Institution: University of Bath

Unit of Assessment: 5: Biological Sciences

a. Overview

The Biology and Biochemistry Department at Bath has shown dynamic and rapid development in the REF period. It has undergone a strategic restructuring enabling all staff to fit within at least one of four research themes (previously 7), this restructuring being underpinned by investment into new academic staff, thereby laying the foundations for sustainable growth. Our outstanding contribution over the period of assessment is evidenced by, amongst other things, nine first / senior author papers in *Science* or *Nature* (including 1 from a member of staff now retired), five major international awards and our **ranking 2nd in the UK in the Biology subject league table in the Sunday Times University Guide 2013**. We have **three winners of the Scientific Medal of the Zoological Society**. The Department of Biology and Biochemistry enjoys a vibrant and dynamic research and teaching environment. The Department is central to this unit of assessment, but embraces collaboration at many different levels, playing key roles in interdisciplinary university centres and both national and international consortia. Whilst all staff within this UoA are based in the Department, five members of the Department are included in the Allied Health UoA, emphasising close links with other parts of the University.

Research combines excellence in fundamental and applied research addressing national and global grand challenges, with a strategic approach to leadership and participation in large interdisciplinary research initiatives. A four research group structure is central to our flexible, collaborative approach. These four Research Themes are:

Cell and Developmental Biology	Evolution and Biodiversity
Infection and immunity	Medical and Industrial Biotechnology

Key improvements to our research environment during the REF period include:

- Recruitment of top international quality young academics and investment, for retention and recruitment, into strategically important senior academics. Since 2008 fourteen new positions were specifically targeted to sustain and focus critical mass for our activities, to realise impact, and to help forge new intra- and inter-disciplinary collaborative links. All of the appointees were identified for their future leadership potential, both in terms of adopting key managerial and mentoring roles in the department, and as influential leaders of their respective scientific fields.
- Strengthened group leadership, providing support for intra- and inter-disciplinary collaborative research and ideas generation. Staff profit from improved dynamism, enhanced communication and a greater sense of identity and inclusion. We nurture junior researchers through an intensive mentoring program that optimizes research effort and enables funding acquisition.
- Development of world-class resources including continued growth of an imaging suite, development of state of the art bioreactors and, in process, a field station.
- We have positioned ourselves at the leading edge of exciting emergent fields such as regenerative medicine and sustainable biotechnology.

b. Research strategy

Our aim over this REF period has been to enhance the quality, volume and impact of our research, and we have achieved this by developing a Research Strategy centred on making the most of our relatively small size. This strategy was introduced following a review of RAE2008 outcomes, which recognised the strength and range of expertise of existing excellence within the Department, and identified how opportunities offered by critical strategic challenges mapped onto this excellence. To this end, we have rationalized research into four areas (previously seven) within each of which we work at an internationally competitive level with critical mass. The new approach emphasises:

- Strongly ***interdisciplinary approaches*** to current research challenges, with close ***alignment with key strategic themes*** at the regional, national and international level.
- Building, developing and supporting ***critical mass efforts*** both within and beyond the Department and University, while ***encouraging and nurturing individual excellence***-led approaches to basic research.

- Leadership, participation and partnership in a wide range of ***major research consortia***, with enhanced ***links to collaborators*** both in academic and industry, in the UK and overseas.

The new strategy is guided by the following principles:
1. Alignment and responsiveness to changing research needs: The influential status of our senior academics within their respective disciplines provides front-line insight as to the most pressing scientific questions for the 21st Century, and mechanisms are in place to ensure the rapid dissemination of new initiatives and priorities to the department as a whole (see Research Governance). Our focussed four-group research structure thus aligns with key problems in the realms of Public Health, Climate Change and Food Security:

- **Developing** novel therapies using stem cells, and elucidating the mechanisms behind obesity, cancer, diabetes and neurodegeneration (Cell and Developmental Biology; Medical and Industrial Biotechnology).
- **Understanding** the basic evolutionary processes underpinning genomic and organismal complexity (Evolution and Biodiversity).
- **Managing** the spread of infectious disease in humans and animals (Infection and Immunity).
- **Improving** crops to meet global demand in a changing climate (Medical and Industrial Biotechnology; Evolution and Biodiversity; Infection and Immunity).
- **Bio-Engineering** new enzymes for the development of novel drugs and fuels (Medical and Industrial Biotechnology).

2. Building collaboration and interdisciplinarity through research centres: A particular mechanism to encourage both concentration of excellence and embedding research within an interdisciplinary environment has been the establishment of **research centres.** These provide important platforms for nurturing collaborations, and a dynamic outward face to our research activities. **The Centre for Regenerative Medicine** (CRM) brings our developmental biologists together with tissue engineers in Pharmacy and Pharmacology, Chemical and Mechanical Engineering and Clinical Medicine. **The Centre for Extremophile Research** (CER) links our enzymologists with other University departments and colleagues in Public Health England at Porton Down. **The Centre for Sustainable Chemical Technologies** (CSCT) includes Chemical Engineering, Chemistry, Mechanical Engineering, as well as Biology and Biochemistry. A new **Centre for Sustainable Biotechnology** (CSB) will focus on the metabolic engineering aspects of this research. **The Centre for Mathematical Biology** (CMB) unites our Evolutionary Biologists with the Departments of Mathematical Sciences, Computer Sciences and Physics. Several groups have coalesced into **The University of Bath Bee Unit** (UBBU), a new research facility and apiary that forges ties between Biology and Biochemistry, Engineering, Mathematical Sciences and Architecture and Civil Engineering. **Cancer Research @ Bath** (CRAB), which links our staff with those in Pharmacy and Pharmacology. The **Neuroscience Network** (NNUB) encompassing Psychology, Biology & Biochemistry, Pharmacy & Pharmacology, Physics and Computer Sciences.

3. Balancing pure and applied research: Our commercial interests include sustained collaborations with both large pharmaceutical companies and small biotech. For example, Professors Leak and Danson (UoA Allied Health) collaborate with TMO Renewables on metabolic engineering for bioethanol generation, and Professor Acharya has close ties with Industry (Syntaxin Ltd) and various external bodies including Public Health England and the Ministry of Defence, relating to his work on elucidating the structure-function relationship of angiogenic molecules and toxins. The Knowledge Transfer Account (KTA), now the Impact Acceleration Account (IAA) helps set up short to medium term (0.5-3 years) partnerships between the Department and industry to fulfil specific translational research project goals. An example of the success of the KTA is the project run by van den Elsen with Professor James (Chemistry) entitled "Promoting new technology for the detection visualisation and analysis of protein glycation in health, ageing and disease" (June – Sept 2012). We also have close ties with key stakeholders including Public Health England and various DEFRA agencies (VLA, FERA, CEFAS).

4. Building on our research strengths: Staff turnover (mainly through retirements) since 2008 has allowed us to consolidate our research priorities. We have begun to build additional critical

mass through two new tenure-track (University Prize Fellow) appointments, and growth will accelerate in 2014 through the appointment of two new academic posts. Our extensive undergraduate placement programme, undertaken by the majority of our undergraduates, helps to maintain external contacts, both academic and industrial. The University is ranked **number 1 in the UK in student satisfaction scores (NSS**) and future expansion of the department is underpinned by a robust increase in undergraduate recruitment. Links with neighbouring institutions have been strengthened by the formation in 2013 of the GW4 South West research partnership between, Bath, Bristol, Cardiff and Exeter. The four Universities have committed a total of £2m over the first two years to enable sharing of research infrastructure, doctoral training, staff development and collaborative research. Though in its early stages, GW4 already includes doctoral training centre partnerships, has developed systems for shared research equipment and infrastructure, and Horizon2020 planning and development. We initiated annual conferences to improve ties with our neighbours (e.g. evolution@bath&bristol; South West Genetics Society) and have hosted or organized numerous national and international conferences including, a European Society of Neurochemistry Meeting in Bath, at least 3 Royal Society meetings (London), plus >20 overseas conferences. To maintain high-level academic contacts the department makes good use of the University funded David Parkin Visiting Professorships (£20K each) for the visit of an overseas academic for 1 year (four since 2008). These have proven profitable visits resulting in one case in a publication in *Science.* The university has recently signed accords with a number of partner universities on four continents, and the International Strategic Fund provides support for academics to initiate international collaborations with these institutions. For example, we have recently established two collaborative projects with institutions in Brazil, one pumped-primed with internal funds (*van den Elsen*) and the other funded through the BBSRC-FAPESP scheme (*Wolf*).

Research Governance

The four group structure plays a central logistic role in research activity within the department. Weekly or fortnightly group meetings provide a supportive and collegiate environment for academics to discuss on-going projects and grant proposals, and an important troubleshooting forum for PhD students. The leader of each Research Theme sits on the Departmental Research committee, along with the Director of Research (Chair), a Deputy Director and a senior technical manager. All of the key roles are reviewed after a fixed term of 3 years. The Director of Research reports to the Departmental Executive committee, chaired by the HoD, and also to the Faculty of Science Research Committee, which in turn reports to the University Research Committee, chaired by the Pro Vice-Chancellor for Research. The Executive Committee also overseas staff recruitment and retention, infrastructure and teaching matters.

The role of the Departmental Research Committee is central to the strategic vision. It continually reviews research funding activity, application rates, success rates, the internal peer review systems and membership of funding boards. This committee also pro-actively seeks funding opportunities and communicates these to individual researchers though the Research Group leaders. The Department Postgraduate committee oversees all aspects of the recruitment and progression of postgraduate students.

The University subscribes to the UK Research Integrity Office. We have integrated policies for integrity and ethics, supported by a central committee, departmental research ethics officers, and research ethics committees for animal experiments, Social Sciences and Health.

We have weekly departmental seminars given by external experts covering a broad range of fields. In addition, both for mentoring and to enhance collaborative opportunities we have a weekly internal postgraduate and postdoctoral seminar series. Our annual Department Research Conference provides academic staff with the opportunity to present recent research highlights, and for post-graduates and early career researchers (ECRs) to take part in a poster competition.

Research milestones over the assessment period

The success of the new structure for research governance and for the new strategy is reflected in our output. Since 2008 staff in this UoA have published over 430 papers, accumulating in excess of 7400 citations. Over the period of assessment we have published nine first / senior author

papers in *Science* or *Nature* and many more in general biology journals such as *PLoS Biology*, *PNAS* and *Current Biology*. Examples of our research highlights include:

Cell and Developmental Biology: Discovery of the first example of an imprinted gene that affects social behaviour (*Ward*: Nature); Cloning of the first adult vertebrate (mouse) from adult cells in England (*Perry*); Development of the first model system of neural crest gene regulation networks (*Kelsh*: PloS Genet); Development of tools to study bacterial infection in real time in *Drosophila* embryos (*Wood*: PLoS Path). The development of CiteAb (http://www.citeab.com), currently holding information on over a million antibodies, and rapidly emerging as the one stop publication-based web-resource for discovering those antibodies that work (*Chalmers*).

Evolution and biodiversity: Demonstration of the non-inviolability of the competitive exclusion principal (*Hurst*: Nature); Development of the mathematical tools to enable estimation of the generalizability of *in vitro* experiments (*Hurst*: Nature); Development of the gold standard *Arabidopsis thaliana* lines for mapping complex trait loci (*Kover*: PLoS Genet); Demonstration that morphological disparity arises early as groups evolve (*Wills*: PNAS); Discovery of a "missing-link" between lizards and snakes (*Longrich*: Nature).

Infection and Immunity: The first use of next-generation genome sequencing for molecular epidemiology of pathogenic bacteria (*Feil*: Science); Discovery that pathogenic fungi have frequent sex (*Henk*: PLoS Path); Discovery that bacterial polysaccharides suppress innate immunity in plants (*Cooper*: Curr Biol).

Medical and Industrial Biotechnology: Inversion of the prevailing view of the interaction between the adaptive and innate immune systems (*van den Elsen*: Science); Establishment of the first integrated model of protein motion and chemistry for detoxifying cytochrome p450 reductase (*Pudney*: PLoS Biol). Deposition in the RSCB Protein Data Bank of >90 protein structures (*Acharya*, *Bagby*, *van den Elsen*).

Research milestones over the coming assessment period
The above discoveries, and others, leave us in an excellent position to make major breakthroughs in the future. The focal aims include:

Cell and Developmental Biology: Modelling and developing novel therapies for major diseases; including cancer, liver failure, diabetes and neurodegenerative disorders. A key goal is the generation of replacement cells for liver and pancreas. Research will focus on models of gene regulatory networks, cell fate choice and differentiation in at least two stem cell systems (embryonic stem cells and neural crest stem cells) and on the use of novel genetic models for the discovery of mechanisms underlying early life programming of life-long health. With recent endorsement by international journals of our reporting guidelines, we expect CiteAb (http://www.citeab.com) to become the world's most widely used antibody search tool.

Evolution and biodiversity: The contribution of imprinting and alternative splicing on evolutionary innovation, and the extent to which selection acts on variation currently assumed to be neutral, with translation to improved diagnostics. The strategy will involve a combination of mathematical modelling, population biology and bioinformatics to efficiently exploit publicly available 'omics' databases representing all domains of life. Macroevolutionary work will focus on major evolutionary transitions, both through extensive meta-analyses to understand the radiation of emergent clades, and a detailed re-evaluation of those fossils pivotal for understanding evolutionary reconstruction in deep time. This will help to pinpoint the conditions pertaining to mass extinction events, with implications for extant populations.

Infection and Immunity: The combination of next-generation sequencing (NGS) and GWAS approaches will lead to the development of community-oriented tools providing phenotypic predictions based on genome sequence alone. Cheap field diagnostic kits will be developed to manage the spread of *Fusarium* wilt of oil palm from Africa. The development of new culturing methodology for *Bordetella* which will greatly facilitate the study of this pathogen. We will expand

the development of invertebrate models of infection through placing the departmental colony of *Manduca sexta* on a self-sustaining footing, and through the establishment of the University of Bath Bee Unit (UBBU) will develop and systematically test experimental hive designs for improved winter survival rates.

Medical and Industrial Biotechnology: Members of this group have developed novel vaccine conjugates and protein therapeutics that will form the basis of a spin-out company within the next two years. This protein-conjugate platform technology aims at improving vaccines and cancer drugs. Other members of the group will apply metabolic modelling and synthetic biology approaches to create metabolically engineered microbes for producing bulk chemicals by transformation of renewable feedstocks, with a particular focus on agricultural co-products and fermentable wastes. The work will have a particular focus on biological methods to integrate production and extraction, and issues of product toxicity.

c. People, including:

1. Staffing strategy and staff development

Our main aim, supported by the University, is one of carefully targeted recruitment. We have sought to recruit internationally excellent researchers, into both junior and senior roles, who will:

- Fill gaps in our research portfolio and target emerging challenges
- Forge new intra- and inter-disciplinary collaborative links
- Ensure critical mass and sustainability of our activities

During the reporting period we have made **14 new academic appointments,** enabling extensive refocusing of our research into strategic areas represented by four Research Themes:

Cell and Developmental Biology. Epigenetics and cancer research has been enhanced by the appointments of *Adele Murrell* (Cambridge) and *Julien Licchesi* (Cambridge). *Tony Perry* (Riken, Japan) brings micro-injection technology that significantly strengthens our developmental biology research and is unique to the UK. *Jim Caunt* (Bristol), *Silvia Munoz-Descalzo* (NYU) and *Rob Williams* (KCL) expand and consolidate our expertise in cell signalling, stem cells and neurodegenerative diseases respectively.

Evolution and Biodiversity. We have strengthened our core expertise in evolutionary genetics through the appointment of *Jason Wolf* (Manchester, Dobzhanzky Prize winner) and *Nick Priest* (Indiana). *Paula Kover*'s (Manchester) research into plant adaptation to environmental stresses strengthens both our focus on evolutionary genetics and has direct relevance to food security. Existing expertise in macroevolution has been enhanced by the appointment of *Nick Longrich* (Yale) who has high profile papers re-evaluating exceptional fossils.

Infection and Immunity: Expertise in the exploitation of next-generation sequencing for molecular epidemiology and pathogenesis has been bolstered by two appointments: *Daniel Henk* (Imperial/Duke) and *Stephanie Diezmann* (Toronto) who both work on the evolutionary genomics of fungi, enabling critical mass for this important, yet understudied, group of pathogenic organisms.

Medical and Industrial Biotechnology. *David Leak* (Imperial) is an internationally established researcher working on enzyme catalysis and metabolic engineering. He is the key player in the new Centre for Sustainable Biotechnology, and provides much of the vision behind the aspirations for metabolic engineering. *Chris Pudney* (Manchester) works on structure function relationships in proteins, thus complementing our recognized strength in structural biology.

As part of the institution's strategic vision, there has been investment into new blood via establishment of tenure-track **University Prize Fellowships**. Of 6 available within the Faculty of Science 2 were awarded to this UoA, reflecting the high quality of bioscience applicants. These Prize fellows**,** Dr *Silvia Munoz-Descalzo* and Dr *Stephanie Diezmann* each have dedicated mentors and are expected to mature into permanent members of academic staff but focussed initially on research (the latter has already secured BBSRC funding). We have a managed route to mentor potential fellowship applicants, a process that has led to the recruitment of several such fellows**:** *Araxi Urrutia* (Royal Society Dorothy Hodgkin Research Fellow), *Will Wood* (Wellcome Trust SRF) and Marie Curie Fellows, *Carmen Rodriguez* and *Yasuhiko Irie*.

Staff Development: Career development of researchers of all levels benefits from a strong

support network at both the departmental and institutional levels. These include dedicated support for ECRs, well-resourced research support and staff development units, a flexible sabbatical leave scheme, clear promotion criteria, a robust workload model and an effective annual departmental staff development and performance review process. The University is fully committed to implementing the national Concordat to Support the Career Development of Researchers and was recognised for this by a "HR Excellence in Research" award from the European Commission.

Nurturing Early Career Researchers: The departmental strategy to focus recruitment on talented ECRs is backed up by continuing support for their research careers. ECR academic staff are prioritised in allocating studentships and receive reduced teaching and administrative duties. They are also given detailed advice in preparing their first grant proposals. Of the new faculty appointed prior to October 2012, all are funded with a mean income of £435K. Additionally, one of the new Prize Fellows secured a RC project grant at the first attempt (BBSRC, awarded Oct 2013). The probationary process for new academics is carefully managed in order to accelerate their research careers. Mentoring arrangements are intense for their first three years. They undertake the Bath Course in Enhancing Academic practice, which offers training in teaching methods, academic practice and research management. The research of ECRs is showcased annually to senior members of the academic community at the Vice Chancellor's Research Day.

Supporting research staff: The University's Code of Practice for the Employment of Research Staff aims to promote a supportive research culture that fosters high achievement. In addition we have a Research Staff representative on the Research Committee. Best practice in proposal writing is shared within the department through the strong research groupings, intense mentoring of ECRs through the grant application process and internal peer review processes. We work closely with the invaluable University Research Development and Support Office (RDSO) who provide support for all forms of research, innovation, and knowledge transfer including bioscience specialists.

Developing our researchers: The Staff Development Unit provides a wide variety of leadership and generic skills training for academic staff, while the Researcher Development Unit provides development opportunities for other research staff. These include workshops for doctoral students and researchers@bath, a development programme for research staff.

Sabbaticals: The University has a Sabbatical Leave Scheme which frees staff from administrative and teaching duties for periods of 6 or 12 months. This has reaped many benefits, not least a ground-breaking paper in PNAS (*Wills*).

Recognising excellence: There has been a healthy throughput of promotions including personal chairs for *Feil*, *Kelsh*, *Szekely*, *Tosh*, *Wills*, *Wolf* and *Wood*.

Equality and diversity: Our research community is multicultural with staff, postdocs and research students hailing from over 20 countries. Monitoring of equality and diversity takes place under the auspices of the Head of Academic Staff Development and at the departmental level. To instil an appreciation of the legal responsibilities of the Equality Act 2010, all academic staff attend a course and take an online test. We have a dedicated Athena Swan officer (Dr *Araxi Urrutia*) who contributed substantially to the University Bronze award.

Research students

Enhancements to the environment for research students include the recent creation of the Graduate School in the Science Faculty. This has streamlined admissions and progress monitoring, now web-based. It has provided a focussed source of information for students, supervisors and directors of study, and has initiated interdisciplinary forums for students to present their work to a broad audience such as the faculty research afternoon held in June 2013. We have a new Graduate Centre, providing social and informal working and training space.

PhD supervising committees consist of a lead supervisor, a second supervisor, plus 2 independent assessors who monitor progression. Support for PhD students is provided through the Graduate School, the International Office and a Postgraduate Student Association. The Mathematics Resource Centre provides mathematics and statistics support to our postgraduate students. At the departmental level, student support is coordinated by the Postgraduate Director of Studies, who oversees translation from MPhil to PhD on the basis of performance and annual monitoring reports. The Postgraduate Director of Studies also oversees skills training for PhD students, in collaboration with University and Faculty coordinators. Postgraduates receive practical training in a wide range of laboratory skills during their induction. Funding is provided for joining a learned society, and for attending and presenting work at conferences. Students are required to attend

departmental research seminars and each student gives a mandatory formal presentation to the department each year. Members of the Department PGBio society represent postgraduates on department committees. This innovative society organises several social events, the departmental research day, a popular course in the use of 'R' for statistics and an annual inspirational public lecture by an eminent speaker (recently including Nobel Laureates and the Director of EMBO). PGBio initiated the filming of the Thursday PG seminar series, which has proved a popular and valuable approach to the improvement of presentation skills.

Postgraduate recruitment: Despite a tough environment, recruitment has remained strong (full-time equivalent numbers): 15 (2008), 15 (2009), 23 (2010) 19 (2011) 17 (2012). Principal sources of studentships are university URS and overseas scholarships, research councils and self-funded overseas students. We have forged ties with regional institutions to secure funding for PhD studentships. Successes include a NERC-DTP bid, in a partnership with Bristol & Cardiff (led by Bristol), and there are further bids in the pipeline (e.g. BBSRC SWDTP consortium of Bath, Cardiff, Bristol and Exeter; in line with the GW4 agreement).

d. Income, infrastructure and facilities

The Department's total grant income over the period of assessment (1/1/08 to 31/7/13) is almost £16M (£15,986,300), 43% of which (£6,929,716) was awarded from UK Research Councils, 24% from UK based charities (£3,819,338), 17% from the EU commission (£2,639,270) and 7% from UK industry (£1,114,800).

Infrastructure and facilities: The ability to do world-class research is strongly supported by University investment into core facilities. All staff and PG students have 24/7 library facilities and online-access to an extensive range of journals with provision for emerging journals continually monitored. Core technical staff maintain our organisms and associated facilities, with a 24 hour emergency call out system. We have improved our core facilities in accordance with our research strategy. A state-of-the-art £4.1M biological services unit (BSU) for small mammals and chickens is adjacent to the department. This accommodates 1855 rodents in ventilated cages, has facilities for behavioural testing, surgery and the generation of transgenic/knockout mice. Our aquarium includes *Xenopus laevis*, and *Medaka* and zebrafish as complementary fish models. Invertebrate models include Europe's only the *Manduca* colony, *Drosophila*, *C.elegans* and our new research apiary. Invertebrate research utilises a recently acquired micro CT scanner. In addition to the research equipment seen in any top bioscience centre (e.g. greenhouses and CT rooms), the department has over the REF period invested in facilities for high level study of protein structure (NMR, crystallography, mass spec, CD and fluorescence spectroscopy) and function (ITC, stopped-flow, high-pressure cell) as well as a suite of scanning, transmission and atomic force electron microscopes. We have recently invested in bioreactor facilities, histology equipment and cell sorting flow cytometry for the study of live cell, cell surface and intracellular proteins

These core facilities have been augmented by equipment acquired by members of the department, available to multiple research groups. These include: a laser scanning system for high-resolution fluorescence analysis of mammalian eggs and embryos following micromanipulation and piezo injection work-stations (*Perry*); a crystallisation robot and facilities for baculovirus protein expression (*Acharya*); mouse body composition analyzers utilising NMR (*Ward*) or X-rays (*Wolf*). We have expanded The Wellcome Trust funded Microscopy and Analysis Suite with the acquisition of three confocal microscopes and a high content microscope with an IN Cell Analyzer 2000 High Content Analysis platform (*Caunt*). HEIF Knowledge Transfer Fund (via RDSO) has enabled further development of bioreactors (*Leak*), and aquaculture raceways (*Scott*) have been installed.

e. Collaboration or contribution to the discipline or research base

Bath Biology has a strong record of collaboration with both academics and industry. This trend has accelerated during the REF period, with a very high level of involvement in major funded collaborations, including extensive interdisciplinary partnerships. This collaboration has involved our academics both in leading such initiatives and as participants in partnerships led from elsewhere and forms a major part of our research strategy. **Examples of collaboration with**

industry and external bodies include: signalling mechanisms that regulate synaptic viability for therapies for Alzheimer's (GSK and Lundbeck AG/Copenhagen; *Williams*); directed differentiation of human embryonic stem cells to hepatocyte-like cells funded through Stem Cells for Safer Medicines (SC4SM), a Public-Private Partnership between Research Councils (MRC and BBSRC) the Department of Health and Industry (Astra Zeneca, Roche and UCB Celltech; *Tosh*); PI of an EU consortium grant co-ordinated by Siena Biotech 7.5M Euro (Bath budget 1.1M Euro; *Ward*); Natural History Museum through BBSRC funded work on reconstructing the arthropod supertree of life (*Wills*), a commercial fellowship with Syntaxin Ltd (*Acharya*); a novel method to identify glycated proteins in complex biological samples (patent pending), involving EPSRC Impact Acceleration Account funding with Glysure Ltd (*van den Elsen*); collaborations with Public Health England and various DEFRA agencies (FERA, VLA and CEFAS; *Feil*). **Examples of Collaborative Funding (Academic):** We maintain an active program to encourage collaborative academic funding at the highest level. *Kelsh* has secured a Royal Society International Collaboration Grant with Nobel laureate Prof. Dr C. Nuesslein-Volhard, Tubingen; *Székely* played a key role in the EU-NEST Framework 6, GEBACO, a collaborative project with 8 European institutions on the genetic basis of cooperation; *Feil* is a PI and WP-leader on EU-FP7 (Health) Consortium TROCAR, on the spread of antimicrobial resistance, involving nine European countries, and a PI on CRCUK funded consortium involving Bath, Cambridge, Sanger Institute and Imperial. *Hurst* collaborates with Max-Delbrück Centre, Berlin on Preeclampsia;

Responsiveness to national and international priorities and initiatives
Our research strategy and monitoring enables rapid exploitation of new research initiatives. These include: Stem Cells for Safer Medicines (SC4SM) (see above); funding on the Insect Pollinator Initiative (IPI) to investigate the causes underlying honey bee decline (*Feil, Priest*); the development of a generic biosensor platform for pathogen detection in response to general national graphene imperative (*Bagby*). BBSRC bioinformatics priority remit to digitise, standardise and disseminate phylogenetic trees in the literature (*Wills*).

The international profile of our academics and their impact on their fields is well illustrated by their awards and invited high profile lectures. All staff have presented plenaries, keynotes or other notable invited presentations at international conferences. **Named lectures** include: The Max-Delbrück Lecture, (MDC Berlin 2011); The Genetics Society Medal Lecture (2011); Nilsson-Ehle lecture (Lund, 2009); The EMBO Lecture (ESEB, 2009). **Editorial Board Membership**: 16 Staff members are, or have been on the editorial boards of 39 journals, excluding guest editorship of 4 special issues. **Review panels:** Panel memberships include: Science Foundation Ireland executive committee, HFSP fellowships committee (*Hurst*); NERC terrestrial ecology panel, Volkswagen-Stiftung Evolutionary Biology, Germany (*Székely*); BBSRC Member research committee B (*Hooley*), BBSRC committee A (*Kover*); Faculty1000 (Medicine; *Feil*); NERC Peer Review College, Standard Grants Funding Panel, MRC Strategic Fellowships Panel **(***Wolf*); Pool Member of BBSRC Committee B (*Leak*); MRC Molecular and Cellular Medicine Board (*Ward*); Alzheimer's Research UK SAB Panel Member, The Michael J Fox Foundation Review Committee (*Williams*). Three Staff are in the BBSRC "Pool of Experts". **Management Committees:** Advisory Board of Public Library of Science (*Hurst*); Advisory Board for the Centre of Evolution and Ecological Synthesis, University of Oslo, and Advisory Board for the European Centre for Disease Control (*Feil*); Management Board Food Security & Land Research Alliance (*Hooley*). **Awards Committees:** BMC Evolution and Genetics Prize (2012); BMC Biology Prize (2011); Zoological Society of London (2010-); Genome Biology Prize (2010) (*Hurst*).

We are especially proud of the recognition our academics have received. We are one of the few departments to have **three winners of the Scientific Medal of the Zoological Society** (*Hurst*, *Wolf* and *Feil*), the latter two in the REF period. Recent awards and other markers of esteem include: Genetics Society Medal (2010), Royal Society Wolfson Research Merit Award (*Hurst*); Visiting Professorship, Groningen, Honorary Member of Hungarian Ethological Society (*Székely*); Biochemical Society's Early Career Research Award, International Raising Talent (Women's Forum for Economy and Society), SHE Inspiring Women Award (*Urrutia*).