Institution: University of Portsmouth

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

a. Context

Researchers in this UoA are members of the Institute of Biomedical and Biomolecular Science (IBBS), a major interdisciplinary research centre. IBBS is committed to promoting innovation and translating world-leading, fundamental, bioscience research into economic and social benefits. Research and impact-related activities are aligned to four research groups: Biomaterials and Drug Delivery (BDD), Cell Biology and Pharmacology (CBP), Epigenetics and Developmental Biology (EDB), and Molecular Biophysics (MB).

The **types of impact** that research across this UoA has generated include:

- Development of new clinical interventions that offer improvements in health and quality of life (research groups BDD and EDB);
- Changes in prescribing guidelines and care practice as a result of new drug delivery systems, and improved understanding of drug interactions (CBP);
- Improvements in the performance of products used in healthcare and households, through innovations in biomaterials and polymer science (BDD);
- Development of new diagnostic tools and technologies that improve the accuracy and efficiency of bioanalysis and biodetection (MB and CBP);
- Enhancement of national and international capabilities in discovery and development, through hosting of resource banks (the European *Xenopus* Resource Centre, and the "Frozen Ark") and contributions to networked development platforms and facilities that serve public and private scientific communities (EDB);
- Enhanced public understanding and awareness of certain conditions, for example, cystic fibrosis, neurodegenerative diseases and brain tumours (CBP and EDB).

Through these impacts, **significant benefits have been delivered** to: patients and users of healthcare products; organisations responsible for the provision of healthcare; large multinational companies, particularly in the pharmaceutical, bioanalysis, biotechnology and specialist chemicals industries; small and medium-sized enterprises specialising in bioanalysis, drug discovery and biotechnology; third sector organisations; the general public.

b. Approach to impact

Our approach to impact begins through sustaining a strong research base, since the confidence for stakeholders to engage with us arises from our reputation for excellence in fundamental, cutting-edge research. By investing in people, equipment, projects and our environment, we have enhanced our research reputation, and laid the foundations for subsequent exploitation of results in the pharmaceutical, biotechnological and medical arenas.

Our principal avenues for generating impact from our research have been via interactions with key stakeholders as detailed below.

(1) Partnerships with bioanalysis, drug discovery and biotechnology companies. For example, (a) Our research spawned a successful spin-out company, *Spirogen*, and **new clinical interventions** for ovarian cancer and leukaemia (see ICS UOP03ANTICANCER); (b) our research funded by GSK, BBSRC and EPSRC led to an **improvement in performance** of oral healthcare products (see ICS UOP03DENTAL); (c) *Horiba Scientific* have invested in **a new technology** for the surface immobilisation of RNA for use in microarray analysis of gene expression (*Callaghan*); (d) research funded by *SC Johnson* led to the development of formulations that **improve the performance** of cleaning products (*Tsibouklis*); (e) a **new technology** for the structure determination of proteins by NMR has been licensed by *Agilent*, and adopted by *Pfizer* for the analysis of oestrogen-receptor targeted peptides (*Pickford*).

(2) Collaborations with medical professionals: For example, (a) links with Southampton General Hospital have resulted in a **new clinical intervention** (now in phase II trials) and **changes in local care practices** for patients with CF and COPD (see ICS UOP03HEPARIN); (b) we are **improving the outcomes for patients** by examining the roles of metabolic and

cardiovascular risk factors in diabetes mellitus through collaboration with Portsmouth Hospitals NHS Trust (www.porthosp.nhs.uk/Diabetes-and-Endocrinology/research.html) (*Laight*); (c) interactions with the Department of Gastroenterology at PHT has led to the adoption of a **new diagnostic tool**, i.e. the duration of oesophageal acetowhitening, for diagnosing high risk neoplasia in Barrett's oesophagus (*J. Brown*); (d) research on the chemical and physical compatibility of five drugs (morphine, clonidine, ketamine, midazolam and furosemide) is **informing prescribing guidelines** in an intensive care setting, referenced in the Medusa Injectable Medicines Guide used by NHS staff (*Van der Merwe*).

(3) Public engagement activities: For example, (a) enhanced **public understanding and awareness** of brain tumour and neurodegenerative disease research has been achieved by radio broadcasts, and through public engagement activities e.g. 'open lab' events and residential weekends for patients, relatives, carers, charity groups and the general public, alongside events as part of the European Month of the Brain (*Pilkington*, *Gorecki* and *Butt*); (b) our extensive research in neuro-oncology has provided the credibility to help **influence decision-makers,** resulting in the **rationalisation and reorganisation** of multiple, disparate brain tumour charities (*Pilkington*) that has produced (i) increases in overall funding and (ii) changed funding mechanisms from short term awards to sustainable core funding for Brain Tumour Research Centres.

During the REF assessment period, we have employed these **mechanisms to deliver impact:**

(1) Recruitment of staff with industrial and clinical contacts and translational expertise. The potential for generating impact continues to be one of our key selection criteria when recruiting new staff. For example, our recent appointees, *Kolstoe*, *Young* and *Lalatsa*, all have significant translational aspects to their research (molecular basis of amyloid disease, the pathophysiology of urinary tract disorders, and delivery of drugs across the brain barrier, respectively). Each brought **new industrial and clinical contacts** to IBBS, with which existing staff can now interact. By embedding translational expertise within IBBS, we are better equipped **to identify and exploit new impact opportunities**.

(2) Support and recognition for undertaking impact-related activity. Translational and other impact related activities are discussed and encouraged as part of our staff Performance and Development Review (PDR) process. Engagement in such activities is a consideration in applications for promotion. The recent promotions of *Callaghan* (Reader) and *Shute* (Professor) were, in part, recognition of their success in generating impact from their research. IBBS staff are encouraged to take full advantage of support available for translational research through the University's Research & Innovation Services (RIS).

(3) Internal financing and professional advice is provided for staff involved in: (a) **proof-of-concept studies**, e.g. financial support to *Callaghan* led to results that underpinned a successful BBSRC Follow-on Fund award, and subsequent filing of a patent "*Method of Immobilising RNA onto a Surface*" (WO2012/156718); (b) **market assessments**, e.g. HEIF funding has been utilised to assess the commercial viability of offering epigenetic and developmental biology services to SMEs, and also to develop commercial sales of antibodies to epigenetic histone modifications; (c) **networking, collaboration, and partnership building**, e.g. enabling IBBS's involvement in the South of England Brain Tumour Alliance (SEBTA); (d) **enterprise and media training**, e.g. coaching provided by *Inside Edge* enabled *McGeehan* to maximise press interest in the recent glycohydrolase enzyme structure; (e) **business engagement and commercialisation**, e.g. support from RIS enabled *Pickford* to provide NMR-based protein structure consultancy services to *Pfizer*; (f) UoP funded strategic **PhD studentships on translational projects**, e.g. to *Tsibouklis* and *Callaghan*.

c. Strategy and plans

We continue in our belief that innovative, far-reaching and profound impact can only arise from high-quality fundamental research. We also believe that strong and sustainable partnerships with key stakeholders are essential to maximize the delivery of potential benefits. We recognise, however, that applications of basic research into un-anticipated areas often arise serendipitously, and can take many decades before the impact is realised.

A good example of this is provided by the basic research of *Kneale* over 20 years into the structure

and function of a bacteriophage DNA binding protein (g5p) which, surprisingly, turns out to be highly specific for detection of the infective form of prions (e.g. in CJD), leading to a productive collaboration with Prof. Wen-quan Zou (National Prion Disease Pathology Surveillance Center, Cleveland, Ohio (USA)). Our most recent multidisciplinary study suggests a novel approach that could be used for treating prion diseases without inducing immune response side effects. (see *http://www.nature.com/srep/2013/131009/srep02911/full/srep02911.html*)

Our impact strategy seeks to maximise delivery of the potential benefits or our research to society and the economy, whilst maintaining our excellence in fundamental bioscience. We will achieve this by supplementing our existing pathways to impact with the following actions:

(1) Enhancing our existing research base and research networks, whilst at all times being open to and aware of unexpected applications of the basic research.
(2) Aligning our research with (inter)national priorities. In association with colleagues submitted under UoA2 and NHS partners, we have recently re-organised our research into four thematic streams: "Neuro-oncology and Cancer Biology", "Genomics and Molecular Medicine", "Allergy and Inflammation", and "Ageing and Lifelong Health". These themes overlay the research group structure within IBBS, and provide additional opportunities for both internal and external collaboration, and for the generation of impact in medical/clinical environments.
(3) Extending strategic partnerships with key stakeholders. We have appointed a Strategic Project Director with senior NHS management experience to lead the development of strategic partnerships with the Portsmouth Hospitals Trust and the newly formed Wessex Academic Health Service Network.
(4) Consolidating and building our relationships with commercial companies, and attracting funding for translational research and innovation.
(5) Exploiting the commercial potential of our world-class facilities and research expertise. We are undertaking a HEIF-funded market assessment of the need for out-sourced biophysical analysis amongst SMEs in the southern region. Commercial exploitation of our facilities and expertise will not only provide economic benefits to the SMEs, but also add to our portfolio of industrial contacts for future translational opportunities.
(6) Increasing our external funding for translational research. We will target funding sources that increase the volume and diversity of external income to support collaborative research, for example industrial CASE studentships, and BBSRC Follow-on Funding.
(7) Expanding our engagement with internal and external networks. We will capitalise on the existence of established networks such as the Peptide Research Network of Excellence (PeReNe), SEBTA, the University of Portsmouth Ageing Network (UPAN), and various Knowledge Transfer Networks to facilitate our interdisciplinary working, and broaden our reach to patient groups, bioscience and medical companies and the general public.
(8) Improving management and monitoring of impact. We will develop a framework for the capture, assessment and evidencing of research impact from across the UoA, and ensure that best practice is adopted across all groups. We will use the evidence to assess and refine the impact our work on an annual basis.
(9) Utilising available avenues to publicise our impact-generating activities. With the help of the Press Office, we will use traditional broadcast media, together with electronic communications and social media, to maximise the exposure of our research and its impact so as to reach the widest possible audience, e.g. the recent glycohydrolase enzyme structure from *McGeehan* was featured on Channel 4 News.
(10) Increasing opportunities for staff mobility, multidisciplinary activity and translational research exchanges with external stakeholders that maximise the impact of research within this UoA.

d. Relationship to case studies

Our Impact Case Studies *UOP03ANTICANCER* and *UOP03DENTAL* arose as a direct result of forging partnerships with drug discovery and biotechnology companies. *UOP03HEPARIN* came from direct collaboration with medical professionals at local hospitals, and the impact was further developed by the formation of a spin-out company to commercialise our novel research finding. These three case studies highlight some of the many impacts of our research on society, providing a range of examples to illustrate the success of our impact strategy and the mechanisms for achieving it.