Institution: University of Kent and University of Greenwich

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

a. Context

Medway School of Pharmacy (MSOP) was created in 2004 as a joint school of the Universities of Kent and Greenwich. The research of the school is governed primarily by the University of Kent. Research at the school has four broad audiences for impact. These are 1) the pharmaceutical industry, 2) local and national health care providers, including practising pharmacists, 3) higher education providers and 4) the general public. Our Biological Sciences (BS) and Chemistry and Drug Delivery (CDD) groups carry out research of direct relevance to the pharmaceutical industry and have collaborative research links with many companies including Pfizer, TEVA, Takeda, Biogen, Colorcon and Genta. This is central to part of the school's mission to *"provide enterprise and consultancy in support of industry".* Our practice based research in Clinical and Professional Practice (CPP) is of direct relevance to Health Service providers and the public and has direct collaborative research links with a number of health care providers including the Kent and Medway Primary Care Trusts cluster, South London HIEC and Lewisham and City & Hackney PCTs. Our philosophy is that all our research should have educational impact and impact for the general public through increased public understanding of what we do. Thus our research is consistent with the University of Kent's Research and Impact Strategy in prioritising research that *"strives to have a positive impact locally, nationally and internationally"*.

b. Approach to impact

MSOP was created in 2004 and our first research strategy was developed in 2008. Since, pharmacy is an area that lends itself to impact potential for its research, given the range of different audiences for whom the research may apply, impact has been embedded within the school ethos from our inception and strengthened with the introduction of our research strategy in 2008. In the broadest sense, our strategy for approaching impact is to encourage as much interaction and collaboration as possible with the pharmaceutical industry and/or with local and national health care providers.

Pharmaceutical Industry: We actively pursue research links with the pharmaceutical industry through engagement with training. For example, after winning a competitive selection process by Pfizer, in 2010-2011, MSOP led a partnership between Kent and Pfizer to accredit their in-house "training matrix" and develop it as a PGDip in Applied Drug Discovery for Pfizer staff. The over-riding principle of the course was application of good quality, quantitative basic science as applied to discovery of medicines. Consistent with the mission of the University of Kent, this helped to "support regional economic success" and "provide enterprise and consultancy in support of industry". Importantly, the partnership provided many opportunities for developing and extending research links between the University and Pfizer. **Mathie** was awarded a Royal Society Industry Fellowship, a BBSRC CASE studentship and a BBSRC Industrial Partnership award for work with Pfizer, supported by substantial additional funds and resources from Pfizer (>£80K). **Peppiatt-Wildman** & **Wildman**'s renal slice model has also received substantial support from Pfizer (>£500K, see REF3b **Urinary imaging**). We have expanded the programme to a MSc in Applied Drug Discovery in 2012-2013 as we seek to increase and further develop our links with industry.

In our interactions with the pharmaceutical industry, we benefit from strong links already developed between academic and industrial researchers through attendance and presentation of research at professional societies. Thus we support academic scientists, research assistants and PhD students to attend annual meetings of national societies such as the British Pharmacological Society and the Academy of Pharmaceutical Sciences and international societies such as Experimental Biology and the Society for Neuroscience. Links made at such meetings allow academic scientists to find out what research is being undertaken currently in industrial laboratories. In discussions with industrial scientists we encourage our staff to think about collaborations as mechanisms by which common research interests might be identified, rather than purely as a mechanism for generating resources. This approach has resulted in a number of novel collaborative engagements since 2008. Some of these have led to the direct generation of research income for the school from the industrial partner and so have generated impact. For example, **Nokhodchi'**s research on drug delivery has received substantial financial support (>£200K) from pharmaceutical companies such as TEVA. **Mathie**'s research on ion channels and their regulation has led to direct financial support (>£50K) from Galleon Pharmaceuticals and

Takeda to collaborate on projects identifying the therapeutic importance of these channels in COPD and CNS disorders respectively. **Gibbs** has received financial support from Alk-Abello to further his allergy related research into basophil function. Other interactions with industry have led to collaborative funding applications, allowing us to carry out research of both academic and applied interest. For example, **Wildman** and **Nokhodchi** have been awarded BBSRC and EPSRC Research Council CASE studentships with Discovery Biomed Inc and Colorcon, respectively, with both projects receiving additional support from the companies. Lavignac was awarded a PhD studentship supported by Kent Cancer Trust and Genta to develop novel polymeric nanocarriers. **Sumbayev, Gibbs, Gubala** and **Lall** are collaborating with the EC Joint Research Centre, Ispra, and several non-academic research institutes and SMEs in Europe to develop gold nanoparticle drug delivery methods for use in treating both inflammation and more advanced myeloid diseases such as leukaemia (see REF3b **Gold nanoparticles**). **Gubala** and **Edwards**, with collaborators in the UK and France are part of a "Peptide Research Network of Excellence" (PeReNE) between academia and industry. PeReNE has been awarded an EU grant from the Interreg-IVA program. Industrial partners include RootLines, MRC Technology and Nanomerics. All of these projects are based on original research outputs of significance from the School and have already generated impact through influence on the research directions and activities of the associated companies.

Health Service: The CPP Group's direct collaborations with Health Service Providers seek to influence optimal use of medicines and support improvements in public health. Although our research in these areas is at a much earlier stage of development than our pharmacology and pharmaceutics research, **Krska** (a strategic appointment in 2011) has a track record of delivering projects with clear evidence of impact on practice, which will influence the direction of the group. Development and evaluation of novel primary care services is a key area which attracts regular funding from local health organisations and has generated recent publications in cardiovascular screening, weight management services and pharmacy alcohol services. The group is also active in training and research in medication review, which has been strengthened by **Krska**'s international reputation in this area. Manfrin has secured funding from multiple Italian Pharmacy Organisations to research the development of Medicine Use Reviews in Italy. Gammie has funding from South London HIEC to research the consultation skills of pharmacists providing this and other patient-centred services. **Krska**'s collaborative work on patient reporting of adverse drug reactions to the MHRA has directly impacted on European legislation and WHO guidance and her work also influences reporting practice in Thailand. Extensive collaborations have been developed with NHS Hospital Trusts, primary care organisations and clinical commissioning groups in Kent and South London, providing excellent routes for impact to be realised.

Public Engagement: MSOP is committed to sharing its research with the public. Since our inception, MSOP has had a strategy to engage the local community through an active programme of school visits, presentations to local societies and a visible presence at outlets such as local shopping malls and community centres. The University of Kent's Public Engagement Strategy has established a network of champions throughout the University who embrace public engagement; ensure coordination of the delivery of clear and consistent messages; encourage staff to undertake public engagement projects to promote and disseminate our research regionally, nationally and internationally; and guarantee appropriate support (administrative and financial) for all approved public engagement activities.

Impact Support: Research impact development through links with the pharmaceutical industry, is supported by Kent's Innovation & Enterprise (KIE) department which provides professional support to develop business collaborations for the purpose of exploiting research outputs for commercialisation, consultancy and training. A dedicated business development team helps to develop public, private and third sector collaborations. The technology transfer function provides advice, guidance and funding to protect and exploit IP generated from research. For example, through the University, **Brown** formed Cangenix, a contract research company that offers crystallography and biophysics services to the pharmaceutical and biotech industry. This company was acquired by Argenta for £1.5 million in early 2013. Support is provided for identifying and gaining follow-on funding and support for leveraging external funding and co-funding, costing, negotiating and managing projects. MSOP has benefitted from a number of schemes run by the University of Kent to support this activity including "Time Out for Reach Out", "Innovation Fund", "Ideas Factory pump priming", a "Patent and Commercialisation Fund" as well as SME Innovation Vouchers. In summary, our research has impact at its heart and this is supplemented by a strong

public engagement remit.

c. Strategy and plans

The longer term goal of all of our research is to answer questions that might lead to significant impact on the pharmaceutical industry and/or in healthcare and this is reflected in our strategy and plans. So, for example, **Mathie**'s collaboration with Pfizer has the long term health goal of identifying novel targets and therapeutically useful agents for the treatment of neuropathic pain. Two pieces of research highlighted in REF3b (**Gold nanoparticles** and **Urinary imaging**) both have demonstrable and growing long term impact in health.

Industry Collaborations: To further maintain our existing partnerships with industry and develop new ones, we continue to cultivate training and teaching opportunities as a springboard for research collaboration. Our Applied Bioscience Technology Foundation degree (also offered as level 5 of the Higher Apprenticeship for Life Sciences) provides work-based solutions for workforce development and training. Geared to all organisations ranging from SMEs to global organisations (current participants are employed or sponsored by GSK, Takeda, Catalent, TEVA, Quintiles, Seralabs and Fujifilm) it allows us to create and improve links with Pharmaceutical companies and develop understanding of research needs and collaborations. It has already led directly to a research collaboration between the school and Takeda, as described above. In addition, academic staff from MSOP represent Kent as members of the Biopharma Skills Consortium (Kent, Reading, Surrey, Royal Vet College, Portsmouth, Brighton and the Open University) which aims to address the skills needs of the biotech and pharmaceutical sectors through collaboration with industry. The consortium has already obtained funding from the National HE STEM programme for research into "enhancing employability through improved understanding of the industrial/commercial environment". We strongly believe that it is only through engaging fully with the Pharmaceutical industry that we can develop research programmes that will have maximum impact.

Health Service Providers: A major impact goal of the school going forward is to develop our research links and the impact of this research with local and national health service providers. All academic research staff in the school are members of KentHealth – the University of Kent's "one stop shop " for health and social care expertise and whose partner organisations include the Kent, Surrey and Sussex Deanery, many local NHS trusts such as Kent and Medway Primary Care Trusts cluster & Medway NHS Foundation Trust and the Comprehensive Local Research Network. This network provides much impetus for future collaboration and has already helped to shape a number of research partnerships. For example, in addition to establishing links with industry (above), **Peppiatt-Wildman, Wildman** and **Loo** have developed appropriate clinical links with nephrologists (UCL Centre for Nephrology, Kent and Canterbury Hospital, Medway NHS Trust; see REF3b **Urinary imaging**) to ensure their basic research has maximal future translational reach. **Temperton** and **Scott** have established a Viral Pseudotype Unit to translate basic virus research into assays for the testing of vaccines, antivirals and therapeutic antibodies with potential impact for animal and public health laboratories. **Krska** and Cumming regularly meet with local chief pharmacists together with the Kent and Medway CLRN which supports the establishment of links with health care providers local to Kent, enabling the School to develop a portfolio of provider-led research. The CPP group also collaborate with staff in the Centre for Health and Social Studies, University of Greenwich School of Health and Social Care and the Kent Business School.

d. Relationship to case studies

The three chosen case studies arise directly from our strategies outlined above and reflect the initial successes of our research in generating impact in the pharmaceutical industry, clinical practice and in higher education. Thus **"Gold nanoparticles"** arose through initial interactions at a scientific workshop and has already influenced the research and development activity of SMEs and has therapeutic promise both in the development of a novel inert drug delivery platform and for direct effects of targeting inflammation using gold. **"Urinary imaging"** has received substantial industrial financial support, has influenced clinical diagnostic practice and has enormous potential for future treatment of renal failure and graft survival. Both of these projects have benefitted from direct financial support from MSOP to facilitate interactions. **"GRAC"** contributes to the development and maintenance of the intellectual infrastructure of the field of pharmacology and provides the general public with accurate information on the basic mechanisms underlying prescription drug action.