

<p><b>Institution: University of Reading</b></p> <hr/> <p><b>Unit of Assessment: 5 Biological Sciences</b></p> <hr/> <p><b>a. Overview</b></p> <p>The School of Biological Sciences (SBS) at the University of Reading is a vibrant community of researchers investigating the key challenges that face humankind in the 21<sup>st</sup> century. The international reputation of SBS has been built on multi-disciplinary investigations undertaken by 37 research academics in life science at levels ranging from molecular and cellular through to the organismal and ecological, united by a shared interest in improving the welfare of people and society whether directly through our work on the nature of disease and its amelioration, or indirectly by understanding and preserving the diversity of life at all levels.</p> <p>Research in the UoA is structured into four groups: <b>Ecology, Evolutionary Biology, Microbiology and Molecular &amp; Cellular Medicine</b>. The appointment of 10 new academic staff since RAE 2008 has enabled our international reputation in these fields to expand through a programme of continued investment, funded particularly from the University's £14M Academic Investment Project (AIP) designed to promote multi-disciplinary research in strategically important priority areas by appointing additional staff, which has invigorated research considerably. The UoA plays a central role in the inter- and multi-disciplinary research undertaken within Reading's research Centres of Excellence (CoE) by hosting the Institute of Cardiovascular and Metabolic Research (ICMR) and providing the relevant disciplinary strands in the matrix of research in the Centre for Food Security, the Centre for Integrative Neuroscience and Neurodynamics (CINN) and the Walker Institute for Climate System Research. All these CoEs are aligned to national and international priorities.</p> <p>Our strategy is to build on the UoA's core research strengths and grow connections between groups involved in cardiovascular diseases, neuroscience, ageing, food security and climate change initiatives across the University, in order to increase our impact on national and international research agendas, to commercialise our research and to influence public policy.</p> <hr/> <p><b>b. Research strategy</b></p> <p>Our research strategy is defined by our mission statement which sets out that by 2020 the School will:</p> <ol style="list-style-type: none"> <li>1. Continue to be recognised internationally as one of the leading university organizations for broad-based biological sciences in the UK as measured by our research excellence, research income, research publications in elite journals, and its impact, fostered by targeted investment in people and infrastructure.</li> <li>2. Be amongst the top 10 UK institutions of choice for highly qualified UK, EU and international postgraduate student researchers, measured by our success in recruitment and their subsequent employability in career-track positions, underpinned by an outstanding training programme. Since 2008, SBS has undergone a fundamental re-structuring programme to enhance and build critical mass in selected areas of research strength whilst withdrawing from others (e.g. aquatic biology, amenity horticulture) driven by the University's reshaping exercise. A key change implemented since RAE 2008 has been the establishment of the four research groups that develop expertise and critical mass required for multidisciplinary investigations; a change enabling us to achieve our mission statement aim. Each group has a designated convener, who ensures that all staff members work to agreed targets to optimize their outputs, develop and review funding applications and to act as the conduit for management data on research activity to the rest of the School. The conveners report to the School Management Group, chaired by the Head of School via the School Research Committee. This organisational structure facilitates timely bi-directional flow of information between the PIs, convenors, the School Director of Research (SDoR), and the Head of School.</li> </ol>
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The adoption of a clear long-term vision, strong managerial structure and the formation of collaborative groups have resulted in a marked increase of grant income and delivery of outputs. During this period of assessment, we experienced a growth of 130% in grant income per submitted FTE compared to RAE 2008 and contributed to 652 published articles. Importantly, these changes have led to greater involvement in the decision making process by the PDRAs, technicians and research students and, through a sense of collective ownership, resulted in the development of a more vibrant research atmosphere.

SBS multi-disciplinary research carried out by the four groups is exemplified in the following section together with long term research goals, which are closely aligned with national and international priorities.

**Ecology (Key staff: Callaghan, Cook, Prescott, Sibly, Walters)** This group is dedicated to developing a better understanding of the ecological and evolutionary consequences of environmental change arising from human activities, specifically pollution, urbanisation and climate change.

**Callaghan and Sibly** carried out ground-breaking work via a £400K NERC/Syngenta/AstraZeneca funded project that implemented a systems biology approach to ecology to understanding the impact of toxins in non-target organisms. Their paper in *Genome Biology* won the best paper award from the Society for Environmental Toxicology and Chemistry (2008). **Prescott** is Director of the Vertebrate Pests Unit (VPU), which leads in the field of rodenticide research, development and regulatory assessment, with particular focus on a major global issue: anticoagulant resistance. Working with a number of industrial partners and local authorities, the VPU has received in excess of £1.3M since 2008 and employs an academic and two technical FTEs (see Impact Case Study). **Sibly's** research on metabolic scaling theory based on the organismal use of energy and materials, has established him as a leading figure in this field. In parallel research he has been at the forefront of developing Agent Based Models to forecast individual responses to predict population vulnerability to pesticides in real landscapes. His multidisciplinary research involving physicists and computational scientists at Aarhus University, Pennsylvania State, Santa Fe Institute, Ecole Polytechnique Fédérale de Lausanne and Università di Padova, has led to the publication of one *Science* and four *PNAS* papers since 2008 supported by EU funding (€232K Marie Curie ITN grant) and NERC (£385K). **Walters** and **Cook** are active in climate change research and work closely with the University of Reading's Walker Institute for Climate System Research. **Walters'** research is directed towards forecasting the ecological and evolutionary consequences of environmental change and the use of the metabolic theory of ecology to scale up predictions (*Evolution* 2013). **Cook's** field-based studies on insect mutualisms, has revealed a novel role for parasite pressure in stabilising the symbiosis (*PloS Biology* 2009).

*Over the next 5 years the Ecology group will:*

1. Test the assumptions and predictions of individual-based models using field experiments and so strengthen the use of individual-based models for ecological forecasting.
2. Build on existing industrial links and enhance outreach activities to increase cross-talk between researchers and users, ensuring our ecological forecasting informs industry practice and policy and has a positive impact in mitigating the impacts of urbanization, climate change and pesticide use.
3. Develop new research programmes at the interface of the interests of the Ecology and Evolution groups in forecasting the impacts of future environmental change by exploiting the critical mass of expertise within the Walker Institute for Climate System Research and our international links (see section e).

**Evolution (Key staff: Culham, Hawkins, Johnson, Meade, Pagel, Perotti, Venditti)** This group aims to change the way evolutionary biologists think about and study evolution, both through methodological innovation (provision of tools and data) and by applying established evolutionary methods to unconventional systems.

**Pagel** has introduced novel statistical modeling approaches that are revolutionising phylogenetics. He has used his techniques to address and solve questions of fundamental importance involving speciation, adaptation and punctuational evolution. Pagel publishes in the highest impact journals (including six *Nature*, one *Nature Reviews Genetics*, two *Science* and one

*PNAS* since 2008) and has been elected as a **Fellow of the Royal Society**. He leads the field in the cross-disciplinary application of phylogenetic methods and has influenced how evolutionary biologists, linguists and anthropologists conduct their science and the evolutionary questions they test. Multi-disciplinary work includes the use of his techniques to understand human language evolution (*Science* 2008, *PNAS* 2013) and he has received an Advanced Investigator Award from the European Research Council worth £1.5M to pursue this work. He has also published a sole-author book on human evolution (*Wired for Culture: Origins of the Human Social Mind* 2012). Both **Meade** and **Venditti** are influencing the field by using new tools to resolve fundamental evolutionary questions and publishing in the highest impact journals. **Meade** developed a statistical comparative method to automatically detect shifts in evolutionary rates of change and applied it to explain variance in mammal body size (*Nature* 2011) and he has been awarded a £150K BBSRC grant to improve these analytical approaches. **Venditti**, a recipient of a Leverhulme Trust fellowship, has shown that neither species diversification (*Nature* 2010), nor phenotypic evolution (*Nature* 2011), proceed as evolutionary biologists and ecologists had assumed.

A step change in the scale and impact of evolutionary research is possible because biodiversity informatics make large volumes of species data available. **Culham** was awarded a grant of more than £1.5M from EU FP7 to manage a virtual international research community, enabling global communities to filter and cross-reference data and to curate reliable taxonomic lists. The commercial potential of **Hawkins'** innovative, multidisciplinary application of phylogeny to ethnobotanical data (*PNAS* 2012) has been recognised by EU FP7 through funding a €4.2M project to train early career researchers in biodiversity-led research into medicinal plants. **Johnson** proposed a novel mechanism for genetic code evolution and was awarded a £151K grant (with Jackson in Microbiology) from the Leverhulme Trust to test this experimentally. **Perotti's** research on the genomic consequences of a permanent parasitic lifestyle exemplifies an international, collaborative approach to understand the evolution of an unconventional system (*PNAS* 2010). She is a pioneer in Forensic Acarology, and has won £233K in project grants from the BBSRC and the Royal Society to study the human acarofauna.

*Over the next 5 years the Evolution group will:*

1. Continue to develop important new phylogenetic methodologies and tools for the evolutionary biology community.
2. Apply these phylogenetic methods to a range of non-conventional systems, such as human culture, language and medicinal plant use, while consolidating phylogenetic work in established systems, namely plants and arachnids.
3. Develop complementary experimental methods to test phylogenetic assumptions and predictions in areas such as genetic code evolution and cancer biology.

**Microbiology (Key staff: Clarke, Jackson, Jones, MacIntyre, Neuman)** This group's ambition is to further the understanding, treatment and control of infectious disease, with a focus on bacterial and viral pathogens. Transmissible disease remains a major cause of global mortality (~25% of worldwide deaths) and key challenges include emergence of new infectious agents, impact of environmental change and spread of antibiotic resistance. Research at Reading addresses these challenges.

Recent research highlights include **Jones'** determination of the 3D structure of a unique virus glycoprotein to provide a new paradigm in the field (*Nature Struct Mol Biol*, 2008) and his development of a new candidate Foot and Mouth Disease vaccine (*PLoS Pathogen*, 2013). **Neuman's** studies with industrial partners, including Isis Biosciences (USA) and Sarepta Therapeutics (USA), have led to the design and patents (WO/2005/086804, PCT/US2005/007548) for new drugs that can stop an entire family of emerging haemorrhagic fever viruses. The Bacteriologists (**Clarke, Jackson, MacIntyre**) use molecular techniques to study how bacteria assemble surface structures, colonise plants and insects and infect the human host. Recent highlights include the characterisation of the inhibition of platelet activation by *Staphylococcus aureus* by cell wall lipoteichoic acid, leading to the award of £195K British Heart Foundation grant, and showing how pathogen evolution can be driven by host factors (*Current Biology*, 2008; 2010; *PLoS Pathogen*. 2011) leading to a BBSRC collaborative grant (£550K with UWE and Oxford) funding further investigation.

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*Over the next 5 years, the Microbiology group will:*

1. Exploit current industrial links to identify novel microbial agents for biocontrol of key insect pests and plant pathogens.
2. Research membrane-altering viral proteins in order to employ them as tools to improve the delivery of gene therapy.
3. Commercialise novel vaccines for Foot and Mouth Disease and haemorrhagic fever.

**Molecular and Cellular Medicine (Key staff: Bicknell, Boateng, Clerk, Darbre, Dash, Foster, Gibbins, Jones, McGuffin, Patel, Stefanini, Sugden)** This interdisciplinary group aims to understand the molecular and cellular causes of disease to facilitate the development of new therapies focusing primarily on cardiovascular and metabolic diseases, cancer and muscle wasting diseases. Over the current assessment period, this section has flourished, driven mainly by creating the Institute of Cardiovascular and Metabolic Research (ICMR) and CINN and also through five key research appointments through the £14M AIP.

**Gibbins** heads the multidisciplinary ICMR that includes cell biologists, mathematical modellers, structural biologists and bioinformaticists (**Bicknell, Jones, Stefanini, McGuffin**) developing new understanding of the mechanisms regulating the balance between platelet activation and inhibition underlying cardiovascular diseases. A key finding has been the identification of a fundamental role for connexin hemichannels and gap junctions in circulating cells and they have established their importance in platelets in the control of haemostasis and thrombosis (*Circulation* 2012, *Nature Communications* 2013). Gibbins has been awarded 3 programme grants (two from BHF worth £1.07M, one from MRC £1.4M) and 5 project grants (MRC, BHF: £1.4M) to study activatory and inhibitory regulation of platelet function in health and disease. **Darbre's** multi-disciplinary research involving chemists, clinicians and cell biologists into environmental oestrogens and breast cancer has defined novel oestrogenic components of personal care products. The work funded by national and international agencies (e.g. Australia and Saudi Arabia) has led to changes in safety regulations implemented by the EU (See Impact Case Study). **Clerk, Sugden, McGuffin** and **Boateng**, members of ICMR, act as the nucleus of the University's multi-disciplinary initiative to investigate cardiac hypertrophy, a leading factor in heart function-related deaths Their work is funded by an extensive portfolio including BHF (two project grants, £348K), MRC (£557K) and part of a Fondation Leducq Transatlantic Network of Excellence grant (\$6M). Exploiting stem cells as therapeutic reagents is the focus of a multidisciplinary team in SBS that brings together developmental biologists (**Patel**), cell biologists (**Dash**), gene therapists (**Foster**) mathematical modellers (**Oxford University**) and industry (**Natural Biosciences Ltd**). They have identified and characterised a novel form of stem cell migration that is altered with ageing (*Stem Cells* 2012). Their research to investigate stem cell reprogramming and stem cell biology in relation to ageing is key to the University's Age Research strategy and CINN mission aims and is supported by two project grants from the BBSRC (£750K) and four industrial BBSRC-CASE awards.

*Over the next 5 years the Molecular and Cellular Medicine group will:*

1. Further develop expertise in the application of world leading imaging modalities in the study of molecular and cell biology and *in vivo* animal models of disease and human subjects using the facilities in the recently established cardiovascular imaging facilities in ICMR.
2. Expand our links with industry and medical translational platforms to exploit our work on stem cells to develop therapies to treat tissue wasting diseases and to take advantage of emerging iPS technologies to generate personalised medicine.

### c. People, including:

#### i. Staffing strategy and staff development

The SBS staff recruitment and development strategy is at the heart of our mission statement and is designed to:

- (1) Build on existing strengths to enhance its reputation in areas where it enjoys international recognition (cardiovascular biology, evolutionary biology).
- (2) Recruit into areas of national and international priorities that complement existing

programmes (stem cell biology, computational biology, regenerative biology).

The distinction between academic and fixed-term research staff is kept to a minimum, thereby encouraging the latter to participate fully in staff development programmes. The following actions are cornerstones to our staff recruitment and development strategy: **(1) Targeted recruitment.** Selecting, recruiting and retaining researchers with the highest potential to achieve excellence in research through strategic appointments, funded through the University's £14M Academic Investment Project (AIP). In the past 5 years SBS has recruited several additional staff (**Clerk and Sugden** – Professors; **Foster** – Reader; **Jones, Stefanini, Venditti** – Early Career), to bring in areas of expertise to foster long term growth and multidisciplinary research. **(2) Mentoring and career development.** All staff are supported by mentors. Regular meetings between line-managers, the Director of Research and Heads of Research groups are held to identify training and funding needs to enable their development as independent researchers. New staff have a formal Induction Programme and participate in the HEA-accredited Postgraduate Certificate in Academic Practice, which includes training in research team supervision, postgraduate supervision, grant preparation and grant management. We develop and support research staff using the framework provided by the local and National Research Concordat and UoR has the HR Excellence in Research Badge to demonstrate European Commission recognition for its plans to implement the Concordat. The Reading Researcher Development Programme (RRDP) is a major element of this support through training. **(3) Annual research planning.** Yearly staff workload surveys allow the Head of School to identify teaching and administration commitments and balance these against strengths and successes in research and plans for future research activities. SBS has invested in 5 centrally funded teaching fellows which helps free key research staff from teaching duties (e.g. **Gibbins, Pagel**). **(4) Financial support for research.** Generous start-up funds (often over £100K) are allocated to new staff enabling timely establishment of an independent research programme. Priority is given to new staff in the University PhD studentship competition run by the Faculty. Funding through SBS and ICMR provides a budget for academic and research staff for equipment, conference attendance, proof of concept experiments and support to international visiting researchers to bolster our strategic aims. SBS staff have won 32 bids and at least 3 have led to successful project grant applications. **(5) Research mobility.** The School recognises the substantial benefits from academic staff research study leave (e.g. **Cook** at University of Western Sydney, Australia). Furthermore we encourage the award of Visiting status at senior levels to leading researchers from international Universities, SME and the NHS (e.g. **Rodgers**, Adelaide University, Australia). **(6) Promoting diversity and equality.** We were the first School in the University to receive the Silver Award from ATHENA SWAN which demonstrates our strong commitment to supporting good practice in recruitment, retaining and promoting women and are currently applying for the Gold award.

## ii. Research students

The School has made PGR recruitment, training and personal development a priority since 2008. The success of newly developed training programmes has led to SBS currently holding the registration of 94 PhD students from across the globe supported by a diverse funding stream that includes RCUK, industry, charities and foreign governments as well as university investment. This equates to 2.5 PhD students per research active academic. Innovative advertising measures continue to yield dividends in terms of recruitment, in particular our use of social media. The SBS Facebook page currently has over 54,000 Likes, making it by far the most popular Facebook page for any school or department of biological sciences in the world and indeed more popular than most UK universities' Facebook pages.

Since 2008, there have been significant improvements to PGR support services offered by the School and University; these services are aligned with goals of Vitae to facilitate students realising their research potential. We have invested heavily to promote the four key elements: knowledge and intellectual abilities, personal effectiveness, understanding of governance, and ability to engage, influence and have impact. The support afforded to research students has been rewarded by the 100% 4-year submission rates for PhD studies funded by the research councils.

**ii.a. SBS and student supervision, development and training programmes.** All projects submitted by prospective supervisors are scrutinised by the School's Director of Postgraduate

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Studies and Director of Research. New students are allocated two principal supervisors and a Supervisory Committee of up to three academic members. Research students's progress is reported to the Faculty Board for Postgraduate Research Studies at the key way points. Progress is monitored by assessing written reports, oral presentations, meetings with their supervisory committee and student and supervisor evaluation forms. A distinctive feature of the SBS development programme is that students have focused research-specific activities that are delivered through the research groups. For example Molecular and Cellular Medicine group students participate in workshops on gene therapy and *in-vivo* imaging, while the Ecology and Microbiology groups have topic-focused seminar series and journal clubs. All training needs required for a particular research project are organised by a dedicated team within SBS who arrange workshops/courses.

**ii.b. University of Reading-led student training and development.** A major new development since 2008 has been the establishment of the Graduate School and delivery of the Reading Researcher Development Programme (RRDP) which maps closely to the Vitae Research Development Framework (RDF). The Graduate School is the hub for all doctoral research activity across the University. In partnership with the UoA, it provides support and skills training to fulfil the student's potential as a developing researcher. The Graduate School: (1) coordinates generic research and professional skills training. (2) Enhances multidisciplinary working with an active campus wide postgraduate research community with common activities, including an informal meeting space. (3) Supports supervisors, School Directors, postgraduate research studies and other staff involved in research activity and helps to share good practice across the University. (4) Supports the development of postdoctoral researchers through tailored skills and career training programmes. (5) Provides funding for students to attend national and international conferences and (6) provides funds for students to travel within the UK and abroad to carry out research. A hallmark of our PhD research programme is engagement with industry which has led to 19 BBSRC Industrial CASE Awards and industry-funded PhDs (Pfizer, Syngenta, Natural Biosciences Ltd) during this REF period. Since 2008 our doctoral graduates have taken up positions in prestigious industrial and academic institutions (AstraZeneca, Merck, Imperial College and Oxford University), a testimony to the high calibre of training delivered by the School and University.

**d. Income, infrastructure and facilities**

**Income.** External grant income in this assessment period has grown to 130% of the RAE 2008 level in terms of funding won per PI and stands at £4M per annum. 90% of SBS academics are currently PI/Co-I on external research grants. Current funders include: BBSRC, MRC, NERC, DEFRA, Royal Society, EU, British Heart Foundation, Wellcome Trust, Heart Research UK, Leverhulme Trust and numerous global industries including AstraZeneca, Syngenta.

**Investment in infrastructure.** The University has embarked on an unprecedented investment in biology of over £28M which is compatible with our strategic research focusing on improving quality of life through disease eradication and the impact of human activity on the ecosystem.

The most significant improvement to the biological research infrastructure at the University of Reading has been the completion in 2009 of the Hopkins Building at a cost of £17M. The building's design fosters major new initiatives in biomedical science that are truly multidisciplinary and independent of traditional departmental and divisional boundaries, it being jointly occupied by staff from SBS and pharmacologists from the School of Chemistry, Food and Pharmacy. Multidisciplinary collaborations have been formed with a particular focus on using *in-vivo* model systems and live cell imaging which were not possible previously (e.g. Dash/Foster/Patel (SBS) and Whalley/Stephens (SCFP) in cannabinoids and muscle development).

The University has also invested heavily to refurbish the three existing SBS research facilities that house research into man's impact on the ecosystem. This includes spending £8.2M to support the Evolutionary Biology group, and £1.8M on new Ecology research facilities (including £0.8M on new constant environment rooms etc). In addition, £0.85M was spent on upgrading the BioResource Unit and £2M on facilities used by the Microbiology group.

**Facilities Investment.** To ensure that our research remains at the cutting edge but also has the capability for the incorporation or development of new and emerging experimental approaches, members of the School have attracted funding of over £2M from a variety of sources including RCUK, charities, government departments and private donors to set up a state-of-the-art **Imaging Facility** which supports a large body of research using *in-vivo* models and live cell imaging to understand human diseases. This platform offers for the first time in Reading the following: three dedicated live cell confocal microscopy systems, a super-resolution N-STORM confocal microscopy system, high speed intravital confocal microscopy incorporating spinning disc high speed confocal capabilities, flow cytometer, high frequency ultrasound imaging, Dual-energy X-ray absorptiometry (DEXA), and Ultrasound for human vascular imaging. The other major investments made in facilities utilized by SBS researchers has been in establishing the **Chemical Analysis Facility** (CAF), a £4.5M University investment that recognises the need for state-of-the-art instrumentation to support research in biological and chemical sciences and in the **Centre for Advanced Microscopy** (CfAM). The CAF offers five groups of instruments that have greatly expanded the scope of research undertaken by SBS by permitting us to incorporate for the first time at Reading aspects of structural and physical chemistry to biological research: NMR spectroscopy, Mass spectroscopy, X-Ray diffraction and scattering, Optical spectroscopy and Thermal Analysis. The CfAM provides comprehensive facilities for electron microscopy (SEM, TEM), X-ray microanalysis (EDX, WDX), spectroscopic imaging (Infra-red, Raman), visible light microscopy and scanning probe atomic force microscopy (AFM).

**Facilities support investment.** We have also recognised that investment in facilities and instrumentation requires management to deliver its full potential. Thus, each project is supported by a dedicated team of supervisors and managers. The Hopkins facility has a team of six technicians responsible for maintenance of the facility and training in the use of equipment, CfAM has six staff members and CAF has five members delivering the same roles in their respective centres. To support these CfAM and CAF costs and the continual maintenance of the equipment to world class standards, the University provides an additional grant of >£400K annually.

**Research governance.** The PVC for Research and Innovation (PVCRI), through the Board for Research in the Sciences and the University Board for Research and Innovation, with the Faculty Director of Research (FDoR) directs research strategy, delivery and investment, most closely in terms of the AIP and the CoEs, linking with UoA management (section b). The Boards include early career researchers and/or research students. The PVCRI manages the Research Endowment Trust (RET) which pump-primes research, supports infrastructure investment and research leave. RET has provided considerable investment in the CoEs. The FDoR oversees the research platforms (e.g. CAF and CfAM) ensuring research infrastructure development and access to shared facilities.

#### e. Collaboration or contribution to the discipline or research base

The School has a prominent international profile across its four research themes and SBS academics receive recognition for their innovative research and contribute to the shaping of national and international research landscape.

Our researchers are recognised as key innovators in their field epitomized by two outstanding awards. **Pagel** became Fellow of the Royal Society in 2011, the first person in the history of biological sciences at University of Reading to hold this prestigious award. In addition he was awarded a European Research Council Advanced Investigator Award to investigate the evolution of human language (£1.5M). **Sibly** was awarded The Scientific Medal of the Zoological Society of London for his lifetime's work on ecology.

Staff have been commissioned to provide expert judgement for governments, industry, media and academia at both national and international level. **Pagel** participated in the World Economic Forum, **Davos**, 2013 aimed at improving the state of the world by engaging business, political, academic and other leaders of society to shape global, regional and industry agendas. **Foster** has advised the UK government on human drug trials on rare diseases, an initiative coordinated by Rt. Hon Andy Burnham, MP, at the House of Commons. SBS staff play key roles in both the industrial

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and healthcare sectors. **Gibbins** is an advisor for Shire Pharmaceuticals. **Jackson** has worked with the North Middlesex Hospital on issues related to hygiene as well as being an advisor for Hypotech, Genus Pharma and Bartletts Tree Experts. **Patel** is the Chief Scientific Advisory for Natural Biosciences Ltd. **Sibly** acts as an advisor for Syngenta. **Prescott** has been involved in applied research with many industrial companies including Syngenta, Killgerm Chemicals, Rentokil, SAGEA and has advised for Bayer, BASF, LiphaTech, Pelgar, Rentokil and Syngenta. SBS staff have also worked with industry to develop marketable projects exemplified by **Neuman** who holds patents with Isis Biosciences (Carlsbad CA) and Sarepta Therapeutics (Corvallis, OR) (WO/2005/086804, PCT/US2005/007548) for anti-haemorrhagic fever drugs and **Jones's** Foot and Mouth disease vaccine (EP2491118 A2).

Many members of SBS have worked with global media organisations including **Jackson** (BBC TV and BBC Radio), **Pagel** with National Geographic, the BBC and Technology Entertainment Design global communications system (TED). We play a major role in coordinating Multi-National Research Programmes e.g. **Culham** is the coordinator of two projects: The EU 4D4Life project, worth €3.3M, embraces research in 11 EU and 6 other countries and The EU i4Life project worth €2.45M has 8 EU participating countries and another 3 from around the world. **Sibly** is one of the lead members of Marie Curie ITN Project - CREAM, funded by the European Commission and involving 10 industrial partners. **Hawkins** is one of the leads on the €4.7M FP7 Medplant ITN of 8 EU countries and 2 industrial partners.

SBS staff hold prestigious professorial positions in overseas universities including **Cook**: Hawkesbury Institute for the Environment, University of Western Sydney, Richmond Campus, NSW, Australia; Distinguished Overseas Visitor to the Chinese Academy of Sciences. **Gibbins**: King Saud University, Riyadh, Saudi Arabia. **Pagel**: Santa Fe Institute, USA.

Our research reputation is recognised through invitation to serve as editors (E), on the boards of high impact journals (EB) and book editors (BE). **Clerk**: *Cardiovascular Research*. **Cook**: (EB) *J. Evolutionary Biology*. **Culham**: (EB) *Botanical Journal of the Linnean Society*. **Darbre**: (EB) *J. Applied Toxicology, Hormone Molecular Biology and Clinical Investigation*. **Foster**: (EB) *Human Gene Therapy Methods*. **Gibbins**: (EB) *J. Biological Chemistry*. **Jackson**: (EB) *Molecular Plant Pathology*, (E) *Phytopathology*, (E) *European Journal of Plant Pathology*, (BE) *Plant Pathogenic Bacteria: Genomics and Molecular Biology*. **Patel**: (EB) *American Journal of Stem Cells*. **Sibly**: (BE) 'Metabolic Ecology' (with Brown and Kodric-Brown). **Sugden**: (EB) *Circulation Research*; *J. Molecular and Cellular Cardiology*.

SBS has strong representation on peer review committees and advisory boards including: **Gibbins**: Member of the BHF Project Grants Committee. **Hawkins**: Evaluator Panels: BBSRC/NERC Systematics and Taxonomy (SynTax); Norges forskningsråd/The Research Council of Norway; Reviewer of the tenders for NERC's "UK Taxonomy & Systematics Review". **Jackson**: External Evaluator for European Union COST Action 873 grant. **Jones**: Member of Medical Research Council Infection and Immunity Board. **Patel**: Core Member of BBSRC Grant Committee C: Genes, Development and STEM Biology and Muscular Dystrophies Commission member for the Association Française Contre les Myopathies (AFM).

The following all play significant roles in providing expert advice as members of steering committees: **Clarke**: Expert Advisor to Wellcome Trust's Health Innovation Challenge Fund. **Cook**: Member of NERC Peer Review College. **Darbre**: Scientific Advisor, European Commission-Committee on Health and Environmental Risks; Scientific Advisory Board of the International Halifax Project. **Foster**: Scientific Advisory Board: 'Joining Jack'. **Hawkins**: Member of the Consortium for the Barcoding of Life. **McGuffin**: MRC College of Experts. **Patel**: Medical Research Council Scientific Advisory Board Member for Skeletal Muscle Therapies.

SBS shape the research agenda through their role as conference organisers. **Cook**: Convenor of the Special Interest Group on Insect Symbiosis, 2008. **Darbre**: Member of Organising Committee of the International Meeting of the *Journal of Steroid Hormone Biochemistry and Molecular Biology*, Seefeld, Austria (2010). **Jackson**: Organiser of Phenotype Microarrays (2009); Molecular Biology of Plant Pathogens (2012); *Pseudomonas syringae* and Related Pathovars (2010); Tree Diseases and Pests (2013). **Patel**: Organiser, European Neuro-Muscular Centre International Workshop: Stem/Precursor Cells as a Therapeutic Strategy for Muscular Dystrophies, The Netherlands. (2011) **Sibly**: Organiser, British Ecological Society workshop on Statistical Evaluation of Individual-based Models (2012); Joint organiser, Marie Curie ITN project CREAM workshop (2010).