

Institution: University of Reading

Unit of Assessment: 3 Allied Health Professions, Dentistry, Nursing and Pharmacy

a. Overview:

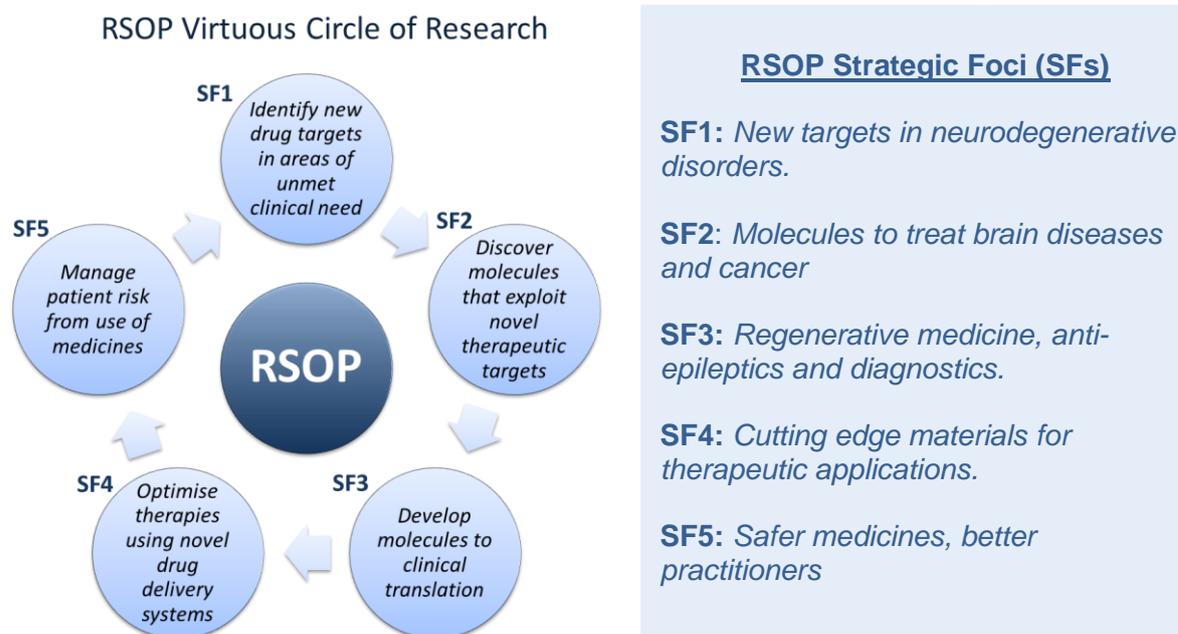
Reading School of Pharmacy (RSOP; est. 2004) has an international reputation for research in cellular and molecular neuroscience, identifying molecules for new therapeutic targets, clinical translation, optimal drug delivery and managing patient risk. We are a discrete but integrated Department of 38 academic staff within the School of Chemistry, Food and Pharmacy (SCFP; 91 academic staff) in the Faculty of Life Sciences. RSOP maintains its own management structure (Head (HoD), and Directors of Research (DoR), Postgraduate Studies and Divisions) and administrative and technical teams. We respond to international and national research priorities through tailored group and individual research plans, and exploit our strategic location within the Thames Valley hub of science and technology.

RSOP is organised divisionally according to core discipline (Medicinal and Biological Chemistry, Pharmaceutics, Pharmacology and Pharmacy Practice), and continued investment has enabled us to appoint 12 new research active academic staff since RAE 2008 to enhance our strategic research strengths. We have established a global reputation in 5 research areas of therapeutic importance to patients (**Section b**) and received targeted funding from the University for specific cross-disciplinary strategic research priority areas, including the £14M Academic Investment Project (AIP). Our goal within RSOP is to foster discipline-, department-, school- and institution-spanning collaborations. Within the University of Reading's (UoR's) Research Centres, we play a leading role in the Centre for Integrative Neuroscience and Neurodynamics (CINN; 9 RSOP staff) and contribute to the Institute of Cardiovascular and Metabolic Research (ICMR; 3 RSOP staff).

Our research is supported by substantial UK Research Council (UKRC), charitable and industrial (large multinationals and SME) funding, which provides equipment, materials, PDRAs, research studentships, technicians and expertise. Our Centre for Inter-Professional Postgraduate Education and Training (CIPPET) delivers training and networking opportunities for practitioners to shape the clinical landscape in which our research is applied.

b. Research strategy:

Our strategy for RSOP is to link the health, physical and clinical sciences to promote the safe and effective use of medicines in a virtuous circle of internationally and nationally recognised research:



The strategy is sustained by current grants totalling £5.4M from UKRCs, industry, charities and PhD studentships, as well as strong links with industry and practitioners. During the REF period, we have significantly advanced our infrastructure and facilities, and have increased our grant

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income by 185%. We have achieved critical mass in each area of strategic focus, and have trebled PhD awards (*cf* RAE 2008). Our staff have published ~250 academic papers and book chapters. RSOP's multi-disciplinary research is exemplified in the following specific, strategic areas of strength, expertise and critical mass for which we have become renowned.

SF1. Cellular and molecular neuroscience: new targets in neurodegenerative disorders

Key staff: Bithell, Cimarosti, Cobb, Cottrell, Dallas, Gritsun, Lewis, McNeish, Nunn, Stephens, Whalley

Key divisions: Pharmacology, Medicinal and Biological Chemistry

Brain disease costs Europe ~€800 billion/year, largely due to age-related dysfunction. RSOP leads Cellular and Molecular Neuroscience research and drove creation of the University's Brain Embodiment Laboratory (see **(d)**). We have won funding (>£2.5M) to conduct collaborative and multi-disciplinary research into fundamental processes involved in neuronal communication and how they can be altered, regulated and exploited in pathophysiological situations to identify novel therapeutic targets, and have appointed 7 new staff associated with CINN (including 3 AIP posts).

We have achieved major successes in the areas of vascular dementia, Alzheimer's disease, Parkinson's Disease, neuropathic pain, epilepsy, stroke, migraine, neuroengineering and CNS infection (see **Impact Case Studies**). We value stakeholder engagement and despite the competitive neuroscience research climate in the UK, have won funding from UKRCs, charities and industry (eg UCB Pharma, GE Healthcare, Pfizer, GSK, GW Pharma and Otsuka Pharma), including a recent £250K GW Pharma sponsored Associate Professor position. Our links with local patient groups (antipsychotic use in dementia) ensure that our vision is informed by patient need.

SF2. Discovering molecules for new therapeutic targets: Brain diseases and cancer

Key staff: Bicknell, Brazier, Brooks, Cobb, Greco, Green, McNeish, Osborn, Strohfelddt-Venables, Whalley

Key divisions: Medicinal and Biological Chemistry, Pharmaceuticals, Pharmacology

We are committed to research in early stage therapeutic drug discovery (small molecule synthesis and target identification) by proactively building sustainable, funded collaborations between biologists and chemists to meet RSOP's translational research agenda. Our research focus is driven by the huge challenges society faces in tackling brain diseases (**SF1**) and cancer (cost to Europe: ~€124 billion per year).

We have won UKRC, Royal Society and industrial funding to develop novel asymmetric organocatalytic synthetic methods to prepare unnatural amino acids, nucleic acids, and natural products, an approach which produces compounds with promise for treatment of chronic neurological disorders (eg epilepsy, ataxia), and 'foldameric' peptides that may form synthetic ion channels or artificial enzymes (see **SF1**). We also develop anti-cancer agents (eg metal-based drugs and anti-angiogenic agents) and diagnostic approaches for cancer progression. The immediate stakeholder relevance is demonstrated by industrial engagement via CASE and other PhD awards with Dextra, Thermofisher, Ludger, MedPharm, GSK, GW Pharma and Syngenta.

SF3. Clinical translation: Regenerative medicine, epilepsy and diagnostics

Key staff: Bithell, Cobb, Connon, Edwards, Khutoryanskiy, Nunn, Shankland, Stephens, Whalley

Key divisions: Pharmacology, Pharmaceuticals, Medicinal and Biological Chemistry

Pharmacy research demands translational success to be relevant, and we have built a reputation for excellence in areas of significant unmet patient need. RSOP translational research is at the forefront of stem cell therapy and polymer science (**SF4**), molecular neuroscience (**SF1**) and diagnostics (**SF2**). Via >£3M of UKRC funding, we have developed polymer-based biomaterials, including intelligent substrates for stem cell therapy and tissue engineering, to generate IPR on stem cell encapsulation and ocular tissue constructs that are in clinical development. The research in non-psychoactive plant cannabinoids (**SF1, 2, 3**) which was initiated at RSOP and later funded (>£1M) by industrial partners (Otsuka Pharma and GW Pharma) has led directly to Phase 1 human clinical trials and named-patient use in treatment of drug-resistant epilepsy (with the UK National Epilepsy Centre). RSOP is now an international leader in non-psychoactive cannabinoid research in CNS disorders, as exemplified by newly funded studies to identify novel exploitable targets for cannabinoids (**SF1**) and derivatise current clinical candidates (**SF2**).

Diagnostic systems invented by RSOP that use capillary film technologies are being developed via a start-up company (Capillary Film Technology Ltd; CFT) to create low cost, mass

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manufactured, microfluidic material to test biomarkers for infection, autoimmunity, cardiovascular and cancer diagnostics. RSOP has also patented and commercialised methods to characterise crystalline pharmaceutical materials and won KTP funding for their commercialisation.

SF4. Optimal drug delivery: Cutting edge materials for therapeutic applications

Key staff: Connon, Edwards, Greco, Greenland, Khutoryanskiy, Lau, Shankland, Williams

Key divisions: *Pharmaceutics, Medicinal and Biological Chemistry, Pharmacology*

In order to respond to clinical challenges presented by toxic/poorly soluble small molecule drugs, and develop successful regenerative therapies, we develop novel polymer-focussed drug delivery systems and substrates for tissue engineering.

In drug delivery, we develop topical hydrogels and patches, anti-cancer polymer-drug conjugates (SF2) and polymers that enhance dissolution of poorly-water soluble drugs. In the tissue engineering area, we focus our research under the Smart Materials And Regenerative Therapies (SMART) grouping which links biologists and material scientists to develop intelligent scaffolds and biomatrices for regenerative/cell based therapies, an essential component in our translational research agenda (SF3). Consistent with our commitment to stakeholder engagement, work has been supported by EPSRC DTG studentships and studentships via industrial partners (Clasado, MedPharm, CCDC, Nanosight, Convatec, Pharmaterials and Syngenta).

SF5. Managing patient risk: Safer medicines, better practitioners

Key staff: Alexander, Donyai, Howard, Lau, Lim, Strohtfeldt-Venables, Whalley, Williamson

Key divisions: *Pharmacy Practice, CIPPET, Medicinal and Biological Chemistry, Pharmacology*

Medicines must be used safely, which necessitates evaluating their intrinsic safety and the way they are used, including the competence of practitioners. We have established internationally recognised research excellence in both areas and are now growing with the appointment in 2013 of a new lecturer with a proven track record in medication safety and ergonomics.

We played a pivotal role in the PRACTICE study which evaluated prescribing errors in UK general practice. It received international media attention and will change GP training in this area. We also played a critical role in the PINCER trial, which was published in the Lancet and showed the effectiveness of pharmacist-led interventions to reduce hazardous prescribing. Our work on quality standards for medicinal chemicals and herbal materials is incorporated into the British Pharmacopoeia (BP) and we advise national and international organisations on the safe use of natural products. Our DoH-funded and RPSGB-commissioned revalidation project has contributed to maintaining practitioner competence and developing frameworks to quantify CPD activities.

Mechanisms and Practices for promoting research : The wider context of RSOP research

We engage with end users and developers of our research, eg through our strong links with industry and practitioners: we submitted 10 patent applications in the current REF assessment period. We actively disseminate our research to the public and end-users through events (eg Brain Awareness@Reading), engagement with patient groups (eg UK Epilepsy Research Network, Parkinson's UK, Thames Valley Cancer Research Network), presentations to the public (eg UoR Public Lecture Series) and local, national and international media (eg BBC, ITV, New Scientist, Lancet, Washington Post, Telegraph). Within the UoR, the research centres to which we belong link with other UoR schools, eg Psychology and School of Biological Sciences (SBS). Our SMART grouping links biologists and polymeric material scientists. The new £300K Brain Embodiment Lab (BEL) engenders collaborations between neuroscientists, roboticists, engineers and mathematicians. Our seminar series (eg BNA funded Cellular and Molecular Neuroscience seminars), discipline-specific (SMART) and inter-disciplinary (ICMR symposia, CINN Unplugged) events bring RSOP and external investigators together to develop our strong, vibrant and supportive research culture.

Responsiveness to national and international priorities and initiatives: We have aligned our research to the strategic priorities of national and international funding bodies from which RSOP has won funding. The most relevant to our own vision are: **BBSRC** strategic priority areas of i) ageing research/lifelong health and wellbeing/healthcare technologies (SF1,2,3); ii) replacement, refinement and reduction (3Rs) in animal research (SF3), iii) systems approaches to the biosciences/systems biology (SF1,2). **MRC** priority areas of i) Resilience, repair and replacement (SF1,2,3) and ii) Living a long and healthy life (SF1,2,3). **EPSRC** themes in healthcare

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technologies (SF4) and centres for innovative manufacturing (SF4). NIHR patient benefit programmes (SF5). We have responded to the Grand Challenges Synthetic Chemistry (Dial-A-Molecule) programme (SF2) and the EPSRC Directed Assembly Network (SF2,4). Prestigious positions held by staff within Learned Societies, UKRCs and other awarding bodies (see (e)) strengthen our ability to influence new priorities and respond to new initiatives.

Future research plans: In the next five years, we will extend our SMART grouping's activities (SF4) to active clinical use, deliver clinical impact upon patient safety via RSOP-initiated Academic Practice Units (SF5), leverage major EU Horizon 2020 funding through 3 COST proposals in neuroscience, polymers and patient safety (SF 1-5), and commence 3 MRes programmes in the same areas. Four academic appointments (SF 1,3,5) during 2013, and two planned appointments in 2014 (SF5), further strengthen our capacity and sustainability in these areas. In the short term, our current PI grant portfolio of £3.75M and excellent infrastructure will further develop existing expertise, eg in stem cell differentiation and preservation (SF3); our co-I involvement in BBSRC research (£442K) will take forward new research collaborations, eg in crystallographic studies of nucleic acids and their metal complexes (SF2). Our vision is to maximise the benefits from our research for our stakeholders and enable us to embody the future of UK Pharmacy research.

c. People, including:**i. Staffing strategy and staff development**

Our strategy is to appoint staff to our areas of strategic focus, to ensure programmes are supported by strong academic environment, excellent facilities and established networks. Opportunities for multi- and interdisciplinary collaborations, and sustainable funding, are assessed ahead of staff appointments. Recent appointments have allowed us to enhance the vitality and sustainability of each of our areas of strategic focus, particularly through the appointment of Early Career Researchers (ECRs) and Academic Investment Posts. Our staffing strategy has also facilitated the award of Visiting Professorships and Fellowships to leading researchers and clinicians from international Universities, SMEs, large Pharmaceutical companies, and the NHS.

The distinction between academic and fixed-term research staff is kept to a minimum, thereby encouraging the latter to participate fully in developing RSOP research programmes. 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. SCFP has recently been awarded an ATHENA SWAN Bronze Award (2012) for strong commitment to supporting good practice in recruiting, retaining and promoting women in SET and we are now working towards Silver. Recruitment panels include members of both genders and all undergo mandatory equality and diversity training. The University provides teaching cover for staff on maternity leave, paid Keeping in Touch days during that leave, and returning staff have lighter teaching loads in the first term of return to support their research.

All new academic and research staff are supported by internal and/or external mentors (eg PPRT Galen award to **Lau** under **Donyai**'s mentorship). Space is provided in well-equipped laboratories/research offices alongside established researchers, and generous start-up funds are provided. Regular meetings between line-managers, the DoR and Heads of Divisions identify training and funding needs and require academic and research staff to develop their own research and publication strategies. In specific cases, buyout of teaching commitments has allowed more intense development of research in line with strategic areas of focus. £100,000 has so far been awarded by the University's Research Endowment Trust to support this scheme. 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. ECRs are afforded lower teaching loads to enable them to develop their independent research. PDRAs participate in a UoR Teaching and Learning Support Programme, which is additional to the RRDP; this provides opportunities to experience and contribute to undergraduate teaching and PhD supervision. PDRAs are also responsible for organising and chairing the RSOP 'Research Day'. PDRAs are invited to sit on the

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RSOP research committee and expected to submit yearly applications for external funds (eg travel bursaries) to strengthen their grant writing skills. We further support academic and research staff development via internally managed research sabbaticals. RSOP provides a budget for academic and research staff (up to £1000/application) for equipment, conference attendance, proof of concept experiments, and support to international visiting researchers to bolster our strategic aims (eg to Japan, China, Brazil, Spain, Kazakhstan).

Termly staff meetings and a monthly Research Newsletter provide guidance on publication strategy, funding opportunities, networking and research successes. Our mentoring programme includes early involvement from Research and Enterprise Development staff (specialist administrative staff who support external grant applications eg through weekly drop-in sessions) and most RSOP ECRs have won funding to support their teams, and disseminate their research results. Staff appointed prior to RAE 2008 have further strengthened their funding and publication records.

Our commitment to rewarding success is demonstrated by the recent (2008 onwards) promotion of a significant number of staff (8 Lecturers to Associate Professor and 1 Senior Lecturer to Chair) and the successful completion of probation by all staff to date.

ii. Research students

Research students at RSOP receive effective and sustainable research training at many levels beyond direct interactions with their supervisory team, eg the Department provides academic stimulation through the Divisions and research groupings; the University provides support through its Centres of Excellence and the Graduate School. Interactions with industry and practitioners allow students to visualise and exploit the applicability of their research. Training programmes and arrangements are discussed and developed through the RSOP Postgraduate Committee. This comprises research staff and student representatives, meets at least 3 times a year, and is guided by the University's Code of Practice for Graduate Research Degrees. It oversees the management of postgraduate training with support from the Graduate School and an online Student Log and Learning Needs Analysis, to monitor academic progress and develop each student's academic, research and transferable skill-sets. Students regularly attend RSOP and UoR seminars aligned to areas of strategic focus and present their research via poster and oral contributions at our RSOP Annual Research Day (see **c(i)**). This is supported by commercial sponsors, and gives students opportunities to network with industrial researchers and practitioners. Prizes are awarded for best presentations. Development of IPR and awareness of commercialisation are essential and are supported by UoR's Technology Commercialisation division. Postgraduate students are expected to attend at least one international conference to present their work, for which travel bursaries are available via University and RSOP schemes. Our students have also won funds from the University's Graduate School to host a Student led research conference within RSOP.

We support research students via a broad range of sponsors (RC DTGs, charities, CASE, UoR awards, international governments and self-funded) and have an excellent track record of successful PhD outcome within 4 years. Every student is supervised by at least two academics. More than 40 students have graduated from our UoA during this period (c.f. 14 during RAE 2008) and staff have supervised an average of 2 doctoral students to completion during this period, (c.f. 0.8 during RAE 2008). New staff members, mentored by experienced colleagues, are encouraged to win studentships to generate data for larger research programmes and increase research project management experience (people, budgets, scientific expectations).

A hallmark of our PhD research programme is engagement with industry and the NHS. The Oxford Academic Health Science Network (see **section e**) and the Academic Pharmacy Unit formed with Berkshire Healthcare NHS Foundation Trust provide NHS links for staff and postgraduate students. Industrial involvement has converted BBSRC DTG studentships allocated to RSOP to CASE studentships (Pfizer), and has realised 10 BBSRC and MRC Industrial Case Awards (Dextra, GSK, Ludger, McCormick, MedPharm, Oxoid, Syngenta). Industrial and charitable funding has provided 10 fully funded studentships (Ataxia UK, GW Pharma, UCB Pharma), with further support won from the Science and Technology Facilities Council and the Cambridge Crystallographic Data Centre.

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We continue to attract students who have won scholarships from their home countries (eg India, Iraq, Saudi Arabia). Since 2008 our doctoral graduates have been appointed to positions within leading industrial and academic institutions (eg Johns Hopkins, Harvard, Tsinghua, Peking Universities, QMUL, Eli Lilly, GSK, GW Pharmaceuticals, Pfizer, Syngenta).

d. Income, infrastructure and facilities

RSOP holds a strong position with respect to research income, infrastructure and facilities. In addition to our established research income portfolio, vitality and sustainability have been significantly enhanced via University funding for i) £17M Hopkins Biomedical Sciences Building (2009), ii) £4.5M Chemical Analysis Facility (CAF, 2010), iii) Research Centres (CINN and ICMR), iv) £300K Brain Embodiment Lab (BEL, 2013), v) Central facilities (eg BioResource Unit, £840K), vi) 12 new research active staff (including 3 AIPs).

Research income portfolio: since 2008, RSOP has extended its range of funding sources and won grant income to support research programmes within all disciplines. Significant sums have been won for doctoral and postdoctoral programmes in regenerative medicine **SF3,4** (>£3M BBSRC, MRC, EPSRC), and areas relating to mechanisms and treatments for serious neurological diseases **SF1,2** (>£2M; RCs, industry and charities). Our postgraduates are funded from various sources (see **Section b**) including through a BBSRC DTG awarded to RSOP (2009-2015). In addition to income listed in REF-4b we have won £270K from industry and charities, and have acted as co-Is in inter-disciplinary work that has attracted income of £630K. Funds from RCs to access National Central Facilities (eg ISIS Neutron Source, Diamond Light Source (Oxfordshire)) enhance our capabilities within **SF4** where we collaborate with researchers at the European Synchrotron Radiation Facility and the ILL. RSOP's pharmaceuticals facilities successfully enable cross-HEI and industrial collaboration, including partnerships with University of Surrey and Reading Scientific Services Limited (RSSL). The breadth of our funding portfolio allows us to respond rapidly to new research priorities and emerging areas whilst continuing to strengthen our existing research programmes.

Investments in infrastructure and facilities:

Infrastructure The new £17M Hopkins building provides state-of-the-art teaching and research facilities where staff benefit from working with colleagues from SBS who have expertise in endocrine, developmental, oncology and systems biology. It supports Cellular and Molecular Neuroscience research, and Cardiovascular and Vascular Biology, and this encourages inter-disciplinary collaborations across all our areas of strategic focus. It is exceptionally well equipped for a wide range of molecular and cellular techniques, with dedicated suites for microscopy, electrophysiology, stem cell culture, developmental biology and whole animal work. These facilities are also crucial to the success of the SMART and BEL initiatives by strengthening new and existing collaborations between RSOP, SBS, Chemistry, Systems Engineering (SSE) and CINN.

Facilities The new £4.5M Chemical Analysis Facility (CAF) in the Pharmacy and Chemistry building provides world-leading analytical facilities that underpin the majority of activities within **SF 2,3,4**. Proof of concept work is heavily subsidised by the University (annual budget £400K) which enables RSOP academics to employ advanced analytical techniques that facilitate our high impact science in, for example, organocatalysis and polymer-drug conjugate development. CAF facilities include state-of-the art NMR (eg 700MHz), mass spectrometry, UV/vis/IR spectrometry, thermal analysis and X-ray diffraction allowing us to characterise a wide range of systems, including molecules, molecular assemblies, framework structures and macromolecules.

The University's significant investments in CINN and ICMR also provide the necessary facilities to support our neuroscience and translational research strategies. Principally, the £300K investment in BEL's *in vitro* and *in vivo* electrophysiological, cell culture and microscopy facilities expand our capacity to create a dedicated and unique facility for long term studies of neuronal networks, including a groundbreaking functional human neuronal culture platform (via GSK Nutrition) and studies of novel anticonvulsant mechanisms of action (via UCB Pharma). BEL EEG and Brain Computer Interface facilities provide access to previously unavailable equipment, fostering new collaborations between RSOP, SSE and Psychology researchers in relation to **SF 1,2,3**. RSOP and the University have further invested in vital equipment to support CINN and ICMR research including *in vivo* imaging systems, calcium imaging and myography.

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In addition to in-house facilities, researchers benefit from University research platforms eg the Centre for Advanced Microscopy (CfAM; atomic force, infra-red, Raman and electron microscopes) and the CINN (fMRI, TMS and EEG). The BioResource Unit (BRU) that supports housing and breeding of a variety of animal species (including transgenics) has received investment of £840K from the University. The facilities allow whole animal surgical and behavioural research, crucial for RSOP's translational agenda. RSOP researchers maintain dedicated procedure rooms within BRU eg facilities for long and short term video monitoring for behavioural studies, *in vivo* electrophysiological recording facilities, surgical facilities (including CNS surgeries, anaesthesia etc), cognitive assessments and motor function testing. This infrastructure and the collaborative working practices support the activities of newly appointed RSOP academics and places RSOP in a pivotal position to facilitate the research of the new CINN-focussed AIPs in **SF 1,2,3**.

Investment in researchers: The UoR Research Endowment Trust (RET) provides central funds for equipment purchase and maintenance, conference attendance, PhD studentships, and internal research competitions (eg RET Best Output Prize in 2010 to **Cobb**). Bids from RSOP for funds for teaching buy-out (£100K) and start-up funds for AIPs (£65K) have also been successful. RSOP researchers also benefit from centralised support and a full time SCFP research officer for assistance with grant applications, and engagement with industry and the NHS. Our interdisciplinary research showcases are attended by the University's Research and Development Team to facilitate rapid follow up of ideas and, often, the allocation of internal funds. Centralised legal advice for contract construction, business development, IP issues and post-award support is also provided in addition to a highly successful Knowledge Transfer Partnership Centre to facilitate early engagement with industry. Staff are supported in the dissemination of research results through the University's open access repository (CentAUR), University funds for Open Access publication, and University Travel awards. Clear Quality Assurance in Research Policies (including Research Ethics and Code of Good Practice in Research) are complemented by individual support in the RSOP and SCFP when staff require ethical approval for their proposed research.

Research governance: This is structured through the Pro-Vice-Chancellor for Research and Innovation (PVCRI) with a Board for Research in the Sciences (attended by the HoS and SDoR) that reports to the University Board for Research and Innovation. RSOP maintains a Research committee chaired by the DoR which is attended by two representatives from each Research Group, the Director of Post-Graduate Studies, the HoD, the UoA lead and the Impact lead, and a PDRA from RSOP to ensure that planning and implementation of impact remains an integrated part of research activity. Pharmacy's DoR is also a member of the research committee within SCFP, and through this committee, examples of best practice and supportive guidance are regularly communicated. The research grant mentoring scheme is the responsibility of the Department's DoR and is supported by Heads of Divisions. The RSOP Research committee provides funds for pump priming research and conference attendance. The PVCRI manages the RET to provide pump priming funds and support studentships, infrastructure, and brief or extended research leave; RSOP is a regular beneficiary of such awards.

e. Collaboration or contribution to the discipline or research base

As outlined in **section b**, our research is closely aligned with the strategic priorities of national and international funding bodies. This has allowed us to demonstrate our international profile in each area of strategic focus through academic networks, and with clinicians and industrialists, to maximise end-user applications of our research. We have contributed to EU networks and programmes (eg Marie-Curie Initial Training Network of 16 PIs in 10 countries, **Osborn**, China-EU consortium, funded under FP7, **Williamson**, Leonardo da Vinci technician training programme, **Strohfeltd-Venables**, the European network on gasotransmitters, COST action BM1005, **Dallas**) and have led virology programmes focussing on neuroinfections through collaborations with the Institutes of Virology at both the Slovak and Russian Academies of Science (**Gritsun**). In addition to academic networks we have established national and international clinical links (eg with Prof Zieske, Harvard) and industrial links (Novozymes and StemCells Inc through a BRIC award) to better understand clinical needs in tissue engineering, cell based therapies and the supply of human tissue (**Connon**). We have collaborated with the most important research centres in patient safety through the National Evaluation of e-Prescribing, the PRACTICE study and the Pincer trial

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(**Howard**) and promote close working with the professional body and Government eg through a DH-funded and RPSGB-commissioned revalidation project on continuing professional development regulation of pharmacists (**Donyai**). RSOP is an important partner in national initiatives of importance to the NHS and DH eg the recently approved £5M Oxford Academic Health Science Network (OAHSN) whose aim is to improve patient care by linking healthcare with academia, research and business, and Academic Practice Units with regional hospitals. These provide opportunities for patient-focused research eg the psychology of medication discontinuation (**SF1,5**). Success in securing external and internal funding to support sabbatical visits to internationally leading laboratories has also resulted in the development of new research skills (eg RS funds for **Cobb** to visit the Gellman Lab, UW Madison, USA; School funds allowed **Cimarosti** to develop new skills related to **SF1,2** with Kageyama at The University of Kyoto, Japan).

Our researchers contribute to, and are recognised by, the broader discipline. For example awards have been made to **Alexander** (MBE for services to Pharmacy), **Cobb** (Thieme prize), **Howard** (Pfizer/UKCPA patient safety award), **Khutoryanskiy** (McBain Medal from the RSC and SCI) and **McNeish** (BPS Bill Bowman lectureship). **Cottrell, Dallas, Lewis** and **McNeish** have held Fellowships/pre-Fellowships with Parkinson's UK, BHF and Alzheimer's Research UK which continue to provide clinical links. Staff provide reports to government, the media and for legal proceedings, particularly in relation to herbal products. For example **Whalley** and **Williamson** advise the American Herbal Pharmacopeia and **Williamson** advises on government and regulatory matters relating to herbal and complementary medicines (BPC Expert Advisory Group, MHRA, International Foundation for Science). **Brooks** was Chairman of the South East Universities Consortium for Biopharma Skills, funded by ECIF. **Williamson** acted as a pharmaceutical consultant to the BBC TV series 'Grow Your Own Drugs' 2009 and 2010, and 'Victorian Pharmacy', 2011 and **Whalley, Williams** and **Williamson** have acted as expert witnesses in court proceedings, including on behalf of the MHRA. Our engagement with industry is equally strong, for example **Osborn, Whalley, Williamson** and **Williams** are consultants to SMEs and **Edwards** is Director of Capillary Film Diagnostics Ltd.

Staff are editors or on editorial advisory boards for high impact journals, eg *J. Pharm. Sci.* (**Khutoryanskiy** and **Williams**); *PLoS One* (**Lewis**), *Br. J. Pharmacol.* (**McNeish** and **Stephens**); *Int. J. Biochem. Cell Biol.* (**Osborn**); *BMC Neurosci.* (**Stephens**); *Front. Neural Circuits* (**Whalley**). Staff are members of peer review and scientific advisory committees, charity boards and learned committees. Examples include membership of committees for the EPSRC (**Greco, Khutoryanskiy** and **Williams**), the BBSRC, the Commonwealth Scholarships Commission, and Athena SWAN (**Osborn**), Ataxia UK (**Lewis**), the Academy of Pharmaceutical Science Board of Directors (**Greco**), the UK and Ireland Controlled Release Society (UKICRS) and Formulation Science and Technology Group (Royal Society of Chemistry) (**Khutoryanskiy**), the IUCr Commission on Powder Diffraction (**Shankland**) and the UK Physiological Society (**Stephens**). Our reputation in **SF1,2,3** is also recognised by **Whalley's** Local Group Representation for the British Neuroscience Association, Membership of the UK Epilepsy Research Network, appointment to the UKERN Interventions & Therapeutics Working Group. Pharmacist membership of the South Central Berkshire 'B' NHS Research Ethics Committee is also evident (**Donyai, Greco, Whalley**). Our staff undertake peer review for International journals, and for International and National research awarding bodies (including RCs, charities, the TSB and the EU) that span all areas of Pharmacy.

Our staff disseminate research through the organisation of international and national conferences, and invitations to deliver lectures. Examples include invited talks at the Joint American College of Clinical Pharmacy and European Society of Clinical Pharmacy Symposium in the US, and the International Pharmaceutical Federation Centennial Congress (**Howard**), Society for Neuroscience, Washington (**Lewis**), IUPHAR World Pharma 16th World Congress on Basic and Clinical Pharmacology, Denmark (**Williamson**). Staff are also invited members of organising committees, and Chairs of sessions, for International conferences that relate to our areas of strategic focus eg Pharm. Sci. Conferences 2011-13 (**Greco**), major bi-annual IBRO meeting 2011 (**Stephens**), 44th Erice Crystallography Conference NATO funded 2012 (**Shankland**) and Perspectives on Percutaneous Penetration Conferences, 2009-2010 and 2011-12 (**Williams**).