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Science, Technology and Innovation: International Capacity Building for Sustainable Growth

A Preliminary Concept Paper

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EXECUTIVE SUMMARY AND AIMS

This paper looks at the evolving international development agenda supporting capacity building in science and technology in developing countries. It looks at some current developments in major players such as the World Bank and DFID, and outlines how Learned Societies might be able to effectively contribute to the development of long term, sustainable, grass-roots, research and teaching communities in their disciplines in developing countries that are closely networked with their international colleagues.

Annex A gives an example of a programme of support that might be developed for physiology, an old discipline that underpins medicine and bioscience. Support for this, and its related biomedical disciplines, is vital in helping developing country scientists tackle local health and disease issues. However the principles developed are also equally applicable to Learned Societies across the entire scientific spectrum that can tackle issues of concern to developing countries in engineering, food, environment, civil society, poverty alleviation etc.

The Physiological Society is a member of an international organisation, the International Union of Physiological Sciences (IUPS) and the UK Biosciences Federation (BSF), an umbrella organisation representing the UK's biological expertise. The Federation brings together the strengths of 44 member organisations (plus six associate members), including the Institute of Biology which represents 39 additional affiliated societies. This represents a cumulative membership of over 65,000 individuals, covering the full spectrum of biosciences from physiology and neuroscience, biochemistry and microbiology, to ecology, taxonomy and environmental science. The Physiological Society is currently working closely with a BSF Working Group on capacity building to develop policy and co-ordinate new initiatives from member societies in this area. The BSF and The Physiological Society are also working with Societies outside the biosciences area, including the Institute of Physics (IOP) and the Royal Society.

We believe that Learned Societies, with their accumulated experience of supporting capacity building in their disciplines over many centuries, and their existing networks of international members in developing countries, can do much to address the concerns of international development agencies. We are moving this agenda forwards with our fellow UK Societies and through our international membership of IUPS, and hope that it will lead to interesting and constructive discussions with governments and development agencies.

LIST OF ACRONYMS

AIMS African Institute of Mathematics
AU African Union
BBSRC Biotechnology and Biological Sciences Research Council
BPS British Pharmacological Society
BSF Biosciences Federation
CASE Campaign for Science and Engineering
CRD Central Research Department (of DFID)
DFID Department for International Development
EMBO European Molecular Biology Organisation
GDP Gross Domestic Product
GTZ German Agency for Technical Co-operation
G8 Group of 8 Nations
IAP InterAcademy Panel on International Issues
IAVI International Aids Vaccine Initiative
ICSU The International Council for Science
IDRC International Development Research Centre (Canada)
IOP Institute of Physics
IP Intellectual Property
IUPS International Union of Physiological Sciences
ISNAR International Service for National Agricultural Research (The Netherlands)
MOU Memorandum of Understanding
NGO Non Governmental Organisation
PCR Polymerase Chain Reaction
PhD Doctor of Philosophy
POST UK Parliamentary Office of Science and Technology
RCUK Research Councils United Kingdom
S&T Science and Technology
SET Science, Engineering and Technology
STI Science, Technology and Innovation
TWAS Academy of Sciences for the Developing World
UN United Nations
UNDP United Nations Development Programme
UNESCO United Nations Educational Scientific and Cultural Organisation
WB World Bank
WHO World Health Organisation

A. Background:

In the last few years, the global development agenda has moved forward to embrace the importance of science, technology and innovation in helping to address the crucial development issues facing the world today, including climate change, health, infrastructure development, the building of sustainable livelihoods and the elimination of poverty. Science and scientists are now seen to be integral to this global effort, and it is recognised that a key aim has to be to develop local scientific capacity in developing countries to enable them to address pressing local issues and build sustainable economies. Local solutions are needed for local problems. This can only be achieved by supporting effective grassroots initiatives, tying these closely to real local needs, and embedding them in supportive Governmental science policy and funding frameworks.

B. The Potential of Learned Societies:

Learned Societies of every discipline are perhaps in a unique position to contribute to this agenda. They are quite different from the many other ways in which science is organised, whether through Government funding agencies, universities or science based industries. In essence they are clubs of scientists, whose *raison d'être* is to capacity build their disciplines, and in some cases having been doing this very successfully for a few centuries. As clubs, they are often not overly hierarchical, and are naturally organised as extended networks of

scientists with strong links at grass-roots level. Many of the older ones, founded centuries or decades ago to serve their immediate scientific communities, have naturally extended towards having an international membership, and have been quietly supporting budding scientists in the developing world before the main international aid agencies woke up to the importance of this. Such programmes have not been developed by sometimes remote policy makers, but have the advantage of having been driven by the expressed needs of their membership. The Royal Society conducted a survey of some current capacity building initiatives in Learned Societies in 2007. This paper is attached at Annex B.

Learned Societies have the potential to help in capacity building at many levels. As well as being able to directly respond to local scientists needs and develop initiatives at grass-roots level, they also often have relevant experience of advising on science policy at Governmental level. Learned Societies and their members know how to set up and run scientific journals (many of which are still closely connected to the Societies that created them), work with the publishing industry, run events on topical research issues, provide networking and career development support, train students, work with schools and universities to encourage young people to study and take up careers in science, and engage with the media and the general public on crucial issues of public concern. Because of lack of funding, many of their international capacity building programmes, though successful, have remained small. Their potential has not yet been realised! Chapter 5 of the United Nations Conference on Trade and Development *The Least Developed Countries Report 2007* which focused on the need for effective S&T capacity building in overseas aid, noted in one section that “Promoting the role of the World Federation of Engineering Associations and NGOs dealing with engineering issues, including through fellowship funding”, was an area of particular importance. The report said that “those professional associations and NGOs constitute another way of pushing forward specific technical training and capacity development at the local level”. We believe the same applies to Learned Societies throughout the complete spectrum of scientific disciplines.

An issue that has to be overcome, in addition to funding, is how to organise and co-ordinate their input. This paper attempts to start the ball-rolling in this area.

C. The Rapidly Evolving International Aid Agenda: Potential New Opportunities on the Horizon for Learned Societies?

A significant development occurred at the UN Millennium Development Summit in 2000, where Heads of State from all over the world gave a new commitment to working together to build a more equitable, healthy and prosperous international community. Various Millennium Development Goals were defined, and science was perceived as having an important role to play in addressing each of them. Following this, many fora are currently engaged in discussing how to build S&T capacity in developing countries.

World Bank

An impressive example was the Forum organised by the World Bank in Washington 13-15 February 2007, which drew together diverse inputs including from international aid organisations such as DFID and the UN, Governments, universities, research and technology organisations, NGOs and many scientists and policy makers from developed and developing countries. The Forum was organised around case studies of specific STI capacity building initiatives in developing countries, focusing on how to effectively build capacity. The draft report *Science, Technology and Innovation: Capacity Building for Sustainable Growth* is now available. The World Bank has already funded useful capacity building initiatives such as the “Millennium Institutes” which seek to be centres of scientific excellence, first in Latin America, and more recently in sub-Saharan Africa.

According to the World Bank “Science and technology have been central in the progress made to date in the fight against poverty and in stimulating economic growth. Today, however, the accelerating rate of progress in science and technology creates both tremendous opportunities and significant risks for developing countries. A lack of capacity among some developing countries to even access and utilise advances in S&T has prevented them from capturing the benefits of S&T that have become commonplace in the rest of the world. To

date, the cost to developing countries of low S&T capacity has been confined mostly to lost opportunities, such as in the failure to capture the benefits of the Green Revolution in Sub-Saharan Africa. In the future, active threats to, inter alia, food security, natural capital and human health will join lost opportunities in comprising the full costs of inadequate S&T capacity". And "The World Bank should be ready to play an appropriate role along with partner agencies in responding to the heightened demand for S&T related services in this new environment of S&T prioritisation". The World Bank emphasised that "it is poised to scale up its STI capacity building support based on the many excellent ideas discussed at the Forum". Key issues and specific areas that Learned Societies may be able to contribute to are listed in Annex C.

DFID

DFID have been supporting capacity building as a part of their research programmes for some time. An interesting review paper of the success of some of these initiatives was commissioned by their Central Research Department *Developing the Capacity of Research Systems in Developing Countries: Lessons Learnt and Guidelines for Future Initiatives* by B. Pound and B. Adolph (September 2005). The paper notes that "In the context of research for development, research capacity involves: the systems, facilities and resources to work with relevant stakeholders to identify and define relevant researchable problem areas; develop and maintain research partnerships and networks; plan and implement research tasks; participate in and utilise international research; evaluate, select and adapt research findings; and publish, disseminate and apply research findings." It notes that capacity development has conventionally concentrated on the enhancement of knowledge and skills of individuals, and although key, the much larger picture of organisational environment, networks etc also need to be addressed. Strong local ownership and empowerment is needed. Brain drain issues need to be addressed, strong incentives are needed for developing country scientists to stay in, and return to, their countries of origin. Attempts to build capacity within the framework of research projects have sometimes foundered on issues such as: being perceived to favour an elite group closely associated with the project; and lacking long term sustainability surviving the project's end.

The paper noted that research capacity strengthening needs time to identify and train the core researchers, and to develop and implement an agreed, but broad ranging, agenda. Traditional competencies in the natural and social sciences will still be needed alongside the abilities to facilitate and coordinate partnerships and networks, and to disseminate and utilise the knowledge and material outputs of research. Local training systems need to be strengthened. If research is to become a vehicle for development and poverty reduction, this vehicle will need researchers who are drivers, not passengers, and are able to innovate by applying and adding to the stock of knowledge. Researchers are constantly meeting new technical and methodological challenges, and so need periodic updating of their knowledge and skills, and continuity of support, through networking, mentorship and other mechanisms. There is a need to move towards a new paradigm of providing appropriate support, including long term mentorship. Access to capacity development should be transparent, based on merit and inclusive, not favouring a core/elite group. Training programmes should be developed in such a way that they encourage team building, networking and collaboration. Change is a long term process, requiring interventions going beyond the lifespan of most research programmes. Capacity building initiatives need follow up and support until new practices are consolidated within organisations or systems. Providing a manual is insufficient.

The review paper also noted findings by Horton et al (2003) documenting ISNAR's experiences in evaluating six research capacity development initiatives. They concluded that there is a need to move from a traditional, linear, project focused approach, which assumes that the development of individual and project-level capacities will lead to improved organisational capacity and performance, to a more inclusive and holistic approach that develops capacity across organisational dimensions.

Douglas Alexander, the Secretary of State for International Development, then launched DFID's *Research Strategy for 2008-2013* on 22nd April 2008. Linked to this is their *Working Paper on Capacity Building*. In his speech the Secretary of State announced £1 billion of

investment over the next five years. A key objective will be “the joining of research with policy and practice – to make a difference”. There will still be a strong focus on tackling poverty. The strategy notes that there is a close link between a country’s capability to use and to do research. DFID will focus on capacity building as one of four “Results Areas” by which their Research Strategy will be judged. It will look at supporting both the generation of research, as well as improving the environment in which research evidence is accessed and used. DFID defines research capacity as “the ability of individuals, organisations and systems to undertake and disseminate high quality research effectively and efficiently. This includes the “institutional” context in which capacity building takes place (such as the incentives, the economic, political and regulatory context), and the resource base on which the context is built.

The DFID have announced that they are not yet inviting submission of proposals. During 2008, the Central Research Department (CRD) will be looking at its future research programme, and will in due course publish Business Planning Information on the application process. DFID will be particularly considering how different forms of partnership can contribute to relative strengths and weaknesses in capacity building. They will be looking to support pilot capacity building initiatives taking a systemic approach in different contexts in order to identify more clearly which variables have a critical impact in capacity building effectiveness. They want to engage with international and regional networks addressing capacity building challenges, and provide support to those institutions equipped to take the agenda forwards in a coherent fashion. DFID recognises that abilities to do, access and use research are inextricably linked, so they will also give renewed emphasis to supporting stronger environments for research uptake. They would like to build the capacity of intermediary organisations to help communicate research. Key issues and specific areas that Learned Societies may be able to contribute to are also listed in Annex C.

Thus it appears that DFID hope to tackle capacity building as an integral part of their funded research programmes. This is vital, but there is another approach that could complement and reinforce this, by also focusing on creating a longer term supportive general infrastructure, developing skilled people, and building professional networks as explored further in Annex A. Enhancing the role of Learned Societies in this area could go a long way towards addressing the issues raised in the *Lessons Learned* paper, and in moving to a “more inclusive and holistic approach that develops capacity across organisational dimensions”. Research funding could then be focused on these strengthened long-term networks, thus achieving more sustainable results.

Research Foresight

Capacity building has also been identified as being of vital importance by the UK Government’s Foresight Programme. Foresight is run by the DIUS under the direction of the Chief Scientific Adviser to HM Government. Foresight creates challenging visions of the future to ensure effective strategies now. The report on the programme *Foresight. Infectious Diseases: Preparing for the Future*, Office of Science and Innovation, London (2006) assessed how the future threats of disease might evolve over the next 10-25 years, and to assess how science could help in managing them – specifically through new systems for disease detection, identification and monitoring. The work has looked at both developed and developing countries, with a particular focus on sub-Saharan Africa. It called for radical action to be taken in managing infectious diseases to meet Millennium Development Goals in reducing mortality, hunger and poverty. It noted that Africa is beset with infectious diseases, old and new.

African experts, who were involved in a project pan-African workshop in Uganda, suggested that Africans could usefully take the lead in developing a new Vision and Strategy for the management of diseases across the continent. This would be surveillance based, and supported by regional centres of excellence. The Vision and Strategy would cover diseases in humans, animals and plants, recognising that these are interlinked in complex ways, and that their detection is increasingly dependent on a common technical platform.

African experts observed that many donor organisations commission studies on Africa, either directly or indirectly, but these are too often conducted by experts outside Africa. This is demoralising for African experts and also acts as a disincentive for experts to stay in the country. If donor organisations were to decide to use more in-country experts, this could help to build capacity and would ensure that local issues and conditions were better considered.

Capacity building in the following areas was considered vital:

Skill sets: traditional training in science and technology does not deliver the range of skills necessary to tackle the breadth of issues relevant to assessing and managing infectious disease risks. Interdisciplinary approaches to training, more opportunities for scientists and technologists to broaden their skill set at any stage of their careers, and international exchanges of knowledge and expertise would all help to address this problem.

Maintaining expertise: the erosion of expertise in key disciplines threatens our ability to maintain infrastructural competence and surveillance – all the more so in developing countries. New technologies, 'smart partnerships', centres of excellence and international fellowships for collaborative study could provide much-needed integration and sustainability.

Communication skills: a key aspect of interdisciplinary working is good communication. This applies at every level: scientists with scientists in different disciplines (including social sciences and the humanities); scientists with technologists; scientists with policy makers and other stakeholders. Greater emphasis on communication skills at every career stage, including direct experience of communicating across disciplines, would facilitate more effective interactions.

Lobbying as a result of this Foresight programme led to the G8 communiqué *Fight against Infectious Diseases* (St Petersburg 2006) which highlights the role of local capacity in developing and delivering solutions to long term risk management.

Bill and Melinda Gates Foundation

The evolving work of this Foundation is worth keeping an eye on, backed as it is by Gates' vast personal wealth, and as a private philanthropic organisation may be able to be more flexible in the long run than S&T capacity building funding derived from Government sources. The foundation's Global Development Program aims to work with motivated partners to create opportunities for people to lift themselves out of poverty and hunger. The mission of their Global Health Program is to encourage the development of lifesaving medical advances and to help ensure they reach the people who are disproportionately affected. They focus their funding in two main areas: access to existing vaccines, drugs, and other tools to fight diseases common in developing countries. and research to develop health solutions that are effective, affordable, and practical. They may be persuadable to support capacity building programmes that develop the local scientific infrastructures necessary to deliver these objectives.

D. A Possible Future Global Co-Ordinating Mechanism for Learned Society Involvement?

The International Council for Science (ICSU)

A meeting of UK Learned Society representatives at The Royal Society in London in September 2007, agreed that Learned Societies should become more involved in international capacity building in S&T. It was proposed that ICSU, the International Council for Science, might, with appropriate support, be able to provide the right sort of support and delivery framework for major global programmes in the long term.

ICSU is a non-governmental organisation representing a global membership that includes both National Scientific Bodies and International Scientific Unions. Through this international network, ICSU plans and coordinates interdisciplinary research to address major issues of relevance to both science and society. It has very close links with UNESCO, which has been

a close partner of ICSU since its creation in 1946. Its mission is to strengthen international science for the benefit of society. ICSU's Strategic Plan 2006-2011 states that one of its main objectives is to facilitate science education and capacity building. ICSU helps create international and regional networks of scientists with similar interests and maintains close working relationships with a number of intergovernmental and non-governmental organisations. It acts as a focus for the exchange of ideas, the communication of scientific information and the development of scientific standards. Its community organises scientific conferences, congresses and symposia all around the world, and produces a wide range of newsletters, handbooks, learned journals and proceedings. Increasingly, because of its extensive contacts with scientists worldwide, it is called upon to speak on behalf of the global scientific community and to act as an advisor in matters ranging from the environment to scientific ethics. It represents the broad spread of disciplines across all the natural, engineering and social sciences "thousands of scientists, be they anthropologists working with local communities in Senegal, or chemists working on the latest applications of nanotechnology in California, are affiliated with ICSU via their professional organisations. Because of this, ICSU is uniquely able to bring together the intellectual resources of the international scientific community to explore complex issues at the interface between different disciplines".

The ICSU Vision:

The long term ICSU vision is for a world where science is used for the benefit of all, excellence in science is valued, and scientific knowledge is effectively linked to policy making. In such a world, universal and equitable access to high quality scientific data and information is a reality, and all countries have the scientific capacity to use these and to contribute to generating the new knowledge that is necessary to establish their own development pathways in a sustainable manner.

The ICSU strategy is science led, but embedded in a larger vision where excellence in science is linked to policy making and socio-economic development in all countries across the world. Its main office is in Paris, but it has now developed a regional network of offices in Africa, the Middle East, Asia and the Pacific, Latin America and the Caribbean. These are expected to facilitate the increased participation of scientists from developing countries in the activities of ICSU and its Members, and to allow ICSU to play a more active role in strengthening science within the context of regional priorities. It has a new Committee on Scientific Planning and Review (CSPR) which is charged with "charting its course" for the next two triennia, and a new Policy Committee for Developing Countries which will focus on the advancement of science to society in developing countries. ICSU would therefore appear to be an ideal partner to help deliver the capacity building aspirations of the World Bank Forum. A key goal is to ensure that capacity building, which is integral to all aspects of ICSU's mission, is given the necessary attention in all the activities of the ICSU community and in relevant policy fora. It is looking for new partnerships and funding to achieve this and its other development goals.

Key new initiatives identified in its Strategic Plan include: Natural and Human-Induced Environmental Hazards and Disasters, Renewable Energy, and Human Health. For capacity building, the Strategic Plan focuses on the need to facilitate interaction amongst scientists, including scientists from developing countries in international research initiatives on an equitable basis. Scientists from countries with weak scientific infrastructures are often severely compromised in their ability to link to international research agendas. Capacity building is a cross-cutting issue for all ICSU's international science activities and will be integrated into the development of all new initiatives, from the International Polar Year through to Sustainable Development. A particular focus is on supporting relevant science Education initiatives and the participation of young scientists in all programmes.

ICSU has a formal MOU with the Academy of Sciences for the Developing World (TWAS), which was founded in 1983 and has over 700 individual scientific members, mainly from developing countries. The Academy is active in capacity building for science and has a

number of support programmes for individual scientists and institutions, including a Visiting Scientists Programme, co-sponsored by ICSU. ICSU is also closely linked to the InterAcademy Panel on International Issues (IAP), a network of over 90 national science academies set up in 1993. The Panel has a programme for strengthening academies in developing countries.

ICSU's key existing strengths seem to lie in developing ground breaking new research initiatives, policy fora, and driving international research agendas e.g. its notable successes on climate change research. How can it help deliver capacity building help to scientists on the ground? ICSU is not a funding agency or a governmental policy making body. A challenge is to establish effective links with national systems for research, funding and policy making. Its strength here is its membership, its National Members, the national committees of the Scientific Unions and Interdisciplinary Bodies, provide good access to national systems. These links must be strengthened to identify individual national capacity building needs and deliver it.

Capacity-Building through the International Scientific Unions (this section contributed by Peter Willmore of the Royal Astronomical Society UK)

The ICSU family consists of 29 Scientific Unions and a number of other associated bodies. Many of these (and ICSU itself) have capacity-building programmes though there does not seem to be any overall description available. Apart from sporadic points of contact through eg the ICSU grants process, all these programmes are operated independently by the individual unions, which also provide the bulk of their funding.

Anyone wishing to undertake capacity-building has in principle a choice between doing this through a national mechanism—in practice no doubt one of the learned societies—or through the appropriate Scientific Union. These two possibilities are linked, since where, as is usually the case, the UK “adheres” to a scientific union, a learned society is usually the adhering organisation.

Two examples may help to clarify the nature of these union activities.

The Committee for Space Research (COSPAR) has had a capacity-building programme for nearly 10 years. The core of this is a series of training workshops for young scientists in developing countries. A feature of space science is the existence of huge data archives from past and current missions which are readily available over the internet, together with the necessary analysis software. These are the basis of research world-wide, but in practice are used mainly in developed countries. The workshops aim to make them equally accessible in developing countries. About two are held each year in developing countries and so far more than 270 young scientists have attended them, and about 100 COSPAR associates have taken part in the teaching.

In such an activity, there is an important need for follow-up, to prevent workshops from being isolated incidents. Recently, a fellowship programme has been added to allow former workshop participants to visit labs in the US, Europe and India, to carry out collaborative programmes of research with lecturers; more than a dozen labs are taking part in this scheme.

This indicates a significant point—COSPAR alone has more than 5000 associates who effectively are the world space science research community and through these has access to all the world's major space laboratories. This is of course mirrored by all the other unions; collectively these have available a scientific resource unmatched by any other organisation.

The International Astronomical Union (IAU) is also active in capacity-building. It also has a series of schools, though their character as the name suggests is not quite the same as those held by COSPAR—the International Schools for Young Astronomers. These again are arranged at a rate of roughly 2 per year. The IAU also has a mechanism for keeping in touch with, and providing advice and help in astronomical matters to developing-country

governments, a scheme to help in producing teaching materials and a fellowship scheme to facilitate exchange of astronomers for purposes of research.

In funding terms, the IAU programme is already somewhat larger than COSPAR's, but the possibility of expanding it by no less than an order of magnitude is currently under discussion within the IAU. Within the UK, there are not at present any similar activities to those carried out by COSPAR and IAU, though the Royal Astronomical Society (which is the UK adhering body to the IAU) is in the process of considering what its policy should be in this area, and the Bioscience Federation is currently scoping capacity building in association with the International Union of Biological Sciences (IUBS).

Given the large number of organisations (not only the Scientific Unions) which are involved in capacity-building of one kind or another and the extent to which the financial resources fail to match the scale or importance of what is required, it is highly regrettable that there are so few ways of coordinating programmes or exchanging experience. It is hard to believe there are not synergistic benefits to be gained.

E. The Next Step?

Although ICSU might provide a useful central co-ordinating mechanism in future, for example by providing a framework of capacity building programmes that Learned Societies might tap into, a key issue is how Learned Societies might get more actively involved in the short to medium term. A good approach to build up solid foundations for more ambitious programmes without overstressing Societies which often have limited staff and other resources, might be for interested individual Societies to each support colleagues in initially one target developing country. For this, we need to develop a coherent framework of linked programmes that could form the basis of an initial bid by The Physiological Society to DFID or other funding organisations, and which might provide a useful "template" for other Learned Societies to consider proposals of their own. A Case example framework for physiology is outlined in Annex A for further discussion.

ANNEX A

A POSSIBLE NEW FRAMEWORK FOR LEARNED SOCIETY INVOLVEMENT? PHYSIOLOGY – A CASE EXAMPLE

1. EXECUTIVE SUMMARY

Physiology is a basic science that underpins the understanding of normal and abnormal function in humans and animals. Its scope extends from molecular and cellular levels to body systems and the performance of individuals. Research in physiology underpins our knowledge of normal function and activity, and provides a basis for understanding abnormal function and disease in humans and animals, birds and fish. An understanding of physiology provides essential support for the evidence-based practice of medicine and dentistry, human and veterinary health sciences, intellectual and sporting performance. Physiology is relevant to aspects of agriculture and aquaculture.

This paper explores a potential framework of activities that The Physiological Society could provide to support the development of physiology in partnership with scientists in a developing country in Africa or elsewhere. Although it focuses on physiology as a case example in Africa, the same programmes could potentially be replicated by Learned Societies in other subject areas and other parts of the world. Indeed there might be significant benefits in encouraging other Societies to apply for similar programmes. There might then be possibilities to promote inter-disciplinary collaboration between scientists in the areas concerned through the development of common programme frameworks.

2. Some Background Issues in Africa

The UK Parliamentary Office of Science and Technology (POST) Note June 2008 NO. 309 International Migration of Scientists and Engineers gives the following relevant background.

In 2004, the House of Commons Science and Technology Committee cited that “the emigration of technically skilled people has left 20,000 scientists and engineers in Africa, servicing a population of about 600 million”. The weakness of many African higher education institutions is seen as a key issue. This has arisen from low investment in higher education, and coupled with political and economic instability in many countries, has exacerbated the brain drain. Awareness of the importance of S&T is increasing, driven by bodies such as the Commission for Africa, an international commission set up in 2004, the African Union or AU (an organisation of 53 African states, founded in 2002) and the New Partnership for African Development (a pan African development initiative established in 2001). S&T was the theme of the 8th AU summit in Addis Ababa in 2007. Heads of State agreed on a number of steps including:

- “strongly urging” Member States to allocate at least 1% of Gross Domestic Product (GDP) to research and development by 2010;
- encouraging youth to take up science and engineering;
- ensuring the enhanced role and the revitalisation of African universities and other institutions of higher education as well as scientific research institutions.

POST give the following examples of some donor funded capacity building initiatives in Africa:

- The International Aids Vaccine Initiative (IAVI), a public private partnership to create and distribute a preventative AIDS vaccine, is an example of a **research partnership**. IAVI has helped to strengthen links between developing country institutions, and has invested in training and infrastructure, all of which contribute to capacity building. Analysts say focusing on a product is more effective than initiatives with broader goals. DFID has committed £38 million to date.
- The African Institute of Mathematics (AIMS), set up in 2003, is an example of a **centre of excellence**. Staffed by international volunteers, AIMS attracts students from all over Africa who come to complete postgraduate diplomas. POST said that

- There is growing awareness of the role of **higher education institutions** in building S&T capacity. For example over 4000 students have graduated in S&Es subjects from the Kigali Institute of Science, Technology and Management in Rwanda since it was established in 1997, with funding from the Rwandan government as well as the UNDP and the German Agency for Technical Co-operation (GTZ).
- Recent initiatives also focus on strengthening the interface between **S&T and policy making**. For example under the Millennium Science Initiative supported by the World Bank, the Ugandan government will dedicate \$15 million towards improving the ability of institutions to create and implement appropriate and effective policies for the S&T sector.

Any bid involving Kenya or Malawi should co-ordinate with the DFID's new £10m programme with IDRC and the Wellcome Trust to develop research capacity in those countries. The Health Research Capacity Strengthening Initiative aims to work with the National Research Council of Malawi, the Kenya Medical Research Institute and the Kenya Consortium for National Health Research to rebuild their capacity to facilitate and disseminate health research in their respective countries. The programme will also work to improve the regulation and co-ordination of the research environment to encourage local scientists to stay within the region. There is also an overarching organisation covering the Universities in Kenya, Uganda and Tanzania which has previously expressed enthusiasm for joint projects.

Another development that it is worth keeping an eye on is the new BBSRC/DFID research funding scheme for developing countries, *Sustainable Agriculture Research for International Development (SARID)*. This aims to provide £7M of funding for new research to harness the UK's world class bioscience research base to address the challenges facing agriculture and food security in developing countries. The first call for proposals under this scheme addressed crop science. The aim of the next programme (calls for proposals for which will be made later in 2008) will be to enhance the livelihoods of the poor of Sub-Saharan Africa and South Asia, by generating underpinning scientific knowledge that will improve farm animal health, welfare and productivity by enabling the more effective, sustainable management of livestock diseases. Some of these projects may provide opportunities for physiologists in developing countries. It is also possible, once the scheme is seen to be successful, that such schemes with DFID will become more common across all the Research Councils.

We may also co-ordinate with the new £13m initiative to fund research collaborations and improve links between UK and overseas researchers which was launched on 4th June 2008 by the UK Science Minister Ian Pearson. The Newton International Fellowships will be overseen by the British Academy, the Royal Academy of Engineering and the Royal Society and aim to attract the most promising post-doctoral researchers working overseas in the fields of humanities, engineering, natural and social sciences. The Fellowships will offer researchers funding to work for two years with a UK research institution, thus establishing long term international collaborations. The funding will be distributed in the form of 50 research fellowships, awarded annually, each providing support of up to £100,000 for a two year placement. In order to help maintain collaborations and develop lasting international networks, former fellows will be eligible for follow-on funding of up to £6,000 per year, for up to 10 years. Former Newton fellows will also become members of the UK International Fellowship Association managed by RCUK, which aims to build a network of overseas researchers. <http://www.britac.ac.uk/news/release.asp?NewsID=294>

3. Two Existing Regional Models of Learned Society Involvement

SciDev.net posted a news item on 16 June 2008 on the signing of a cooperation agreement between South Africa and the European Molecular Biology Organisation (EMBO). The agreement is the first for an African country and follows five years of discussions. South Africa will now have access to core EMBO activities and programmes, such as fellowships,

courses and workshops. South Africa-based scientists can also apply for grants previously only available to scientists working in EMBO's 27 European member countries. Flexible long-term fellowships, most beginning in January 2009 will allow South Africa-based scientists to apply to work at institutions in other EMBO countries. Short-term fellowships will enable masters, doctoral and post-doctoral students to learn new techniques at Europe's top institutions. Some practical training courses organised locally, but funded by EMBO, have already been run in South Africa in anticipation of this month's membership approval. Although no other African nation is in the pipeline for membership, the practical training courses in South Africa are open to scientists from across the African continent. The agreement includes provision for European scientists to visit South Africa, to give them "insight into the magnitude of problems on the African continent".

"For most African scientists, attending training courses in Europe is out of the question because of cost, time and visa administration hassles. Hosting these courses in South Africa encourages more scientists from throughout the continent to participate," says Tsungai Jongwe, a molecular biology masters student at the University of Cape Town Medical School.

The International Union of Physiological Sciences (IUPS) has also put some thought into collaborating with different partners, taking specific regions as a point of focus. A group is active in South-East and East Asia in running research and teaching development activities at regional IUPS meetings. Workshops and meetings have been run in China, Japan and Korea, Thailand, Singapore, Malaysia, Australia, New Zealand and Oceania, with participation not just from these countries but also from India and Pakistan. The organisers involved have noted the development in capacity and confidence in the participants who much appreciate the events, with China notably becoming a source of research strength. Solid supportive networks have been built as a result of the events, which are noted for an almost "family" feel about getting together, and there is increasing commitment to quality educational approaches and support for early career researchers. The events are so popular that individuals from parts of the Middle East (including Iran and Turkey) also attend as not much else is readily available in their regions.

4. Possible Programmes for a Bid

Looking at the EMBO and IUPS examples above, a good way forward could be to focus on establishing an agreement with, and a base in one African country, but to make all the funded programmes open to scientists from across the African continent. We could thus establish a regional hub. Apart from the EMBO example, the strength of a regional approach has already been shown by the success of regional educational workshops run by the IUPS in Asia.

Key areas to be addressed include:

- Teaching
- Research
- Publication
- Lab Equipment and Resources.
- Translation: Research to Application
- Networking and Opportunities for Career Development
- Input to Local Science Policy and Liaising with the Media.
- Promoting the Participation of Women.

Successful activity in the above areas should be closely inter-connected. The emphasis should be on catalysing the development of a critical mass of effective teaching and research in-country, with programmes enabling teachers and researchers to network with, link into, and showcase their work and interests to the wider world through The Physiological Society in the UK, the International Union of Physiological Sciences (IUPS) and the local Physiological Society where one exists. For example if we based a programme in Kenya we could work with the existing Kenya Physiological Society. The Physiological Society also has excellent links with the Physiological Societies of Nigeria and South Africa. To develop critical mass it would

probably be best to focus activities on a small group of departments/research centres, but with access for people from other institutions.

In country workshops for teachers of physiology, run by Society Members from the UK and elsewhere. Addressing the development of effective learning practices, valid assessment and the evaluation of teaching programmes in physiology. The access of up-to-date knowledge in the discipline through validated resources (texts, electronic media, the Internet, conferences and the web based educational materials being made available by The Physiological Society and the American Physiological Society). Review of the relevant educational literature and implementing new teaching strategies to enhance the students' learning. Reflection on the relevance, quality and effectiveness of their own teaching. The carrying out of research into local educational strategies and methods. How to encourage an evidence-based approach to education within their institutions and publish effective educational strategies and experiences in relevant journals. Possibly also workshops for teachers in medical schools building on the core curriculum currently being developed by the Society's Medical Training Working Group. The IUPS experience is that there is a serious need to improve the quality of the basic education in physiology in developing countries. The central focus will be first to concentrate on: undergraduate and postgraduate education, helping teachers to develop skills and knowledge of best educational practice as applied to physiology; and supporting interested and talented young graduates (or even before that, Honours candidates) in early research careers. The quality of the undergraduate education in physiology and related disciplines needs to be brought up to strength, including adopting best educational practice where possible. Only then will we have a confident process to ensure that experiences for students in undergraduate, and then postgraduate studies are of high quality and supported by evidence of effectiveness.

Grants for undergraduate and postgraduate students to study physiology in country.

In country general research methods workshops for PhD students and young postdocs, and specific techniques workshops for more experienced researchers (e.g. PCR, Molecular etc). In country research seminars allowing scientists to build strong in-country networks and showcase their research locally. Capacity building initiatives shouldn't just be aimed at young career researchers, older people may also need career development support.

Travel grants facilitating attendance at IUPS and Physiological Society research congresses and teaching workshops, locally, in the UK and elsewhere in the world, to share knowledge, experiences and identify successful practices and strategies, provide opportunities to access high quality, current knowledge in physiology and to showcase their research. A particular area might be funding to attend *in vivo* animal research courses run by the BPS and The Physiological Society in the UK.

Use of such grants to facilitate international networking through IUPS could be particularly useful in building the necessary experience and global science contacts for developing country scientists, and creating an international network. IUPS has played a key role at each of its congresses (every four years) by providing opportunities for physiologists from the developing world to present their scientific work. They have also been very active in running regional workshops and activities designed in particular to enhance basic educational developments in physiology (and more broadly in medical education) in a range of countries, including China, Japan (where a teaching workshop will be held in association with the main IUPS Congress), Thailand, Korea, Malaysia, Singapore, Taiwan, Australia and New Zealand, Pakistan, India, and Kenya.

In country Translation Workshops addressing such issues as the links between physiological research, clinical practice, drug development in the pharmaceutical industry, traditional medicine etc. The Workshops would also need to raise awareness on IP management issues to help protect developing country scientists from being potentially "ripped off" by home grown and foreign commercial interests.

In country workshops addressing science policy issues of concern to the developing country, with invited UK speakers (scientists, social scientists, CASE, Parliamentarians and

UK and developing country Government policy makers). Topics might include funding and priorities for health research and setting frameworks meeting UK standards in animal research.

Communicating science to the media and schools programmes, workshops in partnership with the Science Media Centre, Science and Engineering Ambassadors Scheme and others.

Research and Teaching Fellowships to enable developing country scientists to spend appreciable periods of time (1-2 years) in Society Members UK host institutions, followed by up to 5 years as a Fellow in their home institution (very important Fellowships don't just support brain drain!).

Technicians Placements to enable developing country technicians to spend appreciable periods of time (1-2 years) in Society Members UK host institutions, followed by up to 5 years as a Technician in their home institution.

“Reverse Brain Drain” Research and Teaching Fellowships for young UK scientists to work in institutions in the developing country to further their experience, transfer knowledge, and build professional links.

Promote participation of women scientists in all programmes. This would include Fellowships specifically for women and providing an element for childcare in all grants. A Mentoring Support Programme would also be provided, modeled on the very successful one run in the UK by The British Pharmacological Society (BPS) and the UK Resource Centre for Women in SET. The aim is to facilitate networking and interaction with role models, providing practical advice, motivation and increased confidence for mentees. Mentoring has been shown to provide a number of benefits for professional women. The scheme is aimed primarily at women who are in the earlier stages of their career, in the final stages of working a PhD, or who already have PhDs and are in the process of establishing their career in academia or industry. It provides individuals with a mentor who is an established female scientist from another institution or company, with whom the mentee can discuss their career progression and from whom they can seek advice on a wide range of topics, from practical information of sources of funding to discussion of work/life balance issues. Feedback from participants has been very positive. Once individuals have registered their interest, they are invited to an annual training day where mentors and mentees are introduced. The scheme provides financial support to cover costs associated with attending the training day and with travelling to meet the mentor.

Funding to pay for joint membership of The Society in the UK and local Learned Society if applicable, allowing individuals access to all of the published Journals of the Society, networking and other membership benefits. Funding to support the initial set up of a local Learned Society if non exists.

Journals workshops in-country covering writing skills and standards that have to be met to enable publication of research papers. This could address the concerns expressed at the World Health Organisation (WHO) meeting of African health ministers in Algiers in June 2008, where there was perceived to be a desperate need to improve the state of academic publishing in developing countries, and develop effective local journals able to focus on topics of especial interest to the countries concerned (See Priya Shetty, “Whose Science is it Anyway” *New Scientist* 12 July 2008 p.20.)

“Internships” for in-country scientists to learn editing and other publishing industry skills in our Cambridge office and/or our Journal publisher Wiley Blackwells.

“Setting up a lab” advice services and grants. Developing country scientists should be helped to visit UK labs and consult with UK scientists on what is really needed (as opposed to what instrument manufacturers sales people or development consultants might try to advise them!). This could be accompanied by lab development grants enabling them to purchase prioritised equipment.

ANNEX B

Royal Society Summary of some of the Capacity Building activities of the UK Learned Societies

Joanna Sprackett and Joann Fong, Capacity Building Portfolio, International Policy Section

Below is a summary of capacity building activities that are organised by different UK learned societies and organisations. Capacity building, in this context, refers broadly to helping developing countries increase their scientific and technological capability for the benefit of their societies.

We hope that this summary will form a basis for discussion on capacity building at the meeting of learned society representatives within the UK ICSU family on 6 September 2007.

1. Biochemical Society

ICSU body adhered to: *International Union of Biochemistry and Molecular Biology (IUBMB)*

Contact name: *Dr Chris Kirk*

Details of Capacity Building activities:

Capacity building activities of the Biochemical Society are mainly confined to assistance offered to all our overseas members to attend international conferences elsewhere in the world or work for a period in another laboratory. We also sometimes support scientific conferences in developing countries, for example by funding the cost of UK/European speakers.

Aims and objectives of these activities: to promote Biochemistry internationally.

Impacts and outcomes: significant for the relatively small number of scientists involved.

2. The UK Federation of Food Science & Technology (UKFFoST)

ICSU body adhered to: *International Union of Food Science & Technology (IUFoST)*

Contact name: *Prof J Ralph Blanchfield, MBE*

UKFFoST itself has no direct CB projects; but both indirectly and through direct involvement of its Chair (Prof J Ralph Blanchfield, MBE) and Immediate Past Chair (Prof G Campbell-Platt) it is involved in IUFoST's CB projects which are:

- The project for food science/technology distance education in Sub-Saharan Africa.

- The joint IUFoST/FAO database of food research projects relevant to the food needs of developing countries

- Integration of industry and rural communities in developing countries.

3. The Institute of Physics (IOP)

ICSU body adhered to: International Union of Pure and Applied Physics (IUPAP)

Contact name: Dr Dipali D Chauhan

Details of Capacity Building Activities:

- Exchange between UK/India: We formally run this exchange programme, where one year a physicist from the UK goes to India and visits leading organisations, gives presentation, develops contacts for future collaboration and the following year an Indian physicist visits the UK and does the same. The duration of each visit is 2 weeks.
- Exchange between UK/China: We are also formally run this exchange programme where one year a physicist from UK goes to China and visits leading organisations, gives presentation, develops contacts for future collaboration and the following year a Chinese physicist visits the UK and does the same. The duration of each visit is 2 weeks.
- On the school level, IOP have worked on a project to build practical physics equipment for a Rwandan School. The project is running extremely well and apparatus is being built, teachers are being trained to build their own apparatus, the workshop has been built and resourced for production, a project manager has been recruited and we are also funding a teachers training initiative in Rwanda
- Physics for development project is organising a one week workshop on 'Economic Development for physicists from Developing Countries'. Last years project achieved great success.

Aims and objectives of these schemes/programmes/events are:

- Promotion of UK scientists and research internationally by enabling access to the best scientists around the world
- Provision of potential global research collaboration for young scientists
- Capacity building for schools and inspiring the next generation in science
- Knowledge to wealth: encouraging entrepreneurial culture and providing developing countries with commercial awareness and engagement with the business community.

Impacts and outcomes of these schemes/programmes/events:

- Workshop is resourced and ready to start production, apparatus are now being built there and then being transported to about 500 schools in Rwanda
- Project is now self sustainable and the teachers training initiative is underway to train other teacher in schools
- An online discussion forum has been established for participants to discuss issues relating commercialisation

- Online meetings and a seminar planned for this year as a part of personal development required
- A number of new initiatives have been started by the participants who attended the workshop, hence, our success can be measured

There are number of new initiative that the IOP are working on for 2008.

4. The Geological Society of London

ICSU body adhered to: International Union of Geological Sciences

Name of person submitting response: Dr Ted Nield NUJ FGS

Details of Capacity Building activities:

The Geological Society is a leader within the IGCP (international Geoscience Programme) now in its 34th year following its initiation by IUGS and UNESCO. The UK has always been a leading player in IGCP, which has since its inception had a strong capacity-building element, enabling as it does the cooperation and interchange of expertise between scientists in the developed and developing world. The External relations Committee of the Society is the UK national committee for IGCP, and under its current chair, Prof. Edward Derbyshire (a former IGCP Chairman) takes these responsibilities very seriously and deals with them diligently.

The Society also makes a point of publicising IGCP work amongst its Fellowship through its monthly magazine. The Society Website has an IGCP portal to help UK geologists participate to the full in IGCP activities (www.geolsoc.org.uk/igcp).

The Society's Bicentenary is being marked this year by making available – through sponsorship of Schlumberger – the Society's Lyell Collection (its entire, digitised published output, sponsored by Shell and BP) to higher education institutions in less developed nations. This will be announced at the Society's Bicentenary Conference next month (September).

Aims and objectives of these schemes/programmes/events:

The Society sees the Bicentenary as an opportunity to look forward as well as back, and sees its Lyell Collection, accessible worldwide through the new website, as a lasting legacy to the world of geoscience. As part of how learned societies must reinvent themselves for the new century, we see the open availability of scientific information and the fostering of development objectives to be part of the way in which we must continue to pursue our "public good" directives as charitable institutions.

Impact and outcomes of these schemes/programmes/events:

IGCP has of course a well known record of success over 34 years and has become a model for other initiatives – notable the United Nations International year of Planet Earth, which is largely coordinated by staff and officers of the Geological Society of London. IYPE took IGCP as its template and has itself a very strong development-related focus. The impact of the Lyell Collection worldwide is a little hard to asses as it has not yet officially been launched!

Past and future CB programmes/schemes/events:

See above re. IGCP. The Society is planning to maintain its Lyell Collection initiative permanently, and in line with its recently evolved strategic plan, will continue to pursue development-related goals in the future. The scientific and technical empowerment of poorer nations is seen as crucial to the future of the Earth sciences, which perhaps have more to give to poorer nations in terms of wealth creation, public health and safety and quality of life, than any other single discipline. For this reason we take it as a duty laid upon us by our charitable dedication to the public good.

5. UK IGBP National Committee (International Geosphere-Biosphere Programme)

ICSU body adhered to: IGBP

Contact Name: Dr Roger Harris

Details of capacity building activities:

The UK IGBP National Committee is a working group of the Royal Society's Global Environmental Research Committee (GERC) with responsibility for UK contributions to and interests in the International Geosphere-Biosphere Programme. In this sense the Committee is part of a wider international organisation, which itself fosters capacity building.

The Committee ensures that the UK science community are aware of the objectives, activities and results of the IGBP, and of the benefits of participation, organises opportunities for the UK community to discuss the IGBP and its participation within it and encourages UK participation in IGBP research activities and related data exchange. Hence the Committee has a role in informing and involving UK scientist in the wider IGBP capacity building effort.

IGBP is committed to capacity building to address the imbalance between the scientific capabilities of developed and developing countries. In this regard, and since its early days, IGBP has promoted an array of research-driven capacity building activities to improve the scientific capacity of less developed countries, such as training workshops, summer schools, post-doctoral networks, etc. In addition, Less developed Country (LDC) scientists are members of most IGBP research networks and participate in observational campaigns and process studies. Meetings of the SC-IGBP and IGBP Officers are often held in developing countries, allowing interaction between the IGBP leadership and scientists from the region.

Aims and objectives of these schemes/programmes/events:

The Committee mainly organises meetings at the Royal Society and these do not have an explicit capacity building focus. However, as open scientific meetings they may have such a role in involving LDC scientists.

Specifically, on occasion we have sought funds to support LDC scientists to attend these meetings. A recent example is The Atlantic Ocean Biogeochemistry and Biodiversity meeting held at the Royal Society on 20 July 2006. Financial support was obtained from SCOR (Scientific Committee on Oceanic Research) to enable two early career scientists from developing countries to attend the meeting and a subsequent AMT data workshop held in Plymouth. The aim of the workshop was to give the participants an insight into how AMT data has been collected and analysed and to demonstrate how to access and manipulate AMT data. The programme was tailored to suit the interests of the participants and involved

practical and theoretical sessions, with one to one meetings arranged with scientists working in similar areas.

Two students were selected based upon whether they were at an early stage in their careers and an assessment of how much benefit they would gain from using AMT data. It was also thought that some Atlantic experience would be useful and that it would be preferable not to select two candidates from the same country. On this basis Camila Fernandez (Chile) and Luciana Santoferrara (Argentina) were selected.

Impact and outcomes of these schemes/programmes/events:

Both students found the workshop to be extremely beneficial to their work and were hoping to continue to access and use AMT data after the workshop. They found it particularly useful to meet and discuss their work with AMT scientists working in a similar area and were especially pleased that the programme had been tailored to their interests. Working with such a small group enabled one to one interaction and tuition and flexibility to extend sessions which the students found to be particularly interesting. In retrospect the workshop worked very well, partly due to the selection of good and enthusiastic students and partly due to the expertise of the tutors

Past and future Capacity Building activities:

The Programme of the UK IGBP-NC is ongoing and scientific meetings are expected to be planned on a once or twice yearly basis into the future, depending on Royal Society approval and funding

6. International Seismological Centre

ISC is an independent organisation with links to IUGG

Contact name: Dr Dmitry A Storchak

The type of activities that the International Seismological Centre (ISC) is involved in and would consider to be involved in the future in order to help developing countries to increase their scientific and technological capabilities:

The ISC has long established connections with seismological services in developing countries. We constantly are engaged in the search for other partners. We have constant exchange of data that goes both ways. Local data get contributed to the ISC and integrated into the global definitive summary of the Earth seismicity. In exchange the ISC gives away to developing countries some vital bulletin data important for those country's development.

On a number of occasions the ISC with the help of either Royal Society or UNESCO donated its entire CD-based collection of seismological bulletins ready to be used by local geophysicists in their research.

On a number of occasions the ISC contributed to international training courses, funded by the International Union of Geodesy and Geophysics (IUGG) or International Association of Seismology and Physics of the Earth's Interior (IASPEI). During such courses young seismologists from developing countries were receiving vital information and guidance on how

to install and run seismic networks, process seismic waveforms, determine important characteristics of seismic events, create and distribute a seismic bulletin, assess seismic hazard in their countries etc.

The ISC as a world renowned data centre is well placed to continue with this important activities but almost always would require a substantial support from other agencies for this kind of work. We would be especially keen to step up with this or similar activities in the developing world, especially in sub-Saharan Africa and South America, should there be a will on the Royal Society's part to support us.

7. SCOR (Scientific Committee on Oceanic Research) Committee

ICSU body adhered to: SCOR

Contact Name: Professor Peter Burkill

Details of capacity building activities:

Via SCOR International, there is a new initiative on Capacity Building with the formation of a Committee headed by Prof Venu Ittekkot (Germany).

Aims and objectives of these schemes/programmes/events:

One of the aims is to create awareness and as a first step, a web based catalogue of activities for ocean research is currently being put together

Impact and outcomes of these schemes/programmes/events:

SCOR promotes the enhancement of scientific capacity in developing countries and those with economies in transition by ensuring that every SCOR working group and other activity includes scientists from such countries. SCOR also administers a grant from the U.S. National Science Foundation to provide travel support to scientists from such countries to attend scientific meetings, participates with the Partnership for Observation of the Global Oceans (POGO) in supporting a program of visiting fellowships for oceanographic observations, and is developing an activity to promote regional graduate schools of oceanography and marine environmental sciences.

Past and future Capacity Building activities:

None

8. Royal Society panel on the International Union of Theoretical and Applied Mechanics (IUTAM)

ICSU body adhered to: *International Union of Theoretical and Applied Mechanics (IUTAM)*

Contact name: Professor Nigel Peake / Professor Keith Moffat

The Bureau of IUTAM, met last week in Beijing, and Capacity Building was high on the Agenda.

ICSU has set up three Regional Offices for Africa, Asia and the Pacific Region, and Latin America and the Caribbean; these are in Pretoria, Kuala Lumpur and Rio de Janeiro respectively. A fourth Regional office is planned for the Arab region (in UN terminology!)

IUTAM is involved in the first three of these regional areas as follows:

Africa

IUTAM secured an ICSU grant of \$100k in 2004 to support the first year of activity of AIMS (the African Institute for Mathematical Sciences) in Muizenberg, Cape Town. This Institute provides a diploma course in Mathematical Science (mainly Applied Mathematics as we know it) to graduate students from all over the African continent. About 50 are now graduating each year, most going on to MSc or PhD work in South Africa or elsewhere. The hope is that the majority will in due course return to teach in their home countries.

AIMS has also provided the seed for a much more ambitious initiative, now one of the Flagship initiatives of NEPAD (the New Partnership for African Development); this is AMINet (African Mathematical Institutes Network), which plans to set up a network of Centres of Excellence, based on selected African Universities, with high-speed computer connectivity, and with AIMS as the hub. It is hoped that IUTAM, as well as other International Scientific Unions, will be involved in this initiative as it gets underway.

The next General Assembly of ICSU will be held in Mozambique in October 2008. Prof Keith Moffatt has agreed to represent IUTAM at this GA.

Asia and the Pacific Region

Just before the IUTAM Bureau meeting, Prof Keith Moffat attended a meeting of representatives of CSTAM (Chinese Society for Theoretical and Applied Mathematics), and of corresponding bodies in Japan, Korea, India, Australia, Singapore and Israel. CSTAM is planning to establish in Beijing a Center for Theoretical and Applied Mechanics (BICTAM), which will serve Asia and the Pacific Region. The Director of the Kuala Lumpur office, Nord Hasan, was also present, and CSTAM has been in close contact with him. BICTAM intends to apply to be affiliated to IUTAM, and indeed their proposal came before the Bureau of IUTAM the following day. The Bureau made some constructive suggestions, and encouraged CSTAM to bring their proposal before the General Assembly of IUTAM in Adelaide next year.

It's worth recalling also that ACFM (the Asian Congress of Fluid Mechanics) is already a well-established Affiliated Organisation of IUTAM.

Latin America and the Caribbean

At the IUTAM General Assembly in Providence, Rhode Island, last year, we considered a proposal from our affiliated organisation CACOFD (the Caribbean Congress of Fluid Dynamics) to expand its scope and geographical coverage to become LACCOTAM (Latin American and Caribbean Congress of Theoretical and Applied Mechanics). This proposal is timely in view of the setting up of the ICSU regional office in Rio. Our colleagues in Brazil had some reservations about the proposed change, and we expect a revised proposal to come before the IUTAM GA next year.

The Bureau has actually asked Prof Keith Moffat to act as a sort of Ombudsman between Brazil and the proposers, to sort out remaining points of concern.

IUTAM is also still actively considering a proposal to open its membership to countries in the Developing World, with a new level of "Associate Membership". This was also discussed in

Providence, and a revised proposal will be considered (and hopefully accepted) in Adelaide. We should all in the meantime seek to develop any contacts we have with scientists in countries of the developing world that are not as yet members of IUTAM (e.g. Mexico, Malaysia, Nigeria, ...) which might be early candidates for Associate Membership.

Results from 2006 survey of learned societies about their activities with the ICSU family with regard to capacity building in particular:

Capacity Building UK- Please summarise any capacity building activities of your organisation.

- Setting up a trading body in order to disseminate scientific knowledge more effectively. Establishing an independent voluntary register of Nutritionists and Public Health Nutritionists. Expanded the professional development team.
- Development Grants - The purpose of these grants is to support research capacity building in developing parts of the world e.g. in Eastern Europe, Africa, Middle East. These grants will be available to enable a member (the sponsor) to support an overseas researcher on a laboratory visit to the sponsor's research facility or to enable the member to go out to visit a research facility in a developing region. The maximum award will be £2,000 per grant and there must be 'matching funds' proposals from sponsors.
- Scientific Committee on Oceanic Research (SCOR) has a strong capacity building philosophy and this varies from ensuring developing country scientists are involved in SCOR Working Groups through to forming Regional Graduate Oceanography Schools
- UKNCAR is working with counterparts in SCAR and COMNAP to develop a common approach to education, training outreach, in support of implementing the SCAR Strategic Plan and IPY initiatives.
- Financial support for the African Institute for Mathematical Sciences. Organization with ICTP of workshop on physics for economic development. Support for physics teaching in Rwanda
- A number of small-scale educational workshops and events, however - due to their small size - they will have little impact. However, there are plans to expand their impact (especially post-16) in the future.
- We have an active Education Committee that has some involvement in both UK and international capacity building. It has developed web pages for online teaching in our new website. We are running the "Teachers of Surveying" conference this year. RSPSoc's Special Interest Groups do pursue their own activities in this, e.g. our Geological Remote Sensing Group is running next year's GRSG conference on Developing Countries.
- RSC is actively involved in many altruistic capacity building activities. The 'Archives for Africa' scheme has recently been extended to Latin America. On behalf of RSC, I am personally involved in the organisation of a pre-Commonwealth Heads of Government Meeting (CHOGM) symposium in Uganda later this year (jointly with the ACU and the Commonwealth Foundation).
- Grants from Nuffield Foundation and Leverhulme Trust in conjunction with IMU and AMMSI for mentoring of African research groups in mathematics.
- organises several conferences, field meetings per year, including major annual discussion meeting; organises and provides financial support to a young scientists' conference each year; provides financial support for young scientists to attend the INQUA Congresses; provide small bursaries to support research by young scientists (members of QRA)
- We (the SGM) run a successful "microbiology in schools" programme for teachers in the UK & Ireland. This has now been rolled into Europe via FEMS. The SGM and SfAM run summer vacation studentship programmes to fund undergraduates in research project training. Both the SGM and SfAM provide very generous support for graduate students to attend domestic microbiology meetings. The SGM also runs a professional affairs programme that involves stimulating interactions with the Westminster, Edinburgh, Cardiff and Dublin versions of governance in the British Isles. There are also active moves on the dissemination of microbiology information to the UK press via the SGM Executive and our Professional Affairs Officer. Both SGM and SfAM run a glossy magazine (Microbiology Today and The

Microbiologist respectively) which helps in their missions to further "the art and science of microbiology". These activities - and more - are run by the domestic societies and not under a IUMS umbrella.

Capacity Building- International

Please summarise any capacity building activities of your ICSU family body.

- IUFOST has a Task Force developing a distance-learning food technology programme in sub-Saharan Africa, and has a joint IUFOST FAO database of food science research projects applicable to the food needs of developing countries.
- Contribution to ARTS workshops various visits schemes and scholarships
- IAU Commission 46 (Astronomy Education and Development) is concerned with: - International Schools for Young Astronomers -Teaching Astronomy for Development, Collaborative Programmes, Exchange of Astronomers, Liaison on Astronomy Education, exchanges of books, journals, materials
- The London Mathematical Society has various schemes for international capacity building. We have been developing these quite rapidly over the last few years, and they were highlighted in the IMU International Congress of Mathematicians in Madrid this August.
- COSPAR has a Capacity Building Panel chaired by the UK national delegate. It has arranged international workshops in the developing world designed to spread experience and skills between nations. This Panel is relatively new and there have only been a few meetings so far but the benefits in terms of developing country involvement in instrumentation and in wider meetings has shown considerable improvement.
- Workshops, Travel Scholarships, Young Scientists Programme, IUBMB-Sigma Travel Scholarships. Support of Conferences in S. America, Africa, Far East
- SCAR is developing a Strategy for Capacity Building (Education and Training) as part of its commitment to helping scientists in all of its Member countries to participate in understanding scientifically the processes at work in the Antarctic region, to use that understanding to predict change both there and elsewhere in the world, and to provide objective and independent advice to policy makers, especially the Antarctic Treaty System. SCAR has become an Associate Member of the International Antarctic Institute, which is a "virtual" university comprising the Antarctic science courses of a number of universities and institutes around the world, operating under the lead of the University of Tasmania. SCAR is putting forward a joint proposal with the International Polar Foundation (IPF) for a capacity building initiative for the IPY.
- Organization of the World Conference on Physics and Sustainable Development in Durban in 2005 and follow through now of the initiatives in education, economic development, energy and health.
- Our organisation holds two international workshops for young physiologists per annum, however, again, these are small-scale. We plan to organise a teaching workshop in Africa in the future, but planning is at an early stage. The IUPS holds its International Congresses every four years.
- ISPRS are also active in capacity building and have established the ISPRS Foundation, to help with this by making grants available. There is usually an ISPRS person on major international initiatives aimed at capacity building in our subject area and there will be sessions at the Congress that address such issues in both the developed and developing world.
- IUPAC is very actively involved in capacity building, especially through its Chemistry Research Applied to World Needs (Chemrawn) Committee, of which I am Secretary. As an example for 2007, Chemrawn XII on 'Sustainable Agriculture and Human Well-being in sub-

Saharan Africa' will be held in Stellenbosch, South Africa in December.

- Many of the SCOPE projects deliberately set out to involve younger scientists, particularly from less developed countries. I have made a major effort to do this in the SCOPE projects with which I have been involved (Earth Source Processes, Mining and Urban Development; Peri-Urban Environmental Change; and ECOPOLIS). This was a major part of the Southern African Savannas project with which Jeremy Woods was involved.
- The seven Associations making up IUGG individually pursue capacity building projects internationally, particularly in 'countries in need'. These range from endowing library resources and local initiatives, exchanging/sharing knowledge in workshops, through field training programmes with UN/NGOs and maintaining task forces for developing countries.
- IMU has a developing countries commission which has become more active over the last few years
- IBRO has extensive liaison abroad - has a high profile international meeting every four years and numerous training schools throughout the year in a variety of international destinations.
- There are a large number of awards for young scientists to attend the URSI GAs and for those from developing countries this covers both fares and accommodation. I believe that the Royal Society has contributed to the special fund for these.
- Organises major Scientific Congress once every four years; provides financial support for scientists from countries with low GDP and young scientists to attend the congresses; provides seed-corn funding for international projects, to support inclusion of scientists from countries with low GDP and involvement of young scientists
- At an International level SGM and SfAM are active in FEMS (European level) by providing delegates to FEMS Council, and some FEMS Executive members. Both SGM and SfAM provide financial support for international exchanges and for funding of PG students and postdocs to attend international meetings. Such meetings include the last FEMS Congress (in Madrid last year) and the IUMS Congress in San Francisco. Graduate students were awarded up to £1000 towards the costs of attending the IUMS Congress - a very generous provision. The SGM also runs funds for International projects that help capacity building such as running lab-based courses in Europe, or outside of Europe, on particular themes that enable training. The SGM also runs an SGM/IUMS fellowship which helps to encourage exchanges between labs and attendance at the IUMS congresses. The SGM is also about to initiate a graduate student / postdoc exchange Fellowship(s) with the Australian Society for Microbiology - though the finer points of this are still under consideration.

ANNEX C

SOME ISSUES IDENTIFIED BY THE WORLD BANK AND DFID THAT MIGHT BE TACKLED BY LEARNED SOCIETIES

World Bank

- S&T capacity building **is not** simply about supporting scientists in labs working on purely theoretical scientific problems;
- S&T capacity building **is** about building the technical, vocational, engineering, entrepreneurial, managerial and scientific capacity to solve each country's pressing social and economic problems, transform their societies, and have a positive impact on the standards of living and quality of life of the poorest strata of society.
- The need to develop specific capacity building programmes that can be implemented on the ground and that will have a significant, measurable impact on people's lives, working with local communities, developing competitiveness in a global economy and the creation of higher wage jobs. Applying modern science to solve local problems. Addressing real local needs, not abstract capacity building programmes!
- Targeted investments are needed in education and training, improving R&D, supporting industrial innovation, promoting lifelong learning, and fostering policies to create an enabling environment for creating and applying knowledge, and for private sector development.
- The need to work very closely with communities to help people in the poorest stratas of Society to get the benefits of S&T in e.g. improved healthcare delivery, access to affordable energy.
- Adding value to natural resource exports before they are exported, and building STI capacity to compete effectively in the more knowledge intensive segments of the natural resource value chain.
- Technology upgrading and latecomer advantage – building the domestic capacity to find existing technologies, adapt them for local use, and incorporate them into the production process.
- The role of R&D – the majority of technologies required already exist and are in widespread use in developed countries. Developing countries often need help in developing engineering, technical and vocational skills to use existing technologies. But leading edge R&D can still be needed.
- Modern science functions best in a development context when (i) research is linked to teaching, (ii) scientists and engineers from different disciplines collaborate in multi-disciplinary problem solving teams, rather than working alone, (iii) the supposed distinctions between basic and applied research are minimised or eliminated; (iv) there are close links between research scientists and business enterprises.
- Creating a golden triangle between traditional medicine (the strength of developing countries), modern medicine, and modern science, leading to new processes of drug discovery.
- Need to get away from the uncritical adoption of OECD models of technological development with too much focus on expanding the frontiers of scientific research, we need initiatives geared to real local needs.
- A change in mind set is needed, particularly in government research, too technology driven, too little understanding of end-user needs and perspectives, and limited capacity for and interest in "mining" the existing body of knowledge through networking and accessing relevant sources of information.
- A focus on small pilot projects is needed to generate an emulation effect. Large, complex projects can sink simply as a result of bureaucratic incompetence.
- Helping Government, university and private research centres perform generic technology search, adaptation and development tasks.
- The need to identify what areas of R&D capacity are needed in individual countries at the early stages of development.
- The need to consider how this R&D capacity can complement university science and engineering education and training initiatives.

- The need to consider how this R&D capacity can be harnessed to solving the country's economic development challenges.
- The need to improve the quality of existing R&D capacity and to establish regional or international centres of excellence.
- The development of local R&D capacity to help reverse the brain drain and engage the skills and energy of the diaspora.
- Helping maximise the quality of R&D capacity.
- Helping countries with smaller numbers of scientists collaborate to form regional networks in conducting scientific research and providing post-graduate education.
- Helping countries with limited numbers of university professors and scientists join together in multi-country R&D capacity building initiatives.
- Promote the participation of women in education, training and research.
- Support and training for scientists working on applied research projects.
- Training engineers to work on infrastructure projects.
- Training scientists to work in innovative private enterprises.
- Training scientists to absorb and diffuse existing knowledge as well as training some to conduct leading edge research.
- Helping national Governments develop appropriate national science policies and set priorities. Addressing pressing policy issues such as deforestation and climate change. Policies can't just copy those from developed countries, need to distinguish and adapt what is relevant in a local context.
- Strengthening higher education to produce high quality graduates.
- Building new Centres of Excellence not necessarily dependent on "bricks and mortar" i.e. virtual institutions encompassing networks of scientists from different institutions in the same country, or even from different countries. The development of a relatively small number of C of E's could turn a country's science base around e.g. collaborate in any development of a network of African Institutes of S&T. Five AIST institutions are planned in Abuja (Nigeria); a centre for water and environmental engineering in Burkina Faso; a centre for mathematical modelling and computing in South Africa; and a centre for offshore petroleum engineering in Nigeria. AIST Abuja will focus on graduate student programmes in petroleum and gas engineering, ICT and applied mathematics, materials science, biotechnology, and water and environmental engineering. Faculty will be recruited from African scientists working in the diaspora.
- Enabling research institutes in developing countries to participate in global R&D projects addressing vital issues e.g. vaccines for tropical diseases.
- Education, training and CPD initiatives enabling and encouraging recipients to stay in their own countries (reversing brain drain to brain gain). Bringing back the diaspora.
- An active role in training young scientists.
- Harnessing expertise to help develop low cost "appropriate" technologies e.g. in energy, agriculture, health. Building applied engineering institutes.
- Support of science education in schools, community health education initiatives.
- Training of medical professionals including midwives, health technicians, nurses.
- Help local scientists capture some of the excitement of working abroad and bring it home (comment from Paul Wolfowitz, President of the World Bank).
- Eliminate isolation and build research groups and networks.
- Training: provide study tours or short courses in a foreign country linked to an explicit strategy of institutional strengthening.
- Shortage of qualified research staff and teachers in developing countries.
- Lack of vetted scientific information is a key constraint,
- There are few programmes devoted to training graduate students in Africa with the primary goal of building capacity for university science and engineering departments. Students need help to build the professional networks vital for their future careers. The Inter-Academy Council recommends that "regional cooperation in S&T training that leads to doctoral degrees, together with post doc programmes should be promoted". Help is needed to produce a professorate capable of educating the next generation of scientists and engineers.
- Good quality R&D requires training and retaining human resources as well as vigorous peer review, competitive selection systems for selecting and renewing projects. The development of master's and PhD level education is essential.

- For researchers in developing countries, the benefit of joining a global network is that it creates links in science so that researchers are only 3 or 4 steps away from each other in a broad global network of knowledge creators. These links increase the chances of knowledge exchange in multiple directions, from advanced to developing countries and vice versa.
- Promoting women in science is very important,
- The African Development Bank, as part of its desired transformation into a “knowledge bank” has created a division of Higher Education, Science and Technology, and Vocational and Technical Training. This is a first in the ADB’s 40 year history! They will provide funding for Centres of Excellence and upgrading of HEIs.
- UNESCO stated a first role for them in capacity building would be to foster inter-agency cooperation for building the capacities of governments to formulate STI policies.
- Gordon Conway, Chief Scientific Advisor, DFID stressed that STI capacity building programmes must strive to integrate developing country scientists into global scientific research networks. To help scientists work on local problems by tapping into the relevant international knowledge networks.
- Another issue is how the developed world can effectively mobilise its scientists to help.

DFID

- Efforts to strengthen abilities of individuals, groups and organisations can comprise a combination of (i) human skills development (ii) changes in organisations and networks (iii) changes in governance/institutional context.
- Sir David King has said to DFID that the development of research capacity in developing countries is a legitimate objective for DFID programmes and emphasised “the need for developing country scientists to be involved in identifying and tackling problems in their communities”.
- Net losses caused by retirement, migration and health problems can mean that people in key teaching and research positions are not being replaced because there is no-one to fill the post. The crisis is set to worsen in a few years as senior academics retire and there are insufficient mid-career professionals to replace them. Lack of funding for research students exacerbates the situation. Occasional scholarships won’t address this, systematic investment is necessary. Tertiary education systems have often been under-funded with emphasis given to primary and secondary education instead.
- The extractive nature of many relationships can be reduced by a strong local research base which encourages researchers to stay in their home country, and encourages UK researchers to go on secondments or sabbaticals to new host institutions and write joint-authored papers with local researchers. Incentive structures need to be developed to encourage people to stay in-country.
- DFID believes that communication is central to capacity building, and is a vital catalyst in getting research taken up and used to create better development. This includes: helping individuals and institutions to more effectively communicate research; making global public goods e.g. information on cutting-edge research, easily accessible; and creating an “enabling environment” in which research can be accessed and deployed by anyone who needs it.
- Public policies work best when they are designed and implemented by locals, otherwise well-intentioned programmes often do not respond to realities on the ground. Donors often fail to invest in local institutions that can do the ongoing research and analysis needed by policy makers.
- Developing country research institutes do not receive the kind of predictable core funding needed for long term planning. Where international donors have given support, this has usually been for one-off projects leading to responsive research rather than setting a forward-looking research agenda driven by locally-determined needs. Stable, core funding is also needed to provide local job security and career development opportunities.

- The time is ripe for policy researchers in developing countries to consolidate stable organisations, develop long-term research programmes, and invest in efforts to better link research and policy.
- There is a need for demand-led research and programmes to prioritise action to strengthen country ownership of research programmes.
- Capacity building should not be of research institutes in isolation, but of partnerships and networks that can innovate and deliver the results of innovation. Actors within such partnerships need to be properly trained to make linkages.
- The concept of conducting only “blue sky” research in the North and more applied research in the South is flawed. Research for development is most effective if end-users are engaged in the process at an early stage. The dominant paradigm of the North “developing capacity” in the South needs to shift to approaches that emphasise the valued perspective of the outsider.
- Developing countries need improved access to scientific literature, good computing facilities and communication links. Facilitation of exchanges of ideas could be helped by establishing long term links between institutions in the region and those in more developed parts of the world.
- There is a particular value in building networks where capacity is so weak that formal organisational capacity building activities might not be cost effective. These networks could be linked to larger international communities of practice.
- DFID funds a range of programmes supporting capacity development. These include: core support to international organisations where capacity building is an integral part of programmes; directly managed and joint programmes that are primarily about capacity development; and research programme consortia which include capacity building in their objectives.
- DFID funding has supported: the training and development of researchers (including grants for Masters, PhD and post-doctoral studies, mentoring initiatives and continuing professional education); research management; re-entry grants to help reverse the brain drain; strengthening research networks, support for policy research, communication skills and the dissemination of research results; workshops on e.g. research methods/academic writing; scientific quality; action research programmes addressing vital problems; enabling programmes for science uptake including training for journalists and access to academic journals; distribution of software and training materials.
- DFID is launching a £10m programme with IDRC and the Wellcome Trust to develop research capacity in Kenya and Malawi. It will work with the National Research Council of Malawi, the Kenya Medical Research Institute and the Kenya Consortium for National Health Research) to rebuild their capacity to facilitate and disseminate health research in their respective countries. The programme will also work to improve the regulation and coordination of the research environment to encourage local scientists to stay within the region.
- Percentage allocated to capacity issues in DFID contracts has been rising as the importance of long-term and more equal partnerships and the need to avoid extractive relationships is recognised. This has been particularly the case for programmes for Africa because the capacity problem is more profound.
- Programmes relating to health research issues has been relatively well funded over the last few decades.
- Explicit frameworks for capacity development in research centres need to be worked out. It needs to be addressed from a systematic perspective, where the relationships between capacity at the individual, organisational and institutional and wider societal levels are acknowledged.
- Baselines for evaluating the success of capacity development strategies need to be developed.
- The range of stakeholders in funded programmes is often limited to governmental organisations, failing to take into account the roles of NGOs and civil society organisations as well as the private sector.
- Capacity building initiatives need to draw strongly on valuable knowledge associated with individual disciplines, even in an era where more interdisciplinary approaches are seen as beneficial.

- Need to get research from developing and emerging countries widely known and used on the global stage.
- Need to recognise complementary activities that nourish publication/research such as networking, formal and informal gatherings.

