

23 February 2006

**Ms Christine Gwyther AM**  
National Assembly for Wales  
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# Institute *of* Physics

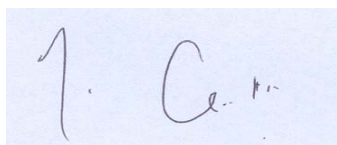
Dear Ms Gwyther

## **A Science Policy for Wales**

The Institute of Physics is a leading international professional body and learned society, with over 35,000 members, which promotes the advancement and dissemination of a knowledge of and education in the science of physics, pure and applied. The Welsh Branch of the Institute, known as The Institute of Physics in Wales, has around 900 members. Our activities are summarised in Annex 1, including details of our support for physics education in secondary schools, in HE institutions and for outreach and public engagement.

The Institute welcomes the opportunity to respond to this important inquiry. The attached document highlights some key issues of concern to us and we look forward to discussing them further with your committee in our forthcoming meeting.

Yours sincerely



**Professor Michael Charlton**  
Secretary,  
Institute of Physics in Wales



**Professor Peter Main**  
Director, Education and Science  
Institute of Physics

# Institute *of* Physics

## **An Institute of Physics in Wales Submission to the National Assembly for Wales EDT Committee Inquiry : A Science Policy for Wales**

### **Introduction**

The Institute is regularly asked for its views on aspects of government policy which impact on its role as a professional representative body. Three recent documents which the Committee may wish to consult are annexed electronically to this submission. The documents are entitled “Science and innovation: working towards a ten-year investment framework” (an Institute response to a joint HM Treasury, DTI and DfES consultation; 30<sup>th</sup> April 2004), “Strategic science provision in English universities” (an Institute submission to a House of Commons Science and Technology Committee Inquiry; 28<sup>th</sup> January 2005) and “Research council support for knowledge transfer” (an Institute response to a House of Commons Science and Technology Committee Inquiry; 16<sup>th</sup> February 2005).

The Institute is about to introduce new National and Regional Officers. The role of these new appointments will be to increase the activity, profile and influence of the Institute with national and local government and their agencies. The current budget is for a total of 6 full-time-equivalent staff across the UK, with one post for Scotland, a 0.5 post for Wales and 4.5 posts covering the English regions. The existing National Officer for Scotland works closely with the Scottish Parliament, and it is envisaged that the new National Officer for Wales would develop a similar relationship with the Welsh Assembly and the Welsh Development Agency.

Two Welsh Institutions (Cardiff and Swansea) participated in the recent International Review of UK Physics and Astronomy. This periodic exercise is co-sponsored by the Institute with the Royal Astronomical Society and the UK Research Councils which fund physics and astronomy research, EPSRC and PPARC. The visiting panel has recently reported, and two of their general remarks may be of interest to the EDT Committee:

“Curiosity-driven research is important in its own right and attracts the most able people into physics and astronomy, but it is also the foundation for the improvement of the quality of life and wealth creation in a knowledge-based society. The Panel has noted that some of the new money entering the science base has been tied up with specific initiatives. Many of these initiatives may be of strategic importance to the UK. However, the Panel is concerned that this could be a creeping trend that could undermine the opportunities of physicists and astronomers to follow their instincts in research, and the UK’s ability to pursue curiosity-driven research at the highest level. *The Panel recommends that the research councils monitor the balance between targeted and curiosity-driven research to maintain a healthy balance between the two funding streams.*”

“The Panel is of the view that physics has a unique place in a knowledge-based society, as a discipline that underpins the other core sciences and engineering. The Panel is deeply concerned that physics has ceased to be an identifiable discipline in a number of UK universities. A continuation of this trend would threaten the UK’s ability to produce the volume of physics graduates needed to compete on an international basis. *The Panel is disturbed to find that the financial health of university departments is to a significant degree dependent on undergraduate numbers, which themselves depend upon career choices of young people in the secondary system. This is not a good basis for strategic planning of the science base.*”

We concur. The physical sciences and, in particular, physics, mathematics and computer science are the strategic disciplines that fundamentally underpin technology and technological advances. Unfortunately, funding their activities within the current UK HE system is fraught with difficulties, which stands to jeopardize the national economy.

In future, inter- and multi-disciplinary research will be increasingly important in some areas (e.g. nanotechnology, nano-medicine) and in other areas generic new technologies will drive the science (e.g. visualisation and VR). The strengths that expert physical scientists can bring to these emerging areas must not be underestimated.

### **The Welsh Physics Scene – a Brief Summary**

Physics in Wales has areas of significant strength, including particle physics theory and fundamental atomic physics at Swansea, materials physics at Aberystwyth, Bangor, Cardiff and Swansea, astronomy and astronomical instrumentation at Cardiff, solar system physics at Aberystwyth, gravitational physics at Cardiff and optoelectronics at Cardiff and Bangor. There is a healthy representation of what are loosely termed “pure” and “applied” physics here.

Wales has around 70 academic scientists working in identifiable physics and astronomy-based units in four HE institutions. This total is fewer than the number in several individual departments of physics in England and the total lags that in Scotland by a factor of about three.

Recent measures, in particular the HEFCW Reconfiguration & Collaboration fund, have begun to address some of these sub-critical mass problems in the Welsh system. For instance, a successful application has been made to this fund to establish the *Centre for Advanced Functional Materials and Devices* - a collaboration between the Institute of Mathematical and Physical Sciences, Aberystwyth and the Schools of Informatics and Chemistry at Bangor. This development explicitly cited the need for a sound base in science and technology, in an interdisciplinary environment involving researchers working at international level, for the success of the Welsh economy.

Wales has research stars in physics and astronomy, and in the wider physical sciences, engineering and mathematics. The prestige that these individuals bestow on our HE institutions is incalculable. Wales has too few of these stars across the board – this is an issue that the Science Policy should address.

### **Scotland – a Snapshot**

Scotland's Physics Departments have recently formed a strategic alliance (SUPA, Scottish Universities Physics Alliance; see [www.supa.ac.uk](http://www.supa.ac.uk)) which has received funding of £6.9M over a 4-year period from the Scottish Funding Council (SFC). An extract from the SUPA website is given below which encapsulates the aspirations of the initiative.

“Six Scottish Universities have come together to form a research alliance in Physics. The aim is to place Scotland at the forefront of research in Physics through an agreed national strategy, an inter-institutional management structure, and co-ordinated promotion and pursuit of excellence. Adopting a coherent approach to staffing strategy, research training, research initiatives and funding opportunities, SUPA will pool and enhance Scotland's strongest Physics research areas and will develop as a world leader in Physics, creating the largest group of Physics researchers in the UK. It is also intended as a single "front door" for potential staff, sponsors, and industrial collaborators.”

Note that SFC is promoting other alliances amongst its HE institutions (e.g. ScotCHEM, EaStCHEM, the Scottish Bioinformatics Research Network and the Edinburgh Research partnership in Engineering and Mathematics).

### **Science Policy – a Commentary**

#### ***General***

The formation of a creativity- and knowledge-led society in Wales is vital for the future of the nation.

It is well recognised that there are several problems facing the government and its agencies in achieving this aim. These have been eloquently set out in other submissions to the EDT Committee. They include the poor uptake of science in HE, the paucity of suitably trained secondary school teachers in certain areas (including physics), the lack of women entering science disciplines (particularly physical sciences) the endemic under-funding of many aspects of the activities of science and engineering departments in HE and the facilitating successful business-academia links.

Many of these problems are deep-seated and inter-related and some of them can be addressed by actions directed towards the funding of science, engineering and mathematics disciplines within HE institutions, the overlap of HE institutions with industry and HE outreach activities.

Wales urgently needs a Science Policy. Framing such a policy is a massive opportunity. It should be widely discussed, and engage and involve representation from all stakeholders in science in Wales. This should include industry, academia, education (both primary and secondary and those involved in ITT) and the general public. Expert advice from outside Wales should be sought as necessary.

The Science Policy should be bold – adopting best practice from elsewhere where appropriate and seeking imaginative ways forward otherwise. Broad support from all stakeholders and unanimous support from Wales Assembly Government is essential.

### ***People***

Our double-sided motto should be “train and retain”. And “retain and train”. The workforce needs to be re-educated and constantly refreshed with young talent. It is advisable that we import talent to drive standards higher. Some suggestions are made with regard to the HE sector below. Evidence presented by the Royal Society emphasizes the fact that Welsh school children are more likely to leave Wales for their HE experience – the consideration of measures to stem this tide are an appropriate Science Policy concern.

A workforce trained at many levels (technical, scientific and managerial) both to contribute to, and adapt to, the worldwide knowledge base is vital for Wales. It seems clear from the submissions of other bodies to the EDT Committee that Wales is lagging nationally and internationally. In the face of a rapidly changing world economy, this situation is potentially disastrous for Wales.

We offer the following suggestions to stimulate the thinking of those who will formulate Wales’ Science Policy.

Consideration should be given to making student bursaries available to pay all, or a significant part of, the tuition fees, to talented students from Wales to study a scientific discipline at undergraduate level in a Welsh institution.

Offer, on a competitive basis, postgraduate scholarships to attract bright Ph.D. students to Wales, irrespective of their country of origin. Such an initiative could bring huge rewards since RCUK studentship funding does not have this flexibility.

Funds could be set aside to attract research stars to (back to?) Wales. Such a funding stream should be competitive and have a strategic focus, which should be reviewed. Universities might, for instance, bid on an annual basis.

### ***Outreach***

Consideration should be given to make funds available to support outreach and public engagement activities. Research scientists have neither the time nor the expertise to do enough of these activities to promote science. Dedicated local outreach officers could be established, with a clear remit and a realistic budget.

### ***HE/Industry Interface***

There are examples of excellence in Wales involving HE/ Industry collaboration. These include the Welsh Optoelectronics Forum. OpTIC Technium, Technium Digital and Technium CAST. There are also interesting physics-based initiatives underway across Wales in the micro- nano-technology areas which may eventually be commercially exploitable. These should be nurtured and best practice from elsewhere adopted in an effort to encourage academics to consider business and industry. Examples might be Business Fellow schemes (e.g. that operated by the London Technology Network). The Royal Society has recently introduced a scheme, in co-operation with the Tanaka Business School at Imperial College London, called "Leading in Science: Innovation and the business of science". The aim is to introduce its young research fellows to the role of science in the economy and invite them to consider their own research and the potential for commercialization.

The annexed Institute document "Research council support for knowledge transfer" (a response to a House of Commons Science and Technology Committee Inquiry; 16<sup>th</sup> February 2005) makes important points of relevance to the interface between academia and industry. Though directed at the UK Research Councils, the suggestions made are largely generic.

The notion that academic researchers are sitting around ready to undertake short-term projects for industry is a myth. Mechanisms need to be found, though, to put industrialists in contact with scientists doing world-class work of relevance to their operations. It is the recruitment of people to support both industrial executives and research scientists, and the mechanism set up to deliver effectively at this interface, which is vital.

## **Annex 1: Summary of activities of IoP Wales**

Currently, the Institute of Physics in Wales has around 900 members, who are distributed through Wales as follows: North (14%), Mid (8%), South West (16%), South East (36%). The remaining 26% of the membership reside outside Wales.

With such a spread out membership, it is increasingly important that we focus our activities and, where possible, work in partnership with other professional bodies and institutions on a local level. In practice, this means arranging joint talks with organisations such as the IEE, and local scientific and astronomy societies. It also means continuing to support activities that either promote the study of physics as a discipline, or that lead to an increased awareness of the role that physics has to play in the world that we live in.

Events for members tend to be organised on a regional basis by local co-ordinators based in Aberystwyth, Bangor, Cardiff and Swansea. Typically there are two talks per location each year.

### **Support for Secondary Education**

There is an existing Physics Teachers Network in Wales which is run by three area co-ordinators, all of whom are members of the Institute of Physics in Wales. The Institute of Physics in Wales provides speakers for the annual Welsh Physics Teachers meetings that take place in Brecon and Dolgellau and provides local organisation for the Institute of Physics Schools' and Colleges Lecture, which is held at three venues in Wales each year. We organise the annual Paperclip Physics competition for schools, in which teams of 3-5 students have to demonstrate a physics concept in a novel way using only household items. Members of the IoP in Wales play an active role in the teacher-scientist network, with a number having developed on-going relationships with teachers.

### **Support for Higher Education**

The majority of talks organised for members are hosted by the Physics Department at the local University, so the topics are often close to the research interests of the staff who work there. We provide support, where we can, for undergraduate student physics societies, and also provide bursaries to enable student members to attend conferences.

The Institute of Physics in Wales offer careers advice by calling on the services of a specialist careers adviser, who is based at Institute headquarters in London.

### **Support for Outreach and Public Engagement**

The Institute of Physics in Wales aims to work in partnership with the organisers of national events in Wales, and members regularly contribute to the annual National Science Week, which takes place in March each year. We also contribute activities to both the National and the Urdd Eisteddfods.

Other events which we have supported financially in recent years include the Cardiff Science Festival (2006) and the North Wales Schools' Science Festival.

Individual members of the Institute of Physics in Wales contribute in many other ways, e.g. providing talks for the Science Cafes which have spread recently throughout Wales.