Institution: University of Bath

Unit of Assessment: 5: Biological Sciences

a. Context The Department of Biology & Biochemistry fosters a dynamic research environment that strongly encourages engagement with potential users of its internationally excellent science. Our research is diverse, encompassing the genomic, molecular, cellular, organismal and population levels, and relates to animals, plants and microorganisms. Our principal user groups are the health-related industries and stakeholders (e.g. pharmaceutical companies; Health Protection Agency) and the biotechnology sector (a range of companies and policy-making bodies in the areas of food security, biofuels and novel therapeutics) with whom close relationships are fostered and maintained via consultancies, spinouts, and knowledge exchange activities and through our large and longstanding undergraduate industrial placement scheme. The Department is structured around four Research Themes to provide a cohesive framework that aims to create, promote and recognise impact. These are **Cell & Developmental Biology** (C&DB); **Evolution & Biodiversity** (E&B); **Infection & Immunity** (I&I) **and Medical & Industrial Biotechnology** (MIB). Research Theme leaders report to the Director of Research (DoR), a Department Executive member, who actively supports our impact agenda. There are 2 research centres that cut across the Themes: the **Centre for Extremophile Research** (CER) and the **Centre for Regenerative Medicine** (CRM).
Our focussed four-theme structured research base aligns with key problems in the realms of Public Health, Climate Change, Food Security and Industrial Biotechnology, including:

- Developing novel therapies using stem cells, and elucidating the mechanisms behind obesity, cancer, diabetes and neurodegeneration
- Understanding and raising awareness of biodiversity and conservation
- Managing the spread of infectious disease in humans, plants and animals
- Improving crops to meet global demand in a changing climate
- Bio-engineering new enzymes for the development of novel drugs and fuels

b. Approach to impact Our approach to impact places a strong emphasis on sustained engagement with key user and beneficiary groups, such as industry, with coordination achieved through the Research Themes and Centres. Here we set out our main routes to impact:

Partnerships with industry An effective approach to generating activities with impact potential lies in establishing and maintaning relationships with industry using a variety of mechanisms. These range from fully funded awards to projects part-funded from University administered knowledge exchange funds. The following illustrate this strategy: ***Fully-funded awards*** totalled £830k, and included TMO Renewables (*Leak*); Denso Corporation, Japan (*Scott*); Syntaxin Ltd (*Acharya*); and Pendragon Ltd (*Cooper*); ***Joint industry–research council*** funding totalled £2,246K and included Stem Cells for Safer Medicines, a Public-Private Partnership between MRC, BBSRC, Department of Health and Astra Zeneca, Roche and UCB Celltech (*Tosh*); and BBSRC Industrial Partnership Award (IPA) with TMO Renewables (*Leak*). Staff won 16 ***iCASE and CASE studentships*** including with: Fujifilm-Diosynth (*Leak*); Health Protection Agency, Syntaxin Ltd (*Acharya*); Lundbeck AG, GSK (*Williams*). Projects valued at £1,029k benefitted from ***Knowledge exchange funds***, such as the Knowledge Training Account (KTA) and Knowledge Training Partnership (KTP) awards. *Hough* secured KTPs with both Biocatalysts Ltd and TMO Renewables Ltd. *Scott* held a KTA with Aragreen Ltd (UK). The Higher Education Innovation Funding (HEIF) account provided a further £132K for joint projects including Summerleaze Ltd (*Scott*), Tocris Bioscience and Storm Consulting (*Chalmers*). A collaboration worth £4.3M between the University and Wessex Water involving *Scott* and *Leak*, along with Chemistry, Chemical Engineering, Mechanical Engineering and School of Management, demonstrates company engagement and our multidisciplinary approach to impact. Our staff also act as ***Consultants*** and sit on ***advisory panels***: Zeal Holding Ltd (*Hough*), Durrell Wildlife Conservation Trust (*Székely*); Alfacell Corporation (*Acharya*); FELDA Ltd, Malaysia and Lime Technology Ltd (*Cooper*).

Generation and exploitation of intellectual property Staff work closely with the University Enterprise and Knowledge Exploitation (EKE) office, which provides an interface between academic staff and external parties, to produce and exploit intellectual property. This includes

using Bath Ventures funds, HEIF, KTA Champion awards and KTN Spark Awards. We generated 4 granted patents (*Tosh*, and *Scott*) and have a pipeline of applications. We exploited patented IP through licensing deals e.g. *Scott* (to Biogemma Ltd). *Chalmers* launched CiteAb, an antibody search engine, which benefited from a KT Champion Award and HEIF funding of £60k, including £35k from Storm Consulting. The company aims to spin out in 2014.

Knowledge exchange Our Research Centres organise regular meetings and workshops involving external speakers and organisations, with the aim of translating contacts into impact opportunities. The CRM hosts 2-3 meetings per year with internal and external speakers, including from pharmaceutical and biotechnology companies and participated in regional (South West Regenerative Medicine Forum) and national (Stem Cell) meetings. Staff organised meetings involving non-academic user organisations, clinicians and industry. Highlights include: *Ward* (Royal Society meetings); *Beeching* (BioCassava Plus Meeting); *Kelsh* (international zebra fish meetings).

Contributions to policy-making and user bodies Staff membership of advisory and policy-making bodies includes: research council strategy panels (*Hurst*) and government bodies, including the All-Party Parliamentary Group on Biodiversity (*Reynolds*), Malaysian Palm Oil Board Programme Advisory Committee (*Cooper*), Science Foundation of Ireland Executive committee and the Advisory Board of Public Library of Science (*Hurst*). *Acharya* is a member of the National Cancer Institute (USA) and the Beam time allocation panel, European Synchrotron Radiation Facility, Grenoble. *Cooper* used workshops to disseminate knowledge of disease control to the oil palm industry. Eight staff served on the governing committees and/or awards panels of professional societies e.g. Biochemical Society, BSDB, and the Genetics Society.

Public Engagement Our research features in newspapers, broadcasts and the popular scientific press (New Scientist, Scientific American, etc), on the University web pages, in forums such as Faculty of 1000, and in Research Council web pages and publications. Staffare frequently assisted by the University Corporate Communications Office, including writing press releases for dissemination to scientific and popular media. Our Research Theme leaders promote a public engagement strategy: e.g. *Williams* (C&DB) spoke on Dementia at a BRACE organised public meeting; E&B highlighted conservation through the Great Bustard project (*Székely*; e.g. BBC's Newsround 2013) and Darwin's birthday (*Hurst*, BRSLI); *Massey* discussed a new strain of MRSA on BBC Radio Bristol. Scott's (MIB) algae research featured on BBC's Newsround. The Bath Science café (Raven pub, Bath) chaired by *Scott* is an important public engagement forum. Cafes include presentations from our academics and industrial collaborators. The café is publicized through University press releases and Home Page, and at http://bathsciencecafe.org/.

c. Strategy and plans Our research covers a broad spectrum of fundamental and applied biology. Our impact strategy has 5 elements, informed by successes such as our submitted Impact Cases:

Management The departmental Research Committee provides strategic oversight and supports implementation of impactful activities through the Research Themes and Centres. Research Themes meet regularly to discuss impact activities and identify new opportunities. Theme leaders sit on the Departmental Research committee, chaired by the DoR, who is also a member of the Departmental Executive and Faculty Research Committee. A workload allocation model and a sabbatical leave scheme are used to ensure time is made available for prioritized impact activities.

Engagement Building long-term relationships with potential users of our science has proved effective in generating and sustaining engagement leading to exceptional and mutually beneficial impact. We will therefore continue to build partnerships with industry through fully funded and joint industry–research council awards together with iCASE and CASE studentships, and use knowledge transfer funds to accelerate engagement toward impact. Our staff will continue to use consultancies and membership of advisory panels to represent our research and provide routes to engagement. Staff routinely access institutional level services designed to facilitate impact such as impact seminars, workshops and guidance for academics and PGs provided by the Research Development and Support Office (RDSO). The EKE team within RDSO coordinate commercialisation of research, assist in filing patent applications, and support patent licensing and

spinout activities. RDSO help us maintain commitment from industrial partners through financial and in-kind contributions. The KTA (now Impact Acceleration Account; IAA), KTP and Consultancy Services are used to develop collaborative projects and consultancies.

Acceleration We aim to create a culture that promotes impact-oriented activities and facilitates translation into meaningful impact. The DoR and Research Theme leaders encourage staff members to find impact opportunities and coordinate engagement with the impact process. With institutional support, contacts are translated into funded research projects using IPA, CASE, LINK, KTP, IAA and HEIF funding. Our recruitment strategy continues to consider the potential for impact of candidates' research, e.g. the appointment of *Leak* strengthened MIB and is key to increasing impact through metabolic engineering and synthetic biology; a lectureship (*Henke*) and University Prize Fellowship (*Diezmann*) in infectious disease bolstered I&I, and a second University Prize Fellowship (*Munoz-Descalzo*) strengthened C&DB/CRM. All new academics attend University impact workshops during probation. Impact activities are an important factor in career progression.

Visibility We value the importance of making our research visible to potential users and aim to improve this through various routes, with the DoR taking overall responsibility for delivery. Our website highlights the Research Themes and Centres, and the placement scheme. A regularly updated Industry page features projects with industry participation, our patents, and provides links to EKE. The University's new Social Media Toolkit is used to promote our research to users. We will increase the number of meetings we organise to bring national and international participants to Bath. The University's new teaching and accommodation buildings will provide an attractive venue for this. This approach fits with the University's internationalization framework for greater impact and visibility of our research. Our placement scheme is one of the UK's largest, providing 449 students to 130 institutions, with more than 50% in industry, since 2008. We aim to generate greater impact from this activity, e.g. by securing joint research projects with placement providers.

Horizon scanning The following are examples from our impact pipeline: **C&DB and CRM** More effective drugs for treating disease will be developed more cheaply through a unique public-private partnership 'Stem Cells for Safer Medicines' funded by UK Research Councils (MRC, BBSRC and Department of Health) and pharma (Astra Zeneca, UCB and Roche). **E&B** will lead on public engagement (see Great Bustard Impact Case). **I&I** Members researching Honey Bee Colony Collapse Disorder are establishing a University funded bee research facility at a nearby field station. Since pollination is a crucial environmental service, this research initiative will have major impacts in food security and sustainable agriculture. **MIB** Many consumers will benefit from new enzymes and production methods for the food industry developed in a KTP graded 'Outstanding' between *Hough* and Biocatalysts Ltd. An Internationalisation Office-brokered collaboration between *van den Elsen* and the University of Saõ Paulo will develop a vaccine for Dengue fever using Bath technology to benefit populations in Brazil and many other countries.

d. Relationship to case studies **1. *Atlas Genetics Limited****: a University of Bath spin-out company developing novel technology for rapid diagnosis of microbial pathogens*, illustrates **partnerships with industry** including generating key IP, hosting the nascent spinout company and sustained collaboration between the department and the company (reinforced by 3 recent I&I appointments). Our pipeline includes at least two spin-out companies to be formed in the next 1-3 years (*Chalmers*; *van den Elsen*). **2. *Palm oil*:** *Novel and sustainable control of two major diseases of a world commodity crop* also illustrates **partnerships with industry** and additionally strong **contributions to user bodies**: the underpinning science was done by a series of researchers supported by industrial and Research Council funding; key IP was generated and knowledge disseminated through workshops for growers, companies, stakeholders and end users. This altered policy on seed distribution and quarantine, and is a springboard for developing activities influencing policy-making bodies. Our growing strength in industry partnership is illustrated by £multi-million contracts involving TMO Renewables (*Leak*) and Wessex Water (*Scott*). **3. *Great Bustard reintroduction into the UK*:** A flagship **Public Engagement** activity attracting high volume media coverage, information dissemination (e.g. involving RSPB), site visits and volunteer involvement. All staff promote their science via the media and outreach activities and we aspire to a major public engagement activity associated with each of our 4 Research Themes.