

INTERNATIONAL PARTNERSHIPS OF RESEARCH EXCELLENCE

UK–USA ACADEMIC COLLABORATION

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1. BACKGROUND

In July 2004 the UK Government published a ten year strategy for science and innovation¹. The strategy was commendably outward-looking with a chapter devoted to global partnerships. Equally commendably, this chapter highlighted the importance of building on research links with the rest of the European Union and the need to improve networks in China and India. Little reference, however, was made to the United States of America, which is and for the foreseeable future will remain, much the strongest research system in the world, and whose researchers are the collaborators of choice for many of the UK's best scientists and scholars. It seemed that UK-USA collaboration was implicitly assumed to be self-sustaining, resulting in somewhat of a laissez-faire approach.

I wanted to establish whether this assumption was safe, and began to conceive of a project reviewing existing collaboration between the UK and USA and if necessary, making recommendations aimed at strengthening transatlantic research partnerships. It became apparent that my view was shared by others some of whom agreed to join the steering group (annex 1) of the project. We met on three occasions between October 2004 and July 2005 and agreed the main areas where some intervention would be beneficial. These were announced at a meeting organised by the Foundation for Science and Technology at the Royal Society on 12 July 2005. The study has prompted activity in various quarters and a good degree of progress has already been made. This is discussed in detail in the text. A summary of proposed actions is given in Annex 2.

"It is good to see that careful attention is being given to an activity which is often assumed to be self-sufficient."

Sir Richard Brook
Director, The Leverhulme Trust

2. RESEARCH FUNDING AND BIBLIOMETRIC ANALYSIS

The first phase of the work was largely an information gathering exercise. This involved visits to Washington DC for discussions and meetings with senior staff in key federal funding agencies; meetings with presidents and provosts from a dozen or so large US universities; visits within the UK to key Government departments, Research Councils and other research funders, research-intensive universities, and key stakeholders such as the British Council, Royal Society etc. In addition, questionnaires were sent to vice-chancellors seeking information on significant UK-USA research links.

The project was from the outset informed by quantitative evidence. A study of jointly authored publications was commissioned from Evidence UK Ltd. The ISI

¹ Science and Innovation Investment Framework : This document can be accessed at www.hm-treasury.gov.uk

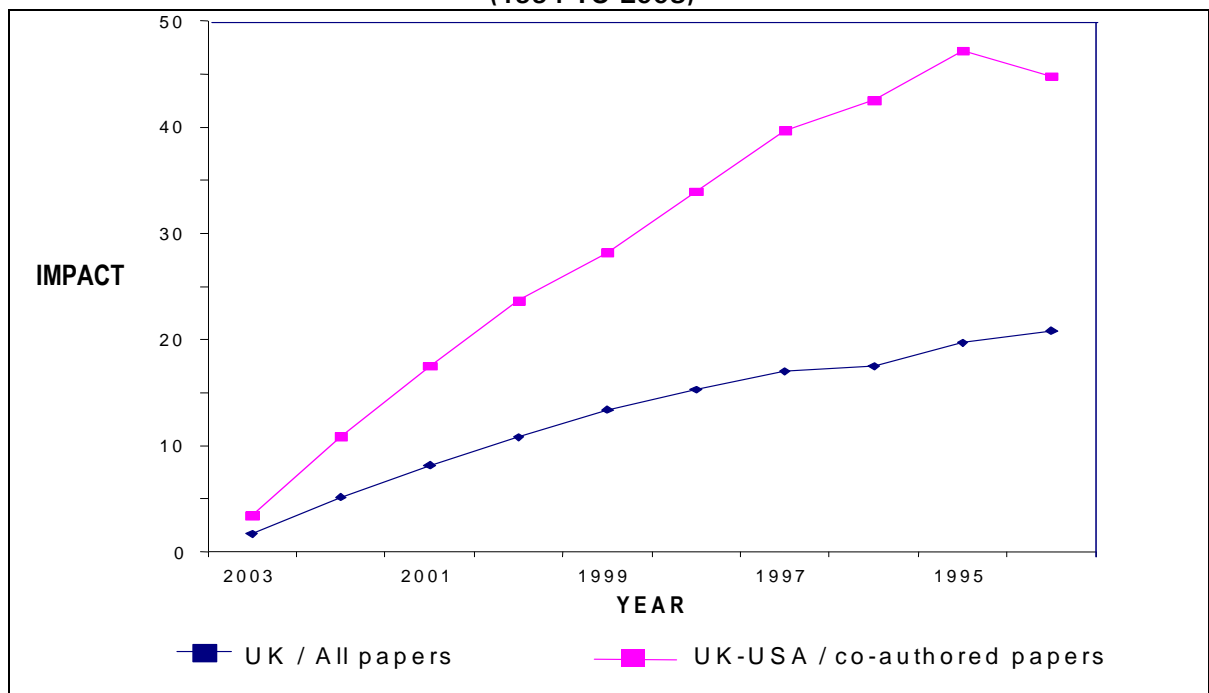
databases of Thomson Scientific were used in this bibliometric analysis in which it was assumed that relative research quality could be determined on the basis of citation impact.

The detailed findings form the basis of a paper to be published by Jonathan Adams and Gareth Roberts. In summary form, they show that:

- UK collaboration with the USA has grown faster over the past five years than for US collaboration with other countries.
- Between 1994 and 2003 the proportion of UK papers co-authored with US collaborators increased from 6.5% to 10.6% and is currently about 12%.
- The most popular collaborator for US researchers is the UK. Between 1994 and 2003, the proportion of US authored papers with a UK co-author rose from 4.2% to 6.5%.
- Nearly a third (30.5%) of the UK's highly cited papers in the period 1997-2001 had a co-author from the USA. This has risen from 24.8% in the period 1993-97.
- Co-authored UK-USA publications have a significantly greater impact factor (citations per paper) than the average UK only or USA only outputs.

Figure 1 provides a comparison between the impact factors for papers with authors from UK universities (including those with US and other overseas co-authors) and papers with a US co-author. The figures for more recent years are lower because papers published during this period have had less time to accumulate citations.

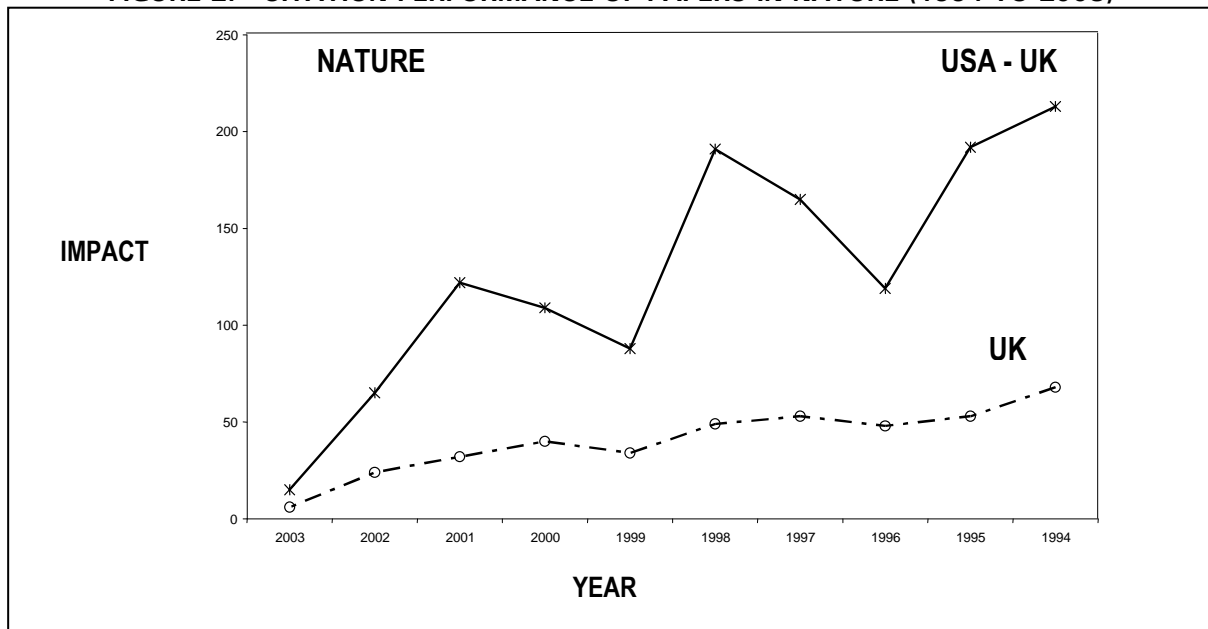
FIGURE 1: CITATION PERFORMANCE OF PAPERS WITH AUTHORS IN UK UNIVERSITIES (1994 TO 2003)



This evidence suggests that the UK benefits from collaboration with the USA; but there is also strong evidence that the USA benefits from collaboration with the UK. A study of papers in biological and physical sciences produced by leading USA institutions showed conclusively, not only that the universities doing most collaborative work with the UK are the great research universities of the United States of America, but that papers from these universities with a UK co-author had impact factors up to four times higher than for the rest of their output. It is also important to note that the UK remains the single most important collaborator for United States researchers.

Part of the explanation for the higher impact factors is probably that only the strongest researchers will have the resources and motivation to overcome the difficulties of collaboration over a distance, and that the biggest and highest profile projects are more likely to be international. To allow in part for these factors, a comparison was made between UK-USA co-authorships published in Nature and Science, and other papers published in those journals (which one might expect also to be produced by elite researchers with good access to funds and resources and a high profile in their communities). The data for papers in the journal 'Nature' are shown in Figure 2. and indicate that over the period as a whole, co-authored papers were cited two to three times more frequently than the average for UK authored papers in the same journal. Therefore, UK-USA collaboration does appear to add value, with collaborators combining their talents to achieve benefits they could not have done alone.

FIGURE 2: CITATION PERFORMANCE OF PAPERS IN NATURE (1994 TO 2003)



The USA, as the world's biggest research economy, is the preferred partner for international research partnerships and makes a significant contribution to the leading edge performance of collaborating nations. UK-USA collaboration represent more than 30% of the UK's strongest research; the equivalent figure for most other G8 countries is even higher. Put simply, there is no advanced

country that does not depend on US input to produce a high proportion of its world-class research. The ability to sustain strong research links with the USA is therefore crucial to research performance.

The scale of US investment in research and development (R and D) is massive and dwarfs the approximately \$6 billion distributed by UK Research Councils and Higher Education Funding Councils for research in UK universities. Table 1 shows the budgets for six of the principal US Government funding agencies. The total spend on R and D from all sources within the US is approximately \$284 billion which is larger than the total expenditures of Japan and EU nations put together and accounts for 37% of world R and D. The total Federal investment in Research alone amounts to about \$56 billion of which roughly \$33 billion goes directly to US colleges and universities.

TABLE 1: BUDGETS OF MAJOR FEDERAL RESEARCH FUNDING AGENCIES

ABBREVIATION	US FEDERAL FUNDING AGENCY	2005 BUDGET (\$ BILLION)
NIH	NATIONAL INSTITUTES OF HEALTH	27.8
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	11.1
DOE	DEPARTMENT OF ENERGY	8.9
NSF	NATIONAL SCIENCE FOUNDATION	5.5
USDA	DEPARTMENT OF AGRICULTURE	2.2
DHS	DEPARTMENT OF HOMELAND SECURITY	1.2
	SIX AGENCIES TOTAL	56.7

The implications of this are clear. It should be a strategic imperative therefore to optimise existing links and to invest further effort and resources to establish new research networks involving the USA. Both communities have a great deal to offer one another but there should be no need to suggest expensive artificial incentives to collaborate so long as some help is provided to overcome the natural obstacle (distance) and the artificial ones (lack of information, different funding systems, outdated perceptions etc.).

Clearly, if UK and US funding agencies can be prompted to work more effectively together, this will stimulate research contacts. It is important, however, to understand the complexity of the US Federal research funding system and not to assume that a single initiative will produce a step change in UK-US interaction. The major public funding agencies in the US have overlapping remits. For example, much of what is funded by the National Science Foundation could be funded by the Department of Energy. The distinctiveness

of each agency rests as much upon their role as a funder of basic or applied or mission-oriented research as the scientific fields covered by their separate remits. For example, the Department of Homeland Security is concerned with immediately applicable research whereas the National Science Foundation is reluctant to fund anything other than basic research – a remit which it interprets as excluding any consideration of ultimate outcomes. Other agencies fall between these extremes. The more ‘mission driven’ agencies are willing to entertain the idea that the maintenance of strong scientific and diplomatic links is in itself a reason to promote collaboration.

It also needs to be remembered that, whilst the agencies are accountable to Congress they are also highly devolved organisations. The heads of the twenty-eight entities which comprise the National Institutes of Health and the nine offices and directorates of the National Science Foundation have considerable power. The more mission-driven agencies have scope to spend money outside the USA in pursuit of objectives which can be shown to be in their national interest. This diversity means that greater co-operation between UK and US agencies is likely to grow from small scale understandings with individual agencies rather than from the unfolding of a grand plan.

In the next section I consider the adequacy of existing initiatives designed to improve UK-US research collaboration.

3. **EXISTING LINKS BETWEEN GOVERNMENT FUNDING AGENCIES**

All the UK Research Councils have recognised the benefits of international partnerships and view them as an essential vehicle for dialogue and influence on behalf of the UK research community. Schemes are in place to support overseas travel grants and workshops to enable researchers to exchange ideas and develop future collaborations. More recently, some Research Councils have increased the flexibility of doctoral training accounts to enable postgraduate students from overseas to work on projects. In many cases, network or collaboration awards, coterminous with conventional research grants are available to facilitate international cooperation.

There is however a distinct difference between the institutional arrangements in place to support UK-US partnerships and those, aimed at intra European collaboration which flow from UK membership of the European Union. Within the EU, research collaboration is actively encouraged and there are few barriers to those who wish to interact across national boundaries. The European Framework Programme and other special initiatives promote the international mobility of postdoctoral researchers and have arrangements in place to receive and assess joint applications from researchers. The European Research Council will stimulate even more activity of this kind. In short there are institutional processes at governmental and official levels designed to promote research collaboration. This is not the case for partnerships involving the USA where arrangements are of a more ad hoc nature.

There is, of course, considerable collaborative, productive effort underway between universities and research institutes in the UK and the USA. In some fields cooperation is thriving at all levels, from ad hoc collaborations between researchers through larger research networks to inter-agency partnerships. Where this is the case little or no action is necessary. For example, there is significant cooperation between scientists on Energy research, and important partnerships exist in Defence and Homeland Security areas. Special agreements are in place to secure strong cooperation in these sensitive and strategic fields of research. It is also impressive to see how well UK and US scientists dominate the major multinational centres in high energy physics, genomics and astronomy research. There are also some good reciprocal arrangements in place between national laboratories in the two countries.

Table 2 provides some of the few examples of bilateral, significant research collaborations co-sponsored by UK Research Councils and US Government funding agencies.

TABLE 2: EXAMPLES OF COLLABORATIVE INITIATIVES INVOLVING UK AND US FUNDING AGENCIES

Agency	Topic of Collaboration
ESRC – NSF	Visiting Fellowship Programme
MRC – NIH	Research Programme on Autism
EPSRC – DOE	Scholarships in Hydrogen Technologies
BBSRC – USDA	Project to Sequence the Cow
NERC – NSF	Rapid Climate Change
PPARC – NASA/DOE	Gemini Telescopes/Linear Collider
CCLRC – DOE	Oak Ridge Computational Science

US funding agencies are extremely diverse in their mission, culture and ways of working. Cultural differences exist within organisations as well as between them. The original intention was to explore the possibility of developing a single concordat outlining the basis of collaboration between funding agencies in the UK and the US. Having spoken to a number of the leading US agencies my conclusion is that there is no alternative to brokering bilateral agreements on an initiative-by-initiative basis; though this may be facilitated by understandings between organisations, for example, between an Institute of the NIH and a UK Research Council.

There is however one key issue for which a concerted effort in transatlantic diplomacy could yield lasting benefits for both countries. The survey has highlighted the difficulty for research groups to be confident of obtaining support on a bilateral basis from UK and US Government funding agencies. (This does not apply to partnerships funded by industry and charities). Double jeopardy,

which occurs when it is necessary to obtain a favourable funding decision from each of two different funders is one of the principal inhibitors of UK-US research collaboration.

Following discussions with the Director of the National Science Foundation, Dr Arden Bement, and senior staff in other US funding agencies, significant progress has been made in overcoming the double jeopardy problem. Protocols are being established which will lead to bilateral arrangements for funding joint UK-US research proposals in areas of shared priority. The first of these collaborative frameworks was signed in Oxford in November 2005 by ESRC and NSF and covered the areas Cyber infrastructure/e-Social Science and Human and Social Dynamics.

"I am in agreement that while some progress has been made due to your leadership in UK-US partnerships, much more is desirable. I have tasked our Office of International Science and Engineering to study your Report further and seek new ways to facilitate such partnerships. The initiative between Ian Diamond (ESRC) and David Lightfoot (NSF) provides a beacon in this respect. The harmonised procedures they suggest, to include joint review of proposals wherever possible address your concern about 'double jeopardy'."

Dr Arden Bement
Director, National Science Foundation

The NSF and the Deutsche Forschungsgemeinschaft (DFG) have recently announced new cooperative activities in Chemistry between US and German investigators. For the first time, collaborative research proposals that establish new partnerships between principal investigators from the USA and Germany will be encouraged in areas of clear relevance to the two funding agencies. A common set of reviewers which makes joint funding decisions will be used. The National Science Foundation has expressed its willingness to consider similar schemes in partnership with UK Research Councils.

PROPOSED ACTION

1. The UK Research Councils, either singly or collectively should enter into detailed discussions with the major US funding agencies, particularly the National Science Foundation with the aim of agreeing mechanisms to reduce double jeopardy. These could be based on recently introduced protocols for collaboration in strategically important fields.

In 2005 the NSF introduced a new scheme entitled 'Partnerships for International Research and Education'. This new programme is intended to catalyse a cultural change in US institutions by establishing innovative models for international collaboration, making possible research effort that neither side would accomplish on its own. The awards are normally limited to support of the US portion of the collaboration but reciprocal visits by foreign researchers and graduate students are encouraged. UK Research Councils already support requests for additional 'glue' money to strengthen links with international

research groups, but have agreed to advertise this more widely. **A more proactive approach by the Research Councils could lead to more UK researchers being given supplementary awards to help create lasting links with US research groups including those in receipt of NSF Partnership for International Research and Education Awards.**

PROPOSED ACTION

2. Research Councils UK should adopt a policy of encouraging their committees to offer the opportunity to those submitting high quality proposals to build links with elite researchers overseas. The policy should state explicitly that, whilst such activities should only be funded if there are clear links with funded research activity, it should not be necessary to demonstrate that the additional connectivity costs represent the most direct means of meeting the immediate research objectives. Such activity might include travel grants, student or postdoctoral exchanges, hosting workshops etc.

4. COLLABORATION IN THE ARTS, HUMANITIES AND SOCIAL SCIENCES

In the arts, humanities and social sciences, collaboration between researchers in the UK and the USA tend to be informal and personal, not to say solitary and lacking any firm institutional structure. While there is considerable movement of researchers across the Atlantic, there is no firm base upon which to build the networks and interactions required to stimulate and sustain collaborative work and partnerships.

Bibliometrics are a less reliable proxy for research quality and degree of cooperative work in the arts, humanities and the social sciences. Even so, the analysis of citations described earlier shows that there is a demonstrable gain to researchers in these fields of study.

The British Library in the UK and the Library of Congress in the USA are the premier research libraries in their respective countries in terms of the breadth and depth of their collections, and the professional leadership which they provide within their nations. They engage together in international ventures such as the Internet Preservation Consortium which is undertaking research and development in the area of tools to harvest and preserve the World Wide Web. The British Library has a strong track record of cooperation with the USA on academic and library programmes, including an important Mellon-funded collaboration with the New York Public Library but until this Review had no formal links with the Library of Congress. There is considerable scope, to build on existing cordial relations between senior staff, for scaling up this nascent scholarly exchange infrastructure in the two libraries, for developing a critical mass of resident fellows, for improving reciprocity of arrangements and for enhancing creative interaction between visiting scholars and permanent research-active curatorial staff. Both institutions are also well positioned, through their national role and professional skills, to link into other research

libraries, archives and data centres in their respective countries and to connect strongly with relevant academic centres.

Collaboration is often hindered by the lack of research materials available in digital form. There is therefore considerable merit in exploring the creation through digitisation from original or surrogate copies, of relevant online primary or secondary sources to underpin collaborative UK/US research. Such an initiative would exploit and add value to current AHRC and ESRC investment in e-science and e-research by utilising grid technology in terms of networks, middleware, applications and repositories to foster collaborative working with US colleagues and to build effective and sustainable virtual research communities and virtual research environments. While a variety of digitisation projects are underway in both the UK and USA, there has hitherto been little coordination between them. There is an opportunity to build a truly colossal and cross-searchable transatlantic database that would open up many exciting new avenues of collaborative and comparative research.

PROPOSED ACTION

- 3.** More should be done to foster UK/US research collaboration in the Arts, Humanities and Social Sciences by optimising the potential of physical or virtual access to - and innovative exploitation of - research resources in printed, digital and other formats in the libraries, museums, archives and data centres of the two countries.

Exploiting the potential for transatlantic research partnerships requires both strategic thought and a certain opportunism. An interesting illustration of this has been the establishment of the first tangible research partnership between the Library of Congress in Washington DC and the British Library, which originated in a conversation between myself and senior officers of the Library of Congress in Washington DC. The key ingredients in this major initiative, which has been enthusiastically endorsed by HEFCE, JISC, AHRC, ESRC, the national libraries in the UK and US and the US National Endowment for the Humanities are:

- The Arts and Humanities Research Council (AHRC) and Economic and Social Sciences Research Council (ESRC) have agreed to support annually up to 10 scholars each to research for a period of up to 9 months in the Library of Congress. Four existing award-holders have been selected to inaugurate the scheme this April. The full quota of twenty AHRC and ESRC Fellowships will be advertised in the Spring of 2006.
- The Library of Congress has agreed to cover all the space charges and curatorial costs associated with the visiting scholars who will be encouraged to share facilities and interact strongly with international scholars in the prestigious Kluge Centre in Washington DC.
- HEFCE (via its Joint Information Systems Committee) has agreed to provide £0.5m per annum for 5 years for a major collaborative programme with the LoC on digitisation. Meetings held in London between representatives of the

BL, LoC, JISC, AHRC and ESRC have agreed to prioritise newspapers, sound archives and official records/publications and other documentary sources.

- The AHRC has committed £0.5m per annum for the next 5 years to the elaboration of an academic programme to run alongside the digitisation work, both to inform and give focus to the digitisation efforts and to encourage UK/USA research collaboration. AHRC is presently consulting with its research community to identify which areas they wish to prioritise. The first of these meetings was held on 21 February 2006 at which a group of researchers was tasked with generating suggestions for the creation of digitisation projects to be conducted in a transatlantic context. The selected themes will be designed to showcase both the worth of the digitised resources and of transatlantic research collaboration.
- The British Library has agreed to develop its own visiting scholar centre and to organise scholarly workshops and exchanges on research topics linked to major collections in the two national libraries.
- The Gatsby Charitable Foundation has agreed to provide a substantial grant to refurbish two floors of a wing of the historic Jefferson Building in which the Library of Congress is housed. This purpose built Centre for UK scholars in Washington DC will help ensure the sustainability of research links between the two national Libraries. Both institutions are well positioned to link into other research libraries, archives and data centres in their respective countries and to connect strongly with relevant academic centres.

"I think we have tapped into a rich seam of collaborative research ideas which really should see UK/US research links in the Arts and Humanities intensifying. Many thanks for getting this initiative on the road."

Professor Tony McEnery
Director of Research (AHRC)

There is every indication that the above initiative will be the catalyst for stronger transatlantic research collaboration across the arts, humanities and social sciences. For example, the ESRC is likely to extend its involvement by funding scholars to spend time in major US universities as well as the LoC.

"It was good news to hear about the AHRC/ESRC Fellowships to the Library of Congress and we owe you much gratitude for your initiative. They do actually rather neatly complement what the Academy does with other American libraries."

Dr P.W.H. Brown
Secretary, The British Academy

Firm links have now been established between AHRC and the National Endowment for the Humanities with joint workshops and conferences planned. A further development has been constructive discussions between AHRC and NSF on concordats covering specific disciplines, similar to those pioneered successfully by the ESRC.

The Chairman of the National Endowment for the Humanities, Dr Bruce Cole, has fully endorsed the above actions and has agreed with Dr Deanna Marcum, Senior Director of the Library of Congress to spearhead the US side of a Transatlantic Steering Group for the overall initiative. The secretary of this Group will be Dr Clive Field of the British Library, who will also chair the committee overseeing the joint digitisation activity. Further funding is required to refurbish the physical space designed to accommodate the US scholars visiting the British Library and for scholarships to fund them during their studies in the UK.

A significant benefit of the above initiative has been the prospect of AHRC and ESRC engaging with the Department of Homeland Security's Centre of Excellence for Behavioural and Social Research on Terrorism and Counter-Terrorism led by the University of Maryland and its major US academic partners.

5. TRANSATLANTIC MOBILITY OF RESEARCHERS

Most knowledge is transferred through the interchange of people. In a recent study of the migration of staff to and from the UK, Bekhradnia and Sastry² reported that the very great majority of movement takes place among junior postdoctoral staff and that overall this is entirely positive for this country. Almost all highly cited UK staff who go abroad subsequently returned so although there was a net quantitative loss to the UK, there is a qualitative gain. Their data showed that for all highly cited researchers from the UK and elsewhere, the USA was the most common destination for research experience abroad but the net flow of migration was from the USA to the UK. Importantly, the publication analysis revealed that many UK researchers maintained the overseas research links they established earlier in their careers, often leading to formal association such as visiting professorships at a US University.

The UK Research Councils do not have an identical approach to postgraduate studentships, postdoctoral and advanced fellowships. They appear to have their own individual schemes, some of which have an international dimension. Most of the advertised Visiting, Advanced Research and Senior Research Fellowships are tenable in the UK but can be held by foreign nationals. Grants are also commonly available to UK researchers to travel abroad to visit laboratories, acquire new techniques and forge new partnerships. The USA is the most popular requested destination, as it is for proposals for workshops interactions.

Few of the Research Councils have bilateral partnerships with US funding agencies that involve young staff. One exception is EPSRC's agreement with the Sandia National Laboratory, the US Department of Energy and UK Department of Trade and Industry, for a collaborative exchange scheme for postgraduates in the area of hydrogen technologies. Another agreement, also initiated in 2004/5 is ESRC's arrangement with the Social Science Research Council in New York to fund scholarly exchanges between the two countries. Our investigations show that about 100 UK researchers are working on three

² Higher Education Policy Institute Report Summary 19 (2005)

year postdoctoral fellowships at NIH laboratories in the US, many of whom intend returning to this country. A popular scheme financed by the NIH is their Health Sciences Research Scholars Program designed to train outstanding US postgraduate students in various areas of biomedical research at the Universities of Cambridge and Oxford.

There are, of course, researchers sponsored by many other agencies, charities and industries engaged in research collaboration with the USA, but the majority of travel grants/visiting scholar schemes sponsored by institutions such as the Royal Society and the British Council are focussed on areas other than the USA. **There is, however, a large demand for places on the small but successful Royal Society/USA Fellowships Award. I believe this scheme should be expanded.**

On the whole, the movement involves more established researchers, those working on big international projects, and those in the most research-intensive universities, predominantly in areas where the UK is strong. There is therefore a need to ensure that the next generation of researchers are able to build upon the strong links generated by their predecessors.

PROPOSED ACTION

- 4.** Grant-giving bodies should provide positive encouragement to grantholders who wish to recruit postgraduate and postdoctoral researchers from the USA to work on funded projects and should similarly give sympathetic consideration to proposals to send young researchers to the USA to work alongside US collaborators on funded projects. The USA should be promoted by the Research Councils as a partner of choice for those seeking funding to assist the inward and outward mobility of new and young researchers.

Each of the UK Research Councils has an International Officer leading their respective initiatives and I have benefited from my meetings with them. **RCUK might give some consideration to assigning each International Officer particular responsibility for a specific cluster of key countries with which the UK collaborates.** There would then be one lead International Officer for links to the USA, sharing his or her knowledge and experience with colleagues in other Research Councils. **The UK could achieve greater impact in the USA if it consolidated some of its existing mobility schemes, including some research fellowships awarded by Research Councils, into an investment which could be administered by the Fulbright Commission which has a strong profile and high reputation within the USA.** Fulbright branding would increase the ability of these schemes to attract the very best young American researchers – tomorrow's research leaders – to come to the UK and see what we have to offer. The agreement in principle of the Fulbright Office in London has been secured for this purpose.

6. INCREASING AWARENESS OF THE STRENGTH OF UK RESEARCH

Through the Foreign and Commonwealth Office (FCO), the British Council, UK Trade and Investment (UKTI) and others, work is already ongoing to raise awareness within the USA of the strength of UK research. Momentum needs to be sustained, particularly building on the 2005 North America campaign 'UK Science and Technology for a New World'. It is clear that there are substantial funding opportunities, of potential interest to the UK research community, provided by US federal funding agencies, based largely in and around Washington. Many researchers in the UK community currently lack awareness of these opportunities and need proactive advice on how to best access the funding.

There is some appreciation in the USA that the research environment in the UK has improved in the last decade but senior academics and funding decision-makers often appear unconvinced, apart from when expensive large facilities are involved such as in high energy physics and astronomy, of the need to seek collaborators abroad. Discussions with university presidents and provosts indicate that time spent in Europe is not always seen as a marker of esteem for US academics, especially for those seeking tenure. The increasing importance of defence-related research and the restrictions placed upon the overseas links of US researchers in sensitive areas are factors with the potential to make the US more insular, but help establish the UK as one of a small number of countries with which US researchers in these key areas are able to work.

The FCO Science and Innovation Network in the USA provides invaluable assistance and many will attest to their competence and professionalism. However the team in Washington is already heavily loaded pursuing core priorities for OST, DTI, Research Councils and other key customers. It does not have the capacity to undertake additional work on federal funding opportunities or research contacts in the Washington region and beyond.

There is a natural tendency within the UK Embassy for general diplomatic work to take precedence over longer-term projects in specialist areas such as science policy. UK HEIs have a real interest in being 'entrepreneurial' – seeking out opportunities and contacts where others might not think to look. For this reason, I am persuaded that a separate unit in Washington, funded by UK HEIs and accountable to them and managed by the FCO is the best way forward.

Germany has had a research presence in the US capital for some time; their staff are thus well positioned to participate in the briefings/workshops organised by the funding agencies and for picking up on opportunities for their researchers. US agencies have indicated the value they place on having someone to talk to in Washington about proposed alliances.

PROPOSED ACTION

5. An office or small unit should be established in Washington as a primary liaison point with the federal funding agencies and to proactively disseminate information about funding opportunities in the USA to the UK research community. It should be funded by a consortium of UK universities and managed by the FCO. Synergies, and the possibility for co-location, with relevant UK Government sponsored staff within the Embassy, should be explored. The unit should be entrepreneurial in character: in evaluating its performance a very strong emphasis should be placed on the identification of new contacts and the establishment of new initiatives rather than simply the maintenance of cordial relations with a limited circle of contacts.

Sir David Manning, the British Ambassador to Washington, has expressed his enthusiasm for the venture. Leaders of the various UK university clusters such as the Russell Group, the 94 Group and the Coalition of Modern Universities have indicated their agreement in principle to support the proposal. There is strong support for 'testing the water' with the early appointment of two 'research transfer' individuals, one focussing on providing advice to UK universities on US funding opportunities, and the other to raising the profile of UK research amongst the funding agencies and US academics.

"Having a UK Research Office in Washington DC in close proximity to NSF and other government agencies could help increase awareness of UK research in the United States and expand communication on issues of scientific cooperation. In addition NSF's professional scientific and engineering staff would welcome visits to NSF and presentations by UK researchers."

Dr Arden Bement

Director, National Science Foundation

"There is considerable productive effort already underway between universities and laboratories in both our countries. Given the very similar energy, environmental and scientific objectives we both have, it is evident that closer working relationships will be to our mutual benefit. One suggestion we might make in this regard is to increase science and technology representation in your Embassy in Washington."

Dr Karen Herbert

Assistant Secretary, Department of Energy

7. COORDINATION OF UK GOVERNMENT SPONSORED TECHNOLOGY TRANSFER ACTIVITY IN THE USA

It is important for UK businesses to engage with markets, partners and technologies from other countries around the world. Because of the dominant position of the US in terms of R and D and enterprise in general, the UK devotes a considerable resource to managing and stimulating such links with the US. These activities are delivered by stakeholders across Government, especially the

Global Watch and UK Trade and Investment teams within the DTI, the FCO's Science and Innovation Network (which includes its science attachés in embassies, consulates and high commissions), and staff in Regional Development Agencies and the Devolved Administrations. Well over 200 staff are engaged in these pursuits within the USA alone.

PROPOSED ACTION

6. Steps should be taken to improve coordination between those in the public sector promoting UK technology overseas and those helping to identify overseas technologies which could be profitably developed and/or exploited in the UK.

A pilot should be conducted in one area of the USA to develop protocols to ensure strong collaboration between various UK agencies and effective coordination of their activities.

Senior civil servants responsible for UKTI and Global Watch have acknowledged to me the need to reconsider priorities, focussing more on science and innovation. They also understand the need to improve the coordination of their activities and to give individual staff more flexibility to enable them to pursue technology-transfer activities in both directions across the Atlantic. They will have been encouraged by the very recent Government announcement that UKTI is to be given an enhanced role in marketing the UK science base to business and to attracting foreign R and D investment as part of a new five year strategy and programme of organisational change.

There are now 21 highly effective International Technology Promoters, all DTI sponsored technology transfer specialists operating globally. About one-third are targeted on North America. Given the strength of R and D activity in the USA it would be prudent to expand this number. The recent structural changes within the DTI should enable them to connect more effectively to the activities of the UK Research Councils.

Many research intensive universities have expanded their technology transfer offices, some initially with University Challenge monies and others more recently with awards from the Higher Education Innovation Fund (HEIF). Some are now world class in building research relationships with industry and transferring this knowledge into the business community. This is often achieved via spinning out companies based on original research or start-ups responding to a market need. However, technology transfer offices in universities do not have sufficient resources or the necessary stimulus and expertise to extend their reach to the USA.

PROPOSED ACTION

7. UK universities should be given earmarked funds or encouraged to use monies obtained through the Higher Education Innovation Fund to develop links with US technology transfer offices. At the same time the DTI Global Watch service should expand its number of international technology promoters and engage systematically with enterprise teams in universities.

The Technology Transfer Offices of four premier UK universities; Cambridge, Imperial, Oxford and UCL collaborate effectively under the auspices of a special HEIF award. Steps should be taken to extend this cooperation to working together in the USA, possibly using further HEIF money. This model, if successful, could be extended to other University Technology Transfer clusters.

8. OPPORTUNITIES FOR NEW PARTNERSHIPS AND COLLABORATION ON TOPICS OF MAJOR IMPORTANCE

The UK and USA are frequently involved alongside other countries in large multinational programmes aimed at improving our understanding of the human genome or the nuclear structure of matter etc. The strength of the UK, the USA and the links between them means that in many cases UK-USA groups are the driving force behind these ventures. In a similar way one can envisage vital partnerships emerging to address other major global issues. It is anticipated that in due course the extensive digitisation programmes currently underway, together with the development of efficient search engines etc. will considerably enhance the potential for more research collaboration in the arts, humanities and social sciences between academics in the UK and the USA. The benefits of doing so have been demonstrated by the bibliometric analysis presented earlier.

There is a good appreciation of the value of international research networks both for industrial and academic cooperation. Two distinctive examples involving major UK universities are the Cambridge-MIT Institute (CMI) and the Worldwide Universities Network (WUN). The former was established via a large Government grant about 5 years ago to enhance competitiveness, productivity and entrepreneurship in the UK by creating research links predominantly between the University of Cambridge and MIT. One of its successes has been the establishment of Knowledge Integration Communities on various research themes. The very impressive WUN partnership has raised its funds largely from within its own membership, which mainly comprises major state or government funded US and UK universities. Large infrastructure projects and others in the arts, humanities and social sciences are being shared across the network to good effect in many multidisciplinary fields. **Government should endorse such initiatives by encouraging DTI and Research Councils to monitor and provide support for successful international networks of the WUN type.**

Two examples where there is considerable scope for strengthening collaborative research between the UK and the USA are in the areas of 'Building Research

Capacity in Africa' and in addressing the difficulties in 'The Supply of Scientists and Engineers'. Each of these is now considered in turn.

(a) Building Research Capacity in Africa

Africa needs its own research capability in order to tap the potential of its people and to create value-adding industries - and the developed nations need to help in the development of this capacity. Centres of excellence of regional, national or international status need to be created and collaboration between neighbouring countries encouraged so that a critical mass of capability can be achieved. Much of the activity and most of the resource must be spent in Africa to ensure that appropriate capacities are both built and retained in that setting. This point and many others relating to the most appropriate strategic policy for engaging with Africa have been eloquently described in a recent article by Sir David King³.

Currently there is little cooperation between the UK and the USA although each invests substantial funds for research widely across the sub-Saharan Region. For many years both MRC and the Wellcome Trust have established strong links and centres in Africa, many of which provide good platforms on which to build UK-US research partnerships.

PROPOSED ACTION

8. The UK and USA should, in partnership, develop a comprehensive set of strategies for the effective harnessing of science and technology to meet human needs in Africa such as agricultural productivity and disease prevention. University and industry players working in conjunction with funding agencies on both sides of the Atlantic should cooperate in establishing joint centres of excellence aimed at building research capacity in Africa.

The shared commitment of UK and US decision makers to multilateral action to boost research capacity in Africa became clear to me very early on in this project. Some preliminary work is underway to facilitate contacts and galvanise action. This Gatsby funded Project has contributed to the development of two important UK-US networks. One is being coordinated by the Regius Professor of Medicine in Oxford, Professor John Bell and brings together the three major UK Schools of Tropical Medicine in Liverpool, London and Oxford, to facilitate the establishment and maintenance of a cohort of scientists in several centres of excellence in Africa. NIAID, one of the Institutes within the NIH has agreed to support the venture and will be co-hosting a Workshop to plan the collaboration. The UK Department for International Development supports the initiative but has encouraged the consortium to await guidelines for cooperation being prepared by the New Partnership for Africa's Development (NEPAD).

³ To be published in the Smith Institute Monograph "Going for Growth, Science and Innovation in Africa".

During the early stages of the Gatsby funded project I presented an invited talk at a meeting of the US Government-University-Industry Research Roundtable (GUIRR) in Washington. My lecture prompted this 'US funders forum' to arrange a further meeting devoted entirely to Africa at which agreement was reached on the need to develop a catalogue of technology focussed networks with special relevance to Africa. Following this meeting I have received encouragement from the USA Department of Agriculture and NSF to connect research groups in the UK and USA interested in Sustainable Agriculture. The principal contact in the US has been Dr Harold Schmitz, the Technical Director of Mars Inc. who is a Council member of GUIRR.

(b) The Supply of Scientists and Engineering

At the time of the 2001 Budget I was asked by Government to lead a Review to determine whether the UK has an adequate supply of people with Science, Technology, Engineering and Mathematics skills. My Review 'SET for Success' reported that fewer students in the UK are choosing to study these disciplines, particularly the physical sciences, mathematics and engineering. It therefore concluded that these emerging shortages will act to constrain R and D and innovation in the UK, not just in these subjects, but also more widely, since much cutting edge research is multi-disciplinary.

The UK Government responded very positively to my recommendations in its Report 'Investing in Innovation' published in July 2002. Substantial funding was provided to both the Office of Science and Technology, and the Department for Education and Skills to improve the teaching and learning of STEM subjects. However, in its annual review of the ten-year science and innovation investment strategy in July 2005, Government expressed its concern that there was little or no improvement in the situation in secondary schools.

The UK is not alone in facing a severe shortage of science and engineering students and teachers. The subject has been a regular item on the agenda at European Summit meetings over the past 6 years.⁴ It also has a high profile in the USA with various agencies expressing concern about the US graduate supply statistics at both school and university level. The US Business-Higher Education Forum describes the shortage as having 'created a new economic and technological vulnerability as serious as any military or terrorist threat'. The US National Academies have supported a major investment in scholarships for those prepared to study for STEM degrees with concurrent certification as secondary school teachers and funds to universities to establish such programmes.

⁴ 'Europe Needs more Scientists' - Report by the European Commission's High Level Group on Increasing Human Resources for Science and Technology in Europe, 2004.

My proposal to cooperate on finding long-term solutions to address the shortages has been enthusiastically endorsed by the National Science Foundation and the Wellcome Trust. Plans are now being formulated for a UK-US Workshop on the Supply of Scientists and Engineers to be held in the USA in October 2006 and for a larger Conference to be held in Cambridge, UK in the Summer of 2007. These events are bound to stimulate new connections between interested groups in the two countries.

9. FUTURE SUPPORT FOR UK-USA RESEARCH PARTNERSHIPS

Most of the proposed actions require little or no additional investment from Government but, given the evidence that UK-USA collaboration represents more than 30% of the UK's strongest research, it should be a strategic imperative to optimise existing links and to invest further effort and resources to enhance existing and establish new research networks involving the USA. Of course, in some instances there may be merit in expanding the partnerships to involve additional international partners along the lines of the well established Human Frontiers Programme.

My meetings over the past year with many people in Government departments, funding agencies and universities on both sides of the Atlantic, have already prompted action in several areas. Indeed there has been pleasing progress in most of the topics highlighted in the eight Proposed Actions mentioned in the Report. These recommendations are designed to influence the White Paper to be published later this year on 'International Collaboration' and subsequently the allocations for Research in the forthcoming Comprehensive Spending Review.

"The United States remains the science and technology powerhouse of the global economy. The UK therefore has a major interest in securing access to Science and Technology Collaboration with the US, learning from best practice and remaining the partner of choice for Americans."

Foreign and Commonwealth Office

Science and Innovation Annual Report 2004-5

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I would like to thank the many people and organisations on both sides of the Atlantic for their willingness to engage with me and for providing useful information towards the project.

The Gatsby Charitable Foundation has contributed in two essential ways towards the Review. Firstly, in covering all the project costs and secondly, in providing generous support for the refurbishment of a wing of the Jefferson Building in Washington DC to provide an attractive working environment for up to 30 UK scholars.

Gareth Roberts

Oxford, April 2006

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PROPOSED ACTIONS

1. The UK Research Councils, either singly or collectively should enter into detailed discussions with the major US funding agencies, particularly the National Science Foundation with the aim of agreeing mechanisms to reduce double jeopardy. These could be based on recently introduced protocols for collaboration in strategically important fields.
2. Research Councils UK should adopt a policy of encouraging their committees to offer the opportunity to those submitting high quality proposals to build links with elite researchers overseas. The policy should state explicitly that, whilst such activities should only be funded if there are clear links with funded research activity, it should not be necessary to demonstrate that the additional connectivity costs represent the most direct means of meeting the immediate research objectives. Such activity might include travel grants, student or postdoctoral exchanges, hosting workshops etc.
3. More should be done to foster UK/US research collaboration in the Arts, Humanities and Social Sciences by optimising the potential of physical or virtual access to - and innovative exploitation of - research resources in printed, digital and other formats in the libraries, museums, archives and data centres of the two countries.
4. Grant-giving bodies should provide positive encouragement to grantholders who wish to recruit postgraduate and postdoctoral researchers from the USA to work on funded projects and should similarly give sympathetic consideration to proposals to send young researchers to the USA to work alongside US collaborators on funded projects. The USA should be promoted by the Research Councils as a partner of choice for those seeking funding to assist the inward and outward mobility of new and young researchers.
5. An office or small unit should be established in Washington as a primary liaison point with the federal funding agencies and to proactively disseminate information about funding opportunities in the USA to the UK research community. It should be funded by a consortium of UK universities and managed by the FCO. Synergies, and the possibility for co-location, with relevant UK Government sponsored staff within the Embassy, should be explored. The unit should be entrepreneurial in character: in evaluating its performance a very strong emphasis should be placed on the identification of new contacts and the establishment of new initiatives rather than simply the maintenance of cordial relations with a limited circle of contacts.
6. Steps should be taken to improve coordination between those in the public sector promoting UK technology overseas and those helping to identify overseas technologies which could be profitably developed and/or exploited in the UK.

A pilot should be conducted in one area of the USA to develop protocols to ensure strong collaboration between various UK agencies and effective coordination of their activities.

7. UK universities should be given earmarked funds or encouraged to use monies obtained through the Higher Education Innovation Fund to develop links with US technology transfer offices. At the same time the DTI Global Watch service should expand its number of international technology promoters and engage systematically with enterprise teams in universities.
8. The UK and USA should, in partnership, develop a comprehensive set of strategies for the effective harnessing of science and technology to meet human needs in Africa such as agricultural productivity and disease prevention. University and industry players working in conjunction with funding agencies on both sides of the Atlantic should cooperate in establishing joint centres of excellence aimed at building research capacity in Africa.