Institution: University of Bedfordshire

Unit of Assessment: 7- Earth Systems & Environmental Sciences

a. Overview

The Institute of Biomedical and Environmental Science and Technology (iBEST) provides a focus and mechanism for world-class research in life sciences at the University of Bedfordshire (UoB). iBEST is one of ten research institutes at the University. UoB provides research infrastructure and strategic growth funding to the Institute. All academic members of staff of the Department of Life Sciences (DLS) are affiliated to the Institute along with staff from other areas of the University with complementary research expertise and interests (19 FTE currently).

The institute was previously known as Luton Institute of Research in the Applied Natural Sciences (LIRANS; RAE2008 submission to UoA17). The name of the institute was changed to iBEST during the academic year 2011-12 and the thematic research areas were restructured in line with the research expertise and interests of the affiliated academics. A number of our academics with research expertise in the biomedical science area are being submitted to UoA3 along with academics from our other institutes (e.g. Institute of Health Research) working in research projects allied to health and wellbeing.

iBEST is an interdisciplinary institute with two major research areas - Biomedical science and Environmental science, and the Director of the Institute is Professor Sreenivasaprasad with expertise in molecular genetics applied to food security and environmental sustainability. Academics affiliated to the institute have expertise in specialisms such as molecular genetics, genomics, proteomics, biotechnology and bioinformatics that span both of the major research areas. We have been proactive in the delivery and dissemination of high quality research outputs. For example, during the academic year 2012-13, these include 34 Peer reviewed Journal Papers, 4 Book chapters and 30 Conference Presentations.

Research carried out by the academics within the Environmental Science area at iBEST is mainly focussed on developing new knowledge and applicable technologies that contribute to management and policy development in environmental monitoring and sustainability in the face of global change.

b. Research strategy

iBEST's research strategy is firmly aligned with the University's strategic plan to achieve new levels of impact through research, innovation and enterprise, building on our strengths in collaboration and partnership-working. In line with this strategy, the University has made considerable investment in increasing the academic staffing level in life sciences from 5.2 FTE research active staff at the end of 2009 to 19 FTE to date. The University Research Committee acts as an overarching body to steer the continued strategic development of iBEST and our other institutes.

The interdisciplinary nature of the iBEST provides excellent opportunities for cross-disciplinary collaborative activities in key areas of health and the environment, e.g. application of bioinformatics and genomics to identify and characterise bioactive molecules, and to develop biomarkers for improved monitoring and management. The institute provides academics with research expertise and interests in life sciences a mechanism through which they can develop and deliver their research programmes and postgraduate research student training focussed in academic excellence, and to engage with external stakeholders to translate research into use and deliver impact in dealing with real life problems in health and the environment.

Our RAE2008 submission to UoA17 included sensor, cryobiology and environmental monitoring research groups. In line with the key global agendas and the expertise of our current team, the major focal themes within the environmental science area have been realigned to focus on global change and biotechnology, and environmental sustainability. These themes complement the research in biomedical science under the thematic areas of health and wellbeing, and disease and aging. Consequently, the strategy for the environmental science area aligns with the institute's

future strategy which has the following key objectives:

1. Enhance our reputation as leaders in national and international environmental change management research agendas and contribute to socio-economic development
2. Further develop and support collaborative and interdisciplinary research and enterprise opportunities both within (e.g. inter-institute collaborations) and outwith the University (e.g. organisations involved in research, policy and practice)
3. Grow PG-R student activity and the research base to further develop a platform for sustainable research income
4. Create a Centre/Network for Interdisciplinary Research and Training that would serve as a vehicle to develop innovation systems research and impact in food, health and the environment areas
5. Further develop systems and implementation processes that effectively support research and enterprise activity of our academic staff.

In delivering these strategic objectives, iBEST Director and the academic team closely engage with various support structures developed at the University (e.g. Research and Enterprise Office, Innovation Director, and Research Graduate School) and Faculty (e.g. Business Development Manager) levels. Similarly, staff receive competitive seed-corn funds at the University (e.g. Research Investment Programme), Faculty (e.g. Enterprise Activity) and Institute (e.g. Research Travel, Exchange and Development Work) levels to develop and promote new ideas and to further enhance our research networks, collaborations and profile internationally. A wide range of internal (e.g. interdisciplinary workshops, meetings and seminars organised by UoB-research institutes such as Sustainabilities: a cross-disciplinary dialogue, June 2013) and external (e.g. conferences and professional associations) interactions in which our research staff and students participate provide opportunities to enhance the overall research experience and to create an active group of researchers functioning in a vibrant and stimulating environment.

c. People, including:

i. Staffing strategy and staff development

New staff with internationally recognised expertise in areas such as environmental biotechnology and genomics, molecular ecology, and conservation biology have been recruited (e.g. Sreenivasaprasad and Pritchard). These academics have also led and co-ordinated research for development, which included collaborative partnerships with community based- and non-governmental organisations as well as the industry promoting socio-economic development and citizen science (e.g. Sreenivasaprasad's UK-Department For International Development funded work on food security and environmental sustainability with international and national research for development organisations and networks in sub-Saharan Africa and industrial partners such as Maganjo Grain Millers Ltd, Kampala, Uganda). This complements the existing expertise within the team (e.g. Crabbe working on coral reef systems with Governmental, non-governmental and community-based organisations in the Caribbean). This provides an excellent opportunity to develop and carry out cross-cutting research in areas identified as global challenges such as environmental change, food security, and ecosystem sustainability (e.g. Haggett, biosensors for environmental protection and quality of life). Some recently retired or departed academics continue to collaborate with UoB to deliver research excellence in the UK and beyond. For example, David Rawson, Emeritus Professor, contributes to research programme on water quality monitoring in the river Lea involving close engagement with the Environmental Agency; Chief Editor, Journal of Cryobiology, Society of Cryobiology, and the editorial office is currently hosted at iBEST.

Staff are supported in the development and delivery of their research programmes by a centrally managed Research and Enterprise Office (e.g. competitive funding received by Worsfold, an early career researcher). Staff members are actively encouraged to develop and foster international collaborations and are provided with financial support to present their work at national and international research meetings. The institute receives QR funding per year since 2009/10 for research and researcher development. This includes use of QR funds to support staff to participate in prestigious conferences to enable promotion of their research and to develop new collaborations

as well as to strengthen existing ones and their network. In addition, our academics regularly present their research in internal seminar series held at various levels within the University. The University's Organisational Development and Training Unit (ODTU) delivers a range of induction and training programmes including health and safety and generic skills such as time management. All academic staff undergo a year-long probationary review period to formally monitor progress. Subsequently, all academics undergo an annual review at which an academic portfolio of research and teaching development and delivery targets are agreed along with any training and further developmental needs. Early career researchers are also supported through a mentoring scheme and in collaborative research development (e.g. Worsfold with Sreenivasaprasad). In May 2013, the University's institution-wide Concordat implementation plan was awarded the European Commission's HR Excellence in Research Award, which will be further developed in the coming period.

The University adheres to an Equality and Diversity Policy covering all areas of recruitment and employs an E & D advisor for policy implementation. Staff affiliated to iBEST are recruited, employed and promoted on the basis of their academic expertise and professional experience. HR processes ensure that this is strictly followed in all situations and the diversity of our staff generally reflects this with 12 males and 8 females originating from a number of different countries.

Our Research seminar series includes active participation by UoB academics and PG-R students, external representatives from academic, government and industry organisations (e.g. Professor Ross Coleman, Director, Centre for Research on Ecological Impacts of Coastal Cities, School of Biological Sciences, The University of Sydney, Australia; Dr. Richard Sharpe, Fellow of the Royal Society of Chemistry, Private Consultant, Techno Lynk Ltd., UK). Our Research and enterprise office via the 'Knowledge-Hub' also hold a series of monthly meetings that enable research staff to promote their work and engage with representatives from public and private sector organisations (e.g. Biotechnology: Environment, Food and Health; Crabbe and Sreenivasaprasad with Guinn, UoA3). Further, iBEST academics deliver invited lectures at external organisations including Universities and Institutes (see examples in Section **e**). The aim of these research development meetings, workshops and activities is to facilitate participation by UoB academics and external collaborators (e.g. Dr Thomas T. Tapmeier, Gray Institute for Radiation Oncology & Biology, University of Oxford) from academic, government and industry organisations so as to stimulate collaborations and accelerate interdisciplinary research, funding proposals as well as to contribute to on-going research (e.g. research in fungal environmental change biology with Professor Naresh Magan, Head, Applied Mycology Group, Food Security, Cranfield University).

ii. Research students

iBEST continues to be successful in attracting motivated research students both nationally and internationally. The institute currently has 17 students at various stages of their postgraduate research (PG-R) programmes in environmental science, and biomedical science underpinning health (in co-ordination with UoA3). This provides our students an excellent opportunity to develop a wider understanding of current and emerging developments and the importance of interdisciplinary research in these fields. A student-led Journal club**,** with guidance from and participation by academic members of staff serves as a forum for these interactions. Our students have 24/7 access to the learning resources centre including a recent expansion of the journal provision with an Elsevier package that includes electronic access to an additional ~1600 Journals in environmental and life sciences as well as allied fields.

Our research students undergo a rigorous monitoring process during their programme progression co-ordinated by the Research Graduate School (RGS). The RGS promotes regular academic interaction between students and their supervisors through an online monitoring system Pebble+ to create, validate, feedback and archive records of monthly formal meetings between the student and the supervisor(s). In addition, an annual monitoring report is provided by the supervisory team to feed into the process. PG-R students receive induction, training, and support throughout their programme as part of a well established monitoring process independent of the supervisory team. These PG-R programme support and monitoring activities are co-ordinated by the RGS through the Institute Director. In the instances of any supervisory staff changes, adequate and appropriate

supervisory support arrangements are made in consultation with the RGS.

Our research students are actively encouraged to present their research at external conferences (e. g. Kumarswami supervised by Hagget in Biosensors, awarded Best Poster, European Materials Research Society Meeting, 2012, Strasbourg) organised by discipline-based professional bodies nationally and internationally, where necessary with required financial support. The research seminar series, and open seminars delivered by postgraduate research students as part of their progression process and the annual University Conference all provide our students with the opportunity and grounding in presenting their research to a range of audiences. Research students are further encouraged to become members of their discipline-related professional societies (e.g. British Mycological Society), and also to participate in career development workshops/fora (e.g. Naturejobs Career Expo 2013, London). Our current postgraduate research cohort represents a good diversity including Home/EU, Middle East and Asian students. A student-led Research Student Support Group working with the UoB-Student Union serves as an important mechanism for wider interactions and the integration of our postgraduate research students into the academic community across the University.

d. Income, infrastructure and facilities

The University has an on-going competitive Research Investment Programme through which a number of research projects are awarded annually. A panel comprising four senior professors representing various faculties and chaired by the Pro-Vice Chancellor, Research and Enterprise reviews the various proposals. The two types of awards include a 'Rising Stars' award that provides up to £10K to pump-prime research projects for those staff aspiring for research leadership; and a 'Research Funding Opportunity' of up to £20K to support further development and acceleration of a research programme for more senior members of staff. In addition, the University also holds two dedicated Leverhulme Trust senior research fellowships, which are awarded through a competitive internal process. During the review period, our academics have received c. £428,000 research funding from a range of organisations including UK industry, Government bodies and other sources. iBEST academics have been very successful in winning the competitive grants offered by the University with 12 awards during 2011 – 13 (~£115,000), to increase further the research, and external funding opportunities.

The University has made considerable investment in developing the infrastructure and facilities required for environmental science research within life sciences. This includes a wide range of molecular, biochemical and imaging equipment established through University's capital grants and external funding. For example, the Leica SP5 Confocal Microscope System established through joint funding from the EEDA is used not only by iBEST academics and students but also by staff and students from other research institutes and departments/faculties within the University as well as external organisations (e.g. staff from Open University). Other capital equipment purchases include Olympus BX65 fluorescence microscope; Real-time PCR system; Cell analyzer, HPLC systems, Flow cytometer; Low temperature and CO_2 incubators; and additional liquid nitrogen storage and -80 C freezers.

The University has a strong commitment to maintain and further enhance laboratory facilities for life sciences. This includes, most recently, a new £1 M laboratory that includes analytical, molecular and tissue culture facilities. These core facilities enable staff and students to apply a range of current and emerging research technologies including molecular and computational methodologies integrated with ecological and environmental research methodologies. Staff members have been successful in participation in externally funded national and international collaborative research projects leading to a range of outputs including publications in field leading journals (e.g. Crabbe, long standing collaboration with Fudan University, China).

In addition, plans are currently underway to further develop life sciences laboratory facilities at the University square in Luton to house our expanding research and academic programmes. Furthermore, discussions with local businesses are continuing to develop commercial-partnership projects (e.g. Colworth Science Park, Bedford). Newly appointed staff members have been proactive in further developing their national and international research collaborations and

networks through the University's Research Investment Programme grants (e.g. with Warwick and St Andrews; Research Institutes in Portugal and Uni. of Salamanca, Spain; Sreenivasaprasad). Examples of on-going collaborations through external funding includes a post-doctoral award by FCT (Portuguese Govt-Foundation of Science and Technology) in the food security area to jointly host a post-doctoral fellow Dr. A. Cabral (Sreenivasaprasad, Co-investigator with ISA and IICT, Portugal); a Science and Technology Facilities Council funded 3-year project 'STFC/NERC Bioinformatics & Environmental 'Omics Network' led by Professor Thomas Meagher, St Andrews (Sreenivasaprasad, Project Consortium Member).

The University's Research and Enterprise Office and the Research Graduate School have a number of staff who provide administrative support to the Director and the Academic members of the institute, for example in PG-R student recruitment and programme management processes. Some of these staff also act as business development managers and provide the research staff with details of funding calls. In addition, visits and participatory workshops by UKRO and EU funding information day are organised annually. Further, more senior researchers within UoB who have been successful in gaining external funding are invited to share their experience to help researcher development and to promote good practice (e.g. Professor Gordon Clapworthy, examples/case studies of successful EU funding). University Research Committee acts as an overarching body to direct strategic developments and the institute directors sit on the committee.

e. Collaboration or contribution to the discipline or research base

Several collaborations across the research, policy and practice continuum have been developed, underpinning the delivery of outputs contributing to new developments in the field as well as building the opportunities for application and impact. The range of collaborations includes academic organisations (e.g. Australian National University, Canberra; Fudan University, China; USA National Oceanic and Atmospheric Administration), government agencies (e.g. Environmental Agency, UK), industry, and community-based and non-governmental organisations (e.g. TASTE – Toledo Association for Sustainable Tourism and Empowerment, and TIDE - Toledo Institute for Development and Environment, Belize). On-going and planned Research projects and postgraduate research programmes include key areas such as Biodiversity conservation – development of new knowledge and applicable technologies; Environmental change adaptation – integrated application of ecological assays, molecular genomic technologies, bioinformatics and computational modelling; Environmental monitoring and protection – application of microbiological and biosensor-based approaches (e.g. development of electrochemical biosensors with Newcastle University, and Manchester Institute of biotechnology, Haggett). Some of the more applied and industry-supported work has led to a series of patent applications (e.g. with Johnson and Johnson, and Unilever, Haggett).

Our research is published and disseminated through high quality international journals (e.g. BMC Genomics, Fungal Genetics and Biology; PLoS One; and PNAS). Currently, two edited books are in preparation for publication by springer, and Wiley-Blackwell (e.g. Fungal bioactive molecules: Recent advances and applications, Gupta [NUI, Galway] and Sreenivasaprasad, Wiley-Blackwell). In recognition of these contributions, our academics are invited to serve as Members of Professional Bodies, Editorial Boards, Review and Examination Bodies including Grant Applications, Journals, and PhD theses. Staff members are also invited to deliver keynote or oral presentations at conferences and external organisations (e.g. International Conference on Marine Biology, 2011, Cairns, and University of New South Wales, Australia, Crabbe; STFC-Environmental Futures Workshop, October 2011, and Cranfield University, Dec 2011, Sreenivasaprasad). These interactions with and contributions to the scientific community have provided us with excellent opportunities to maintain and further enhance our research network and profile.

The range of professional work carried out by academics in the environmental science includes:

- Committee membership of professional bodies (e.g. Vice President, Institute of Marine Engineering, Science and Technology, Crabbe; Fellow of Society of Biology, Sreenivasaprasad; Board of the international environmental NGO PasoPacifico, Pritchard);
- Review panels of funding agencies (e.g. NERC, Crabbe; ESRC and BBSRC,

Sreenivasaprasad); Journal editorial boards (e.g. Computational Biology & Chemistry; American Journal of Climate Change; Journal of Studies in Atmospheric Sciences; British Microbiology Journal; World Scientific Journal – Biotechnology);

- Postgraduate research examination panels/PhD thesis examinations internationally (e.g. University of Nottingham, University of Kent, University of Copenhagen and University of Madras, India);
- Membership of various knowledge transfer networks, which enables us to interact and consult with various stakeholders including the industry (e.g. Sreenivasaprasad, Bioscience- and Environmental Sustainability- Knowledge Transfer Networks).

In addition to the primary driver of maximising high quality research outputs through a whole range of avenues such as journal publications, books/book chapters and proceedings, we recognise the importance of informing local and national government policy (e.g. working with National Environmental Protection Agency, Jamaica; Environmental Agency, UK) as well as to promote public understanding of science (e.g. Open Access Community Essay in Sustainability: Science, Practice, & Policy, 5, 42-47, 2009; by Crabbe with co-authors from the Earthwatch Institute, TASTE, TIDE, Friends of Nature, and Department of Fisheries, Belize).

We also use various media channels such as internet and radio to highlight our research achievements and to raise public awareness of topical issues (e.g. 'Ash die-back and Invasive species', Interview on BBC Three Counties, Sreenivasaprasad; 'conservation approaches in the face of climate change' by Pritchard quoted in New York Times in 2012, www.nytimes.com/roomfordebate/2012/07/05/does-captive-breeding-distract-from-conservation/humans-can-manage-wild-animal-populations). Our academics, many of who are STEM ambassadors, regularly take part in outreach activities such as STEM club events at local schools (e.g. Aylesbury Grammar School STEM Club) and the University Open Days and Taster Days to stimulate youth interest (e.g. All Saints Academy, Bedfordshire) in bioscience and the potential of biotechnology to the global sustainability agenda.