

Earth and Biosphere Institute

Institute Report

2004-2009



A summary of the work of the Earth and Biosphere Institute, a University Inter-disciplinary Initiative at the University of Leeds bringing researchers in Biology, Geography and Earth Sciences together under one umbrella.

University of Leeds
Woodhouse Lane
Leeds
LS2 9JT

How EBI has fostered inter-disciplinary research across school boundaries at Leeds.

It is very easy when you sit in a large organisation, as Leeds University has become, to forget how good ideas have evolved to the place we are now. When the previous Vice- Chancellor proposed the idea of a University Interdisciplinary Institute it was to try to get some real momentum for change. As is usual, the existing structures of departments and faculties tended to gravitate towards their existing “center of mass” and generally resisted attempts to move into new areas and disciplines. So he decided to invest money in groups that would cross disciplinary boundaries, and that would drive forward new research ideas.

Many of us involved in Environmental Science at Leeds at the time were concerned that, although we had strong groups already in Physical Environmental Science and in Ecology and Biodiversity, there was almost no contact or cooperation across the disciplines. After all, pollution is not pollution unless it affects organisms, and the prime effects of climate and environmental change are on organisms including man. So a group of us enthusiastically got together to talk about both the scientific issues involved in what was to become the EBI and the structural issues. It was an exciting time creating real synergies, both academic and personal, between the Physical and Biological Sciences. And so EBI was born. At the time any one of the committee could have appropriately taken on the role of director. I ended up with the job because I had just finished an EC project in which I was coordinator and had some ‘spare’ time. Pre Carbo became the administrator of the EBI.

The birth was not entirely simple. The university asked for a very detailed financial business plan including how we would not only spend our money but also how we would become financially self-sustaining. This took a lot of time and effort possibly in part because of my lack of financial expertise. Very soon after we started the financial model was discarded by the university anyway. We decided as a matter of policy that what we really wanted to do was to improve the quality and nature of the science at Leeds. Our aims were to encourage new interdisciplinary grants and high quality papers which would get us better grading in the RAE. We aimed to provide an environment at Leeds in which scientists working at the boundaries between these disciplines were attracted to come to Leeds and those already here wanted to expand their work into new areas. We have succeeded spectacularly in those aims.

However the downside was that we did not set out to ‘earn’ money ourselves to make the EBI self sustaining. The original funding model was that EBI would get a proportion of the overheads of new grants that were created as a result of our work. However it was never possible to demonstrate unambiguously that any particular grant only existed because of EBI, even though we have been able to show a dramatic increase in grants that were across school boundaries and in grants in the scientific area which we define as EBI. Not

unreasonably one of the first changes made to all UIIs was that the heads of the resource centres would not accept that any part of their FEC income went out right to the UIIs.

So what have we achieved in the years of our existence so far? The most important achievement as far as I can see is that the barriers between schools and between disciplines have been broken down. It is now natural to think of colleagues in Geography, SEE and Biology as people to work with and with whom to develop new and exciting academic ideas at many different scales. There have been EC training centres, major European and UK consortium grants, many NERC grants and other smaller grants that have been written based on and including EBI cooperation. We were involved in the successful water@leeds transformation fund bid. We are just beginning to see the papers appear that are the results of the many linkages we've built, including the highly successful studentships. The studentships were a particular success. They generated real cooperation between academics and the idea, which came originally from Peter Mackie, is being used in new initiatives such as the transformation funds.

In writing this summary I must mention the work carried out by Pre Carbo initially and subsequently by Jay Ratnam. They have been the public face of EBI and have been instrumental in actually turning our ideas and plans into reality. Pre created the website and organised the studentship competitions for several years. She ran a number of successful symposia, including the one which started the Water Research Institute which subsequently has become water@leeds, and the Life on Mars project which was a main contribution by Leeds University to the 800th anniversary celebration of the founding of the City of Leeds. Jay has continued this work including organising a series of in-house symposia much enjoyed both for the science and the Hansa curry meals afterwards. Both have really well developed 'people skills' and I am sure we would not have worked anything like as well without their contributions.

What about the future? Our funds are coming to an end. There is no more money for new studentships. Our remaining resources will be used to fund small cooperative ventures including specifically to help the development of future transformation fund bids between our constituent schools. We will keep the EBI website operational into the future.

However the work we set out to do is only just beginning. The national scientific agenda is even more about interdisciplinary science across conventional boundaries than it was when EBI was founded. We must jealously guard what we have achieved already and ensure that the atmosphere of genuine cooperation across our schools, between physical and biological environmental sciences, continues into the future.

Prof Michael Krom



Background and Mission

The EBI was funded by the University of Leeds as a University Inter-disciplinary Initiative in February 2004, and began functioning on March 1st 2004 with a mission to develop new research synergies and foster communications across its member departments, the Schools of Biology, Earth & Environment and Geography at the University of Leeds.

At the time that the EBI was created, it was clear that the direction of environmental research was becoming increasingly inter-disciplinary, and that looming issues of climate and land-use change required asking new questions and revisiting old questions with a holistic approach across the life science - physical science divide. Indeed, this trend continues; the need to think outside traditional disciplinary boundaries is an issue that

is at the top of many international social, governmental and scientific priorities. It is clearly reflected in NERC's recent strategy plan (2007-2012) which identifies sustainability of life on earth as the critical issue for the 21st century, and the creation of integrated research communities as a strategic goal (<http://www.nerc.ac.uk/about/strategy/ngscience.asp>).



The EBI was created in response to an early perception by the University of this need for integrated research on environmental issues, and united previously disparate groups within the university to provide an internationally-leading research institute in this area. It brought together earth surface scientists, ecologists and geographers to create a large thriving research group focussed on the effects of environmental change and working towards enhanced stewardship of the environment. The EBI today is a grouping of internationally recognised scientists with interests in the effects of biotic and environmental changes on a spectrum of time and space scales, from short term to geological, and from nano-scale to global.

At a glance: EBI and inter-disciplinary research at Leeds

The EBI has used a variety of tools in its work of facilitating inter-disciplinary work across its member departments. By far and away, its most successful contribution in this area has been the competitive **cross-departmental PhD studentship award program**. This studentship competition required that faculty from at least two member departments collaborate on the proposed research and that it contained explicitly inter-disciplinary aspects. Proposals that met the criteria were then ranked by a committee and the top 2-3 funded every year following student interviews. With active advertising and publicity on the EBI website and the topical nature of the proposals, EBI studentships have attracted high quality students. Most importantly the studentships have generated active discussions between EBI members in different departments and acted as catalysts for new collaborative engagement by faculty. EBI studentship proposals have often spun-off into other studentship proposals, and in some cases, into full fledged research proposals to funding agencies. Indeed, cross-school grant funding across the EBI has increased dramatically since it began in 2004.

Recently, the EBI has worked with the Department of Geography to develop an **inter-disciplinary Masters (Research) program** in “**Climate Change and the Biosphere**”. This program, well publicized on the EBI website, includes inter-disciplinary courses co-taught by members from different EBI departments, and a rigorous research component in which novel approaches to current environmental issues will be fostered. Through this program, the EBI contributes to the building of a next-generation workforce for environmental stewardship that is trained to routinely cross disciplinary boundaries.

The EBI has enhanced scientific networking and raised public awareness of environmental sciences research at Leeds by organizing and supporting several **international, national and university-wide events and meetings**. Examples include Water Research Day which eventually led to the successful water@leeds initiative, the AMASE Life on Mars workshop, Science Day and a symposium on ‘Global Biogeochemical Cycles’ which allowed international level networking between members in this field of research. Over the past year, the EBI has also organized a series of in-house seminars on inter-disciplinary topics of common interest to all members, (EBI Networking Seminar Series or EBINS), which provided a platform for members to regularly meet for casual discussions.

The EBI has directly supported research that pertains to its themes through **small grants and seed money awards**. These have either supplemented ongoing research or enabled pilot work towards larger grant proposals. The EBI has also indirectly supported research across its member departments by providing faculty with **teaching buyouts** which has freed up time for them to work on grant proposals, travel to workshops and spend time with collaborators.

EBI PhD Studentships

As of 2008, the EBI has funded 10 cross-departmental PhD studentships. These interdisciplinary and cutting-edge projects, many with important applications in policy planning and environmental conservation have attracted high quality students and produced exciting results!



2004

***Molecular pathways to
Biosilicification in Icelandic
geothermal hot springs***

Student: Dominique Tobler

*Advisors: Liane Benning (SEE)
and Jeremy Knapp (Biology)*

Silica polymerisation and the formation of silica sinters occur in active geothermal systems around the world, yet the chemical and biochemical controls for this process are not well understood. EBI graduate Dominique Tobler used a combination of field studies in active geothermal systems and laboratory studies in inorganic environments to better understand the silicification process.

Using a variety of techniques, Dominique studied how water chemistry (ionic strength, salinity, silica content, pH, temperature, and flow rate) and diverse microbial communities affected the growth rate and structure of *in-situ* sinters in different Icelandic hot springs. Her work shows that in geothermal areas with high salinity (seawater) and high silica supersaturation, high precipitation rates lead to porous and homogeneous sinters. Microbial activity in these areas is low and sinters are poorly preserved. In contrast, in hot springs with low ionic strength (meteoric water) and low silica saturation, slow precipitation rates allow dense and heterogeneous sinters to form. Even though the spring water temperatures are high (up to 90°C), thick biofilms are present in these hot springs. The slow precipitation rates result in microorganisms being fully silicified and well preserved within these sinters. Dominique then combined this work with molecular phylogenetic analyses of the bacterial communities and found that microorganisms clearly affected, and in part controlled, the formation of the macroscopic textures and structures of silica sinters. In addition, the class and genera level phylogenetic diversity and distribution appeared to be closely linked to variations in temperature, salinity and pH regimes. She has also conducted a series of laboratory experiments in a flow-through geothermal simulator system to detail the effects of water chemistry on nucleation and growth of silica nanoparticles.

