

<p><b>Institution: University of Reading</b></p> <p><b>Unit of Assessment: 3 Allied Health Professions, Dentistry, Nursing and Pharmacy</b></p> <p><b>a. Context</b></p> <p>The Reading School of Pharmacy (RSOP) conducts research in the four core Pharmacy disciplines (Medicinal and Biological Chemistry, Pharmaceutics, Pharmacology and Pharmacy Practice) but the research is organised in several strategic foci (<b>SF1-5</b> in REF5 Environment), in order to best exploit critical masses of expertise and resources. Our strategic foci are the fundamental building blocks upon which our impact profile is built, as we increasingly work across disciplines to ensure that new research ideas, relevant to our end users, are developed in a timely and coherent fashion. These end users are broadly defined as scientists in pharmaceutical industry and healthcare professionals, who acquire and exploit the technology, know-how and expertise arising from RSOP research to the ultimate benefit of the health of the general public.</p> <p>Although RSOP was formed relatively recently (2004), and has a large proportion of early career researchers, our research has led directly to a number of strong impact case studies being developed. Since its inception, RSOP has strongly emphasised and supported impact through a variety of mechanisms, which are described in <b>Section (b)</b>. RSOP's impact encompasses a number of important areas, including economic and commercial benefits, influence on practitioners and services, and improved health and welfare. As such, it has direct and measurable impacts upon the pharmaceutical industry, community and hospital pharmacy, medical practitioners, regulatory authorities and the media, as well as indirect impact on the broader public.</p> <p><b>b. Approach to impact</b></p> <p>RSOP uses four key approaches to actively develop and support research which lead to impact:</p> <p><b>i) Interdisciplinary groupings and research platforms</b></p> <p>RSOP research expertise and resources are strategically organised to maximise the opportunity to conduct successful, high-impact research. Further success is leveraged via a number of highly specialised teams that bring inter-disciplinary skills to bear upon particular research areas (e.g. polymer chemistry, SMART materials, cellular and molecular neuroscience, and patient safety; see <b>SF1-5</b>). Frequently, cross-disciplinary interactions are cemented with joint PhD studentships and further amplified by links with other Schools and departments, such as Chemistry, Food &amp; Nutritional Sciences, Institute of Education, Mathematics and Statistics, Systems Engineering, Biological Sciences, and Psychology &amp; Clinical Language Sciences.</p> <p>Very strong University-led, inter-School research centres within the Faculty of Life Sciences (i.e. The Centre for Integrative Neuroscience &amp; Neurodynamics and The Institute of Cardiovascular &amp; Metabolic Research), have received substantial investment from the University, facilitating the conduct of world-leading, high-impact science. When coupled with other University Research Platforms, such as the Chemical Analysis Facility, BioResource Unit, Brain Embodiment Laboratory, Hopkins Life Sciences Building and the Centre for Advanced Microscopy, these resources comprise an exceptionally strong research platform that is relevant to RSOP and upon which staff, PDRAs and PhD students can build innovative and high-impact research programmes.</p> <p><b>ii) Building strong relationships with industry</b></p> <p>Since its inception, RSOP has had an outward-facing approach to research partnerships, with the development of relationships with industry a key feature of our successes. Evidence of the impact of our research to end users is clearly demonstrated by RSOP's ability to attract significant funding (c£1.6M) <b>from charitable and industrial sources</b> (e.g. MHRA, Alzheimer's Society, Motor Neuron Disease Association, GW Pharmaceuticals, UCB Pharmaceuticals, Syngenta, CDC, Convatec, Otsuka, GSK Nutrition, Pfizer Neusentis, Pharmaterials and Oxoid). Our PhD students frequently engage in research projects that are of direct commercial relevance and the University helps to support this via the competitive awarding of PhD funding for joint studentships with industry. A number of our PDRAs are employed on projects which have user impact as a desired endpoint (e.g. GW Pharmaceuticals, fundamental research undertaken to support a clinical trial proposal).</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Highly successful and innovative collaborations with industry are strongly evident and are exemplified by the **Whalley/Stephens** impact case study where original research from RSOP has been coupled with a novel business model in the pharmaceutical industry to take specific cannabinoids for the treatment of epilepsy to the point of translation to the clinic. RSOP's pedigree in epilepsy research is further exemplified via a long-standing relationship with UCB Pharma (**Stephens/Whalley**) which funds research into the next generation of anticonvulsants. Bioprocessing Research Industry Club (BRIC) funding of £0.75M has also been obtained (**Connon**) to further develop novel stem cell transportation methods towards commercial viability.

The University's strategic focus on new appointments and facilities for neuroscience research has been instrumental in creating an attractive environment in which companies want to invest. Not limiting ourselves to interaction with established industrial partners, RSOP has also spun out a novel company. Capillary Film Technology Ltd (**Edwards** is a director) was created in July 2012 to exploit our pharmaceuticals IP for next-generation point-of-care diagnostic healthcare products, in collaboration with Lamina Dielectrics Ltd, a UK-based manufacturing SME. Industrial scientists (e.g. from GSK Nutrition, GW Pharma, Bristol Myers Squibb) are regular visitors to RSOP, helping to steer our research in directions that are directly relevant to industry.

The Research Platforms also provide a mechanism for strengthening our relationship with industry through the provision of expert services and equipment, such as the Chemical Analysis Facility (open Autumn 2010). An important part of this established facility's long-term viability is engagement with industrial users and RSOP staff have been very effective in extending routine service provision (e.g. data collection) into higher level engagement of industry, providing access to state-of-the-art data analysis expertise and methods developed in the department (e.g. consultancy X-ray diffraction for a major US-based food manufacturer).

### iii) **Exploitation of the University's specialist support services**

Interactions with industrial partners and exploitation of intellectual property are undertaken with full support from the University's Research and Enterprise Development Team (RED), who interact closely with School staff during weekly drop-in sessions. RED plays a crucial role in promoting the timely exploitation of the School's IP and there is a particular focus on support for Early Career Researchers to ensure that our ethos of end-impact through research is instilled at the earliest opportunity. Our highly successful academic mentoring system for *all* members of staff involved in research was specifically extended to cover non-academic impact in order to increase the potential for exploitation of IP. The department actively maintains a portfolio of its exploitable IP (e.g. Corneal Graft Technology, Novel Method for Manufacturing Hydrogels) which is promoted to industry by RED via <http://www.southeastip.co.uk>. RED also actively encourage the protection of RSOP IP through the effective use of patents (e.g. cell delivery technology (**Connon** WO2010/133853), CBDV in epilepsy (**Whalley/Stephens** GB 2479153-A), polymeric hydrogels (**Khutoryanskiy** EP2526140 A1), immunoassay kit manufacture (**Edwards**, GB 1005191.0)).

### iv) **Excellence through Continuing Professional Development and outreach**

RSOP hosts the highly regarded Centre for Inter-Professional Postgraduate Education and Training (CIPPET), which delivers continuing professional development (CPD) for pharmacists, medics, dieticians and nurses and provides training for new roles such as non-medical prescribers and Medicines Use Reviews (see **SF5, Safer Medicines, Better Practitioners**). Active CPD-related research themes within RSOP further support this centre's prestige, informing and influencing both medics and those working in professions allied to medicine (e.g. CPD records for Revalidation (**Donyai, Alexander**)). Further emphasis on high-impact research in the professional arena is exemplified by the pharmacist-led information technology intervention for medication errors (PINCER) that is discussed fully in the case study of **Howard** and the participation of **Donyai** as a pharmacist member of the Central London 1 Research Ethics Committee.

RSOP staff also engage with local radio, national TV and international media, using their general and specific expertise, to aid public understanding of science (e.g. **Dallas** on BBC Radio Berks Breakfast Show, February 2013 on the role of performance-enhancing supplements; **Whalley** in Washington Post, April 2013, on cannabis and epilepsy). Particularly noteworthy is the role of **Williamson** as the scientific consultant to two series of BBC's award-winning 'Grow your Own Drugs' show (2009-2010) and to the BBC's 'Victorian Pharmacy' show in 2010.

**c. Strategy and plans**

At institutional level there is a strong commitment to making impact a fundamental part of strategy, as reflected in the University's recent submission to the BBSRC's Excellence with Impact competition. The University is developing a range of policies and procedures that seek to maximise impact from research, including: emphasising impact as a criteria for recruitment and promotion; training programmes to inform and equip researchers to generate impact from their research; and enhanced central resource to focus on the development of impact. We will exploit these central initiatives in the development of our own impact strategy, which relies on (a) maximising the impact-generation potential of our research by ensuring its consideration from the outset in research planning and (b) actively promoting RSOP research that has the potential for impact generation. We will continue to raise awareness of our high-quality research to ensure it attracts attention and support in a competitive funding climate. In order to achieve this, we will:

- Closely examine our existing research strategies, critically assess both their academic relevance/excellence and their alignment with national and international priority research areas, and respond positively to justified changes. In this light, we will regularly assess our structure/research groupings to ensure optimal organisation for the execution of high-quality research and impact generation. This process of optimisation will provide higher-quality time for research and its development, allowing closer integration with RED and greater opportunities to explore impact opportunities with other departments/schools.
- Enhance critical mass (via ongoing collaboration/recruitment) that will generate higher impact research via intelligent grouping of expertise and experience. For example, a bid for a doctoral training centre in Polymer Science is currently in preparation.
- Actively increase awareness of our existing impact successes at all levels, to promote RSOP's impact focus to industry and other investors, by improved interaction with the University's Marketing and Communications Office and better use of conventional and social media.
- Create an 'impact aware' culture for all staff, by providing training for both new and established members, through our Impact Lead and dedicated central resources, and by continuing to extend and refine our mentoring system.
- Showcase our expertise and facilities to industry through regular short courses, led by RSOP scientists closely involved with, or heading up, key research facilities (e.g. **Shankland** with CAF X-ray diffraction), thereby also fostering closer industrial links and impact 'steer'.
- Ensure that future recruitment specifically considers candidates' awareness and involvement in impact-generating activities and their potential for impact.
- Further develop research-led professional education. For example, CIPPET have been invited to tender for the provision of obesity management courses nationwide. New MRes programmes in neuroscience, polymers and patient safety will also commence in 2014.
- Further encourage successful winning of fEC grant funding and specifically employ overhead funds from such to seed fund research projects with impact potential.

**d. Relationship to case studies**

**1. Development of anti-epileptic cannabinoids: from discovery to the clinic:** Focussed RSOP research, partnered with UK industry, has resulted in investment and targeting of resources towards preclinical justification for human clinical trials. Our strategic focus on appointments and facilities for neuroscience was instrumental in creating an attractive environment for investment.

**2. Public and Commercial Engagement with brain-computer interfaces:** Original research carried out by RSOP and the School of Systems Engineering has been actively promoted through a variety of media outlets, resulting in major impact in terms of public understanding of science and further University investment (Brain Embodiment Lab) in an emerging research area.

**3. Identifying strategies for reducing prescribing errors in general practice:** An example of an intelligent collaboration with complementary experts in related fields and strong use of media to market and communicate the results of the research to a wide audience.