, but that may be unrealistic; perhaps

there can only be one Oxbridge in the UK, if I can put it like that.

[147] In terms of numbers of staff and income, we are now on a par with those universities, but we have to keep doing this for a number of years, and the next research exercise will be crucial. However, you raise a good point—where is the fine chemical sector in south Wales? It is just not there, but it is over the water in Avonmouth and such places. AstraZeneca International has a big development there. We do not have chemistry in south Wales, which is a great shame for us. We could try to develop it, but I would err on the side of caution at the moment. External advisers would probably say the same: be very careful and if you have some money to invest—watch it. I suppose that that has always been true.

[148] **Gareth Jones:** I believe that Kirsty and Christine have a few follow-up questions.

[149] **Kirsty Williams:** You say that south Wales may have an image problem. When Corus representatives came here, they said that they found it difficult to attract graduates to work in south Wales because people did not want to come to Wales—they have a misconception about Wales. I spoke to a company yesterday, the new chairman of which could not understand why they were still based in Cardiff; he thought they would be better off based in Oxford. That company found it difficult to attract venture capital to develop its spin-out, because of where it is located, people's preconceptions, the time that it takes to get from London to Cardiff on the train and so on.

[150] **Professor Knight:** That is such a frustrating misconception. I trained in Nottingham, which has the same journey time, but it does not have this trouble.

[151] **Kirsty Williams:** As universities, do you find it difficult to attract the kind of staff that you need? Do you have to run your departments according to where you are based?

[152] **Professor Knight:** Not now.

[153] **Kirsty Williams:** This afternoon, we have a debate on higher education funding. Higher Education Wales says that there is a big funding gap between England and Wales. Do you worry about that? Is it beginning to threaten your ability to keep doing what you do?

[154] **Professor Knight:** Yes. We cope with it in many ways, but of course it is a threat, because an undergraduate brings less money in Wales than he or she does in England. How stupid is that? Around half of our graduates are English. It is plainly indefensible.

[155] **Professor Kalaji:** It is a serious threat in terms of our ability to recruit good-quality students. On the first point that you raised, do you know which is the third largest chemical company in the world? Where is it based? Take a guess.

10.40 a.m.

[156] **Kirsty Williams:** In Oxford?

[157] **Professor Kalaji:** No.

[158] **Kirsty Williams:** In Dublin or London?

[159] **Professor Kalaji:** Somewhere off the New Forest. It is a British company and it is the third largest in the world. Therefore, location is a misconception. One of the most successful medium-sized companies in the UK in terms of pharmaceutical intermediates is in north Wales, and it has had no problems. Location, therefore, is not a subject for discussion. Companies can go wherever they want and they look at the advantages. Cardiff has a fantastic

base in terms of science, and pharmaceuticals will go there. They may not necessarily be big pharmaceutical companies, but chemical industries would go there and make use of it. There is a huge cluster down in the south. In north Wales, we have a number of them and we are very proud when we see another one coming in and very sad when one of them closes down, like Peboc in Anglesey, which is closing down at the moment. Location is not an issue.

[160] **Professor Knight:** This image problem is of great concern. Cardiff is the youngest city in Europe and with the huge mess made of Wembley, you saw Cardiff everywhere, with the FA Cup and all kinds of things, and that all helps. I am sure that it has helped with our recruitment. It is a strange business. It is an attractive city now; it has been scrubbed, basically.

[161] **Kirsty Williams:** So, to be clear, the ability of higher education to be able to continue to contribute to a thriving Welsh economy is threatened by the funding gap between English universities and Welsh universities?

[162] **Professor Kalaji:** I could not have put it any better myself.

[163] **Profesor Knight:** Yes, of course.

[164] **Christine Chapman:** On the curriculum and the comments that you have made about graduates, do you think that more entrepreneurial skills could be taught as part of the chemistry curriculum? Some of the evidence that we have received has suggested that, if we want spin-out businesses that come from PhD and Masters graduates—and they could be the same people, rather than having chemistry graduates doing the subject and industrialists—

[165] **Professor Knight:** The trouble is that the subject has grown so much; we despair of what we have to cut out to cover all that chemistry graduates should know in the space of four years. Having said that, I have great sympathy for what you say, as do many of us. That may be possible at the Masters level, or as a joint degree. One of the ideas that we had was law, patents and accountancy as a general package to try to get awareness. We were kind of put off by one or two industrialists who said that they would teach them all that stuff. So, I am not sure in my own mind whether it is a good idea; I know what you mean, but, as I say, we were put off slightly by some senior industrialists.

[166] **Christine Chapman:** Were those industrialists chemists themselves? There seems to be a real divide here.

[167] **Professor Knight:** It was only a few, but we had quite enough on at the time. However, your point is worth pursuing; I would never say no to it, that is for sure.

[168] **Professor Kalaji:** As part of the course, students go to Gregynog in mid Wales and we have what is called ‘business games’ for them. Industrialists go through business models with them and explain their relevance. However, that is done, again, at a very low level. Industrialists come to talk to them. Alumni in the chemicals industry came to an event two weeks ago, which again was funded by KEF, interestingly, and they explained the benefits of choosing chemistry and how it is relevant to industry. They presented models of what they and their colleagues had done and explained the benefits of having a chemistry degree. The benefits of having a chemistry degree are tremendous in terms of your potential earnings over a lifetime. It is something that people should be drumming up, continuously.

[169] **Gareth Jones:** On that note, I draw the meeting to a close. Thank you for the frank exchange of information and ideas that we have had this morning. We share your concerns, which is why the scrutiny committee is important to us all, as it gives us this opportunity and this forum. I hope that we can deliver a useful report that has the right impact on the situation

in Wales. We heard earlier how we compare with Scotland, and we are mindful of many of the points that you have raised. We would like to have a clear mission and see a way forward for us in this very important matter. We must get it right. The contribution of higher education to the economic development of Wales is what this is all about. We are grateful to you, and wish you all the best in this important work. Good luck for the future. Diolch yn fawr.

[170] **Professor Knight:** Diolch yn fawr. Thank you for letting us talk about our subject. It is always a pleasure.

[171] **Gareth Jones:** I declare the meeting closed.

Daeth y cyfarfod i ben am 10.46 a.m.
The meeting ended at 10.46 a.m.