

<p>Institution: University of Reading</p>
<p>Unit of Assessment: 5 Biological Sciences</p>
<p>a. Context</p> <p>The School of Biological Sciences (SBS) was formed in 2005 from a merger between the School of Animal and Microbial Sciences, the School of Plant Sciences, and Applied Statistics. This merger facilitated a focussing of research into specific areas that are seen as key to developing excellent research and impact over the longer term. Staff are engaged in basic and applied research and fully recognise the importance of translating their research into real-world outputs that will have an impact on the UK and global economies and society. The internationally recognised work of SBS is based on outputs from the following research groupings: (1) Molecular and Cellular Medicine, improving the health and wellbeing of humans and animals through new approaches to disease prevention, diagnosis and treatment; (2) Microbiology, to improve human, animal and plant health including disease prevention and treatment; (3) Ecology, to improve surveillance, management, preservation and control of organisms and their environment; (4) Evolutionary Biology, to apply outcomes from the study of organismal diversity to improve management of conservation and reductions in the risks leading to extinction. The non-academic user-groups and beneficiaries of the impact developed by SBS are: the healthcare sector; the personal care industry and associated regulatory bodies; the agriculture sector; the law enforcement sector; charitable organisations; civic and amenity sectors. The impacts developed relate to influencing national and international policy, the development of novel tools, immuno- and bioassays that are adopted by non-research organisations, and the provision of databases that facilitate national and international organisations in monitoring and implementing their strategies. The ultimate beneficiaries are the general public.</p> <p>b. Approach to impact</p> <p>SBS staff fully recognise the importance of research impact and have enhanced their awareness and understanding through University-led activities, advice and guidance. SBS uses a number of mechanisms to support, monitor, reflect upon, and respond to the development of impact.</p> <p>i) Exploitation of University specialist support services and management structures</p> <p>The University Research and Enterprise Development (RED) office supports SBS funding applications and provides appropriate guidance on developing impact pathways. The RED office also provides specialist help for Knowledge Transfer (KT) e.g. provision of expertise for developing patents, licences, linkage to industry and intellectual property. These activities lead to staff developing impact; for example, Jones has developed an approach for generating a new Foot and Mouth Disease Vaccine that has been patented and assigned to the Institute of Animal Health with a licence back to the University. Such a vaccine has the potential to make a significant impact on farming industries in both the UK and abroad.</p> <p>In SBS, the Director of Enterprise (DoE) supports networking and linkage to potential industrial partners, as well as dissemination and outreach activities. This includes, with help from the Director of Research (DoR), maintenance of the outward-facing SBS Research, Impact and Enterprise web pages to make SBS expertise visible to external stakeholders. For example, an SME developing a UV- sanitisation lamp for computer keyboards recognised that SBS had a number of research-active microbiologists and directly approached the DoE to find a suitable academic partner. The DoE prompted Jackson to engage with the SME, which then provided funding for Jackson to examine the microbial contamination on computer keyboards in hospitals. Through an NHS clinical study, the efficacy of the sanitisation lamp was validated, and the lamp has now been adopted by hospitals in Finland to reduce nosocomial infections.</p> <p>ii) Interdisciplinary Centres</p> <p>SBS staff are supported for development of impact through collaborative Centres of Excellence, such as the Centre for Food Security and the Institute of Cardiovascular and Metabolic Research (ICMR), which is part of SBS. For example, Gibbins is the Director of the ICMR and carries out research into how platelets are regulated to control blood clotting in health and disease, in order to develop innovative, safer and more successful strategies to prevent thrombotic diseases such as heart attacks and strokes. Gibbins has assembled a review system within ICMR to assess the</p>

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grant outputs and their contribution to impact. This example of good practice is highlighted by Gibbins and collaborators for colleagues to follow through a committee that includes the grant holders, a member of RED and an external colleague from industry, who specialises in translational approaches. The committee meets annually to tailor aspects of the project development in an industry-friendly manner, such that the translational aspect becomes embedded and leads to the development of impact.

iii) Strategic funding streams and teaching leave

The University provides funding to Faculties to support PhD studentships. These studentships require matched funding, thereby encouraging academics to engage with industry to acquire funds. Some of the Faculty funding, along with consumables funds from SBS, is disbursed to centres like ICMR. **Clarke** obtained an ICMR PhD studentship, to collaborate with Gibbins, and has identified a novel molecular interaction between platelets and the MRSA pathogen *Staphylococcus aureus*. Clarke's research has since been recognised by provision of grant funding from the British Heart Foundation and for the development of novel drug treatments that will help to prevent harmful blood clots, with a major impact on the lives of people with a history of cardiovascular disease.

Staff in SBS are supported to develop their impact through sabbaticals. Central funding and school support enables the school to buy-out teaching time and support staff on sabbatical leave to focus on developing their research and impact. **Watson's** 12-month sabbatical (2012-13), working on metabolic enzymes with an industrial company, has led to a newly engineered β -galactosidase enzyme with significantly enhanced activity. This work subsequently led to a BBSRC-CASE PhD studentship to develop directed evolution of mutant cold-adaptive enzymes. This work will lead to the production of stable, tailored industrial enzymes that will have a major impact for industries using enzymes in biotechnological applications.

Meeting with industrial collaborators is essential for the development of impact, and travel is supported by SBS/Faculty through provision of travel grants. **Perotti's** development of her expertise in forensic acarology (use of mites to study forensic samples) has required overseas travel. She has made an impact on an international scale by training law enforcement agencies in Europe and shaping policy in European standard operating procedures. She has analysed crime scene samples at the request of law enforcement agencies from Sweden, France, The Netherlands, Italy, Spain and Colombia. In a recent murder investigation, her testimony was the only evidence that led to an arrest warrant in Chile.

iv) Excellence through public engagement and outreach

Staff disseminate information about their work to the public through engagement exercises such as Café Scientifique and University public lectures. Staff engage with schools, the Royal Institution, specialist interest groups, medical charities, the Association for Science Education and broadcast and print media to explain the significance of their work. Staff use the University's Communications office to communicate major discoveries via press releases and through link-ups with the media. As well as describing his seminal discoveries around evolution in eminent journals like Nature and Science, **Page** (FRS) has also published a high-profile popular science book, *Wired for Culture*, and was recently an invited delegate to the World Economic Forum in Davos, 2013. Together with media coverage, this activity publicizes his key discoveries and arguments, affecting the perceptions and policies of global society.

c. Strategy and plans

The SBS Committee for Impact and Enterprise, chaired by the DoE, has built upon the past research and impact activities to develop its future plans for impact, looking forward to REF 2020 and beyond. A significant part of our future strategy will be focused around the work we will do for the University's submission to the BBSRC's Excellence with Impact competition (see <http://www.bbsrc.ac.uk/business/impact-incentive/excellence-impact.aspx>), building on the learning that has been gained through the development of our case studies for REF2014. The competition encourages participating universities to transform their research cultures by embedding impact as a central pillar of their overall research strategy. To this end, the University is developing a range of policies and procedures that seek to maximise impact from research, including: appointment of School Directors of Impact (DoI); emphasising impact as a criterion for recruitment and promotion; training programmes to inform and equip researchers to generate impact from their research; and

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enhanced central resource to focus on the development of impact. These central initiatives, which will be overseen by the University Board for Research and Innovation, will be exploited by SBS as the context for its own impact strategy, set out in the five-point plan detailed below.

An essential requirement for maximising research impact is to build upon the University's impact vision and formally **embed impact within the SBS operations**. To facilitate this, the SBS DoR, with help from the DoE and DoI, will allocate a section of the annual 3-year operating plan to development of impact. SBS will ensure that job specifications for new posts include consideration of impact. Concomitantly, staff development reviews will include a section devoted to discussing translational aspects of the staffs' research and how they might develop impact from it. SBS will maintain existing support through the granting of study leave, teaching buy-out, travel grants, and 'bridging funding' to staff to facilitate their research and development of impact, particularly external collaborative work at the international level.

To **improve impact knowledge and awareness**, the DoE/DoI, with help from RED, will develop resources for staff to aid understanding of the wide variety of ways in which they can develop impact. This will include establishment of a portfolio of Impact Summary and Pathways to Impact from the many successful grant applications in SBS. Additionally, a Community of Practice system to draw on examples of best practice (e.g. case studies) will be established. This will help staff who are currently developing impact and also support new staff, especially early career researchers who will have little experience in this area.

Long-term goal planning for impact will be supported through regular workshops within the school. Existing case studies will be examined to identify further development opportunities as well as to consider how current and planned research will develop impact. Importantly, we will learn from some of our current activities (e.g. collaboration between cardiovascular and microbiology research) to identify key strategic research synergies within the School that when combined will lead to generation of impact. This process will also help to define any long term recruitment goals to plug gaps or reinforce areas of existing strength.

A vital aspect of developing impact is for staff to understand how to **engage with key stakeholders**. For established staff, this is an integral, embedded part of their job, while for new staff this will be supported via the SBS planning processes described above, and by drawing on existing expertise within the school. Additionally, SBS makes key contacts via Industrial Experience placements for undergraduate students. SBS will be able to use the outcomes of these to plan activities such as industry-academia workshops and seminars to encourage networking and needs analysis. A crucial part of engagement with stakeholders is to ensure that research results are appropriately disseminated. This is currently done via the outward-facing SBS website, including an impact-specific webpage highlighting the existing activities. SBS also uses social media, including Facebook and Twitter, to publicise key stories and developments.

Unification of these activities will be achieved by development of a **roadmap for impact**. This will draw upon the above activities to provide a user-friendly document to aid staff in the process of generating and delivering impact. Importantly, this roadmap will also define the requirements for capturing the trail of evidence required for future case studies.

d. Relationship to case studies

SBS's approaches to translating research to stakeholder outputs that develop impact for society are exemplified by the case studies submitted for the REF assessment. **Prescott's** research has influenced the UK Regulatory Authority (Health and Safety Executive) and the European Commission, in their assessment of the risk mitigation measures applied to anticoagulant rodenticides. This case study highlights the involvement of the UoR KT service in the development of intellectual property and in a subsequent patent application. The **Knight** case study (inhibin assay and Down's screening) exemplifies impact arising through timely dissemination of underpinning research and academic collaborations between non-clinical and clinical scientists (as actively promoted by the then departmental head). The **Darbre** case study has used the media to engage the public and inform society of her work highlighting the potential toxicity issues surrounding the use of parabens in cosmetics, leading to changes in policy and manufacturing.