Institution: Liverpool John Moores University

Unit of Assessment: UoA3 - Allied Health Professions, Dentistry, Nursing and Pharmacy

a. Overview

This submission reflects the membership of the University's Institute for Health Research (IHR, launched in 2006) that aligns health research across LJMU. The majority of the 36 (34.5 FTE) staff returned are based in the School of Pharmacy and Biomolecular Sciences (PBS) and the School of Natural Sciences and Psychology (NSP) in the Faculty of Science, and the Centre for Public Health (CPH). Psychology research, within the IHR and submitted with UoA3 in RAE2008, is now returned to UoA4. Two broad research groups are identified: Laboratory-Based Health Sciences and Public Health & Health Promotion focussing on six research themes aligned to specific IHR priorities, namely: (a) Health Promotion, (b) Computational Chemistry, (c) Formulation and Drug Delivery, (d) Medicinal Chemistry and Natural Products Research, (e) Biomedical Sciences, and (f) Natural Sciences. There is a substantial crossover of researchers and research projects between these teams promoting multidisciplinary research.

The unit's strategy is integrated within the management of the individual Faculties and Schools and much of the research is driven by strategic developments in line with national and international policy and the development of links with other academic institutions, the NHS and industry. This structure enables staff to undertake innovative, flexible and quality driven research with an overriding focus to develop novel approaches and solutions for the healthcare industry and to improve public health.

b. Research strategy

Achievement of strategic aims 2008-2013

We have successfully delivered on the four main aims of the 2008-13 research strategy as identified in RAE2008 as follows:

1. We have improved both the number and quality of our research outputs. Since 2008, the staff submitted within this unit have published 643 peer reviewed journal articles including systematic reviews, editorials/letters, and conference abstracts; many in high impact journals (e.g., Lancet, British Medical Journal [BMJ], Nature Protocols, Proceeding of the National Academy of Sciences, Journal of Controlled Release, Chemical Communications and Journal of Medicinal Chemistry).
2. We have further developed our collaborations with national bodies such as Public Health England (PHE) and the National Institute for Health and Care Excellence (NICE); local government; NHS Provider Trusts (e.g. St Helens & Knowsley NHS Trust, Alder Hey Children's Hospital); former Primary Care Trusts across the North West of England; and national and international industrial partners (e.g. Astra Zeneca, Boots, GSK, L'Oreal, Manesty, Unilever, United Utilities, Rockwood Ltd and Wakunaga of America Co Ltd.).
3. We have awarded 33 PhD degrees and currently have 70 students registered for MPhil/PhD. International PhD recruitment is growing with 17 international students now registered for PhD.
4. Our external research income has grown to almost £25m (2008-13) compared with the £15.8m reported in RAE2008. Significant sources of funding include: the World Health Organization (WHO), European Commission (EC), National Institute of Health Research (NIHR), Technology Strategy Board (TSB), Department of Health (DH), Home Office (HO), Department of Environment, Food and Rural Affairs (DEFRA), NHS executive and UK Charities.

We have also successfully delivered on the specific key projects identified in RAE2008 as being of particular strategic importance to the IHR, namely: (a) influencing practice and policy at international level as a WHO Collaborating Centre for Violence Prevention; (b) successful completion of the LYOCARD EU FP6 project (2006-11); (c) development of interdisciplinary research projects via collaboration with the University's General Engineering Research Institute (submitted to UoA15); (d) completion of the MODRIC project with the Medicine for Children Research Network (MCRN) as part of the UK Clinical Research Network into the safety and effectiveness of medicines for children; and (e) delivery of key health promotion projects exploring, for example, injecting behaviours and behaviour change (in collaboration with PHE & Public Health Wales), and the value of media in the consumption of alcohol (funded by Joseph Rowntree Foundation [JRF] and NIHR).

Future Strategic Aims

Our strategy for the next five years is to build upon this approach to deliver high quality and innovative research in our particular areas of expertise and to further develop emerging areas of research. We have the following five strategic aims for 2014-2020:

1. Strengthen our approach towards the development, translation and impact of high quality inter-disciplinary research concepts, activities and outputs that reflect our expertise and interdisciplinary thinking. This will be achieved by growing the number of research staff and students; encouraging greater internal collaboration within research projects; and improving the quality of our outputs by targeting high impact journals.
2. Grow our external research funding by supporting staff to develop collaborative projects and focus on applying for funding from EU Horizon 2020, NIHR, WHO, DH, HO, TSB and RCUK.
3. Develop key partnerships with academic institutions worldwide, public bodies and industry via joint studentships, staff exchanges and involvement/leadership of collaborative projects.
4. Promote a thriving, inclusive research culture that supports the development of researchers at all stages of their career through greater investment, appropriate guidance and by celebrating and rewarding innovative and excellent research.
5. Enhance our external profile by engaging in a greater number of public engagement activities to achieve a broader reach for our research through our partnerships and activities.

The IHR has existed in its current form since 2006 and a forthcoming review of its structure and operations (2014) will ensure that it remains a key asset in the delivery of the above strategy.

Research Themes: rationale, activities and achievements.

A review of the research activities and working practices in PBS, NSP and CPH identified six major themes. Each is led by a senior academic responsible for establishing a research agenda and promoting collaborations within and across the unit to meet more complex research challenges and develop emerging, strategically important research areas. They foster an improved support network and share best practice, encourage senior colleagues to take the lead in developing research excellence and mentor of Early Career Researchers (ECR) including support and training for staff preparing for registration and submission of PhD by published work.

Health Promotion: Located within CPH, this research theme focuses on three main strands:

i. Alcohol: This team (Hardcastle, Hughes, Jones and Wood) investigate the consumption of alcohol in society and the impact of wide ranging interventions such as social marketing campaigns, (e.g. Local Alcohol Profiles for England and the Big Drink North West survey). Recent work examining levels of alcohol consumption, alcohol-related harm and the effectiveness of interventions to reduce such harms has contributed to guidance on the consumption of alcohol by children and young people. An example of current work includes: Two research projects for ARUK looking at 1) Understanding the alcohol harm paradox in order to focus the development of interventions and 2) Constructing alcohol identities. How young people navigate and make sense of online intoxicogenic marketing and culture (total income from ARUK £358K). The Steps Towards Alcohol Misuse Prevention Programme (STAMPP, NIHR, £1.3m) is led by LJMU with collaboration from Oxford Brookes, Queens University Belfast, University of Liverpool, and the Northern Ireland Clinical Research Support Centre. The research to investigate the effectiveness of a combined school curriculum and parental intervention to reduce the harms associated with young people's drinking is being undertaken in 96 post-primary schools in Northern Ireland and Scotland, and involves approximately 10,000 children, making it the UK's largest alcohol prevention trial.

ii. Violence: These researchers (Hughes, Jones, Quigg and Wood) provide knowledge, skills, resources and evidence to organisations to assess and address violence and have published a range of evidence reviews (subsequently incorporated into WHO European reports - http://www.preventviolence.info/resources.aspx) covering issues such as knife violence, elder maltreatment and violence against individuals with disabilities. CPH is continuing its international and national contributions to research on violence through a renewed status as a WHO Collaborating Centre for Violence Prevention with a four year work programme (2011-2015), which will include the production of evidence reviews. Additionally, CPH is evaluating the end of the gang and youth violence programme (2013-2014) and NHS data sharing on violence (2012-2015).

iii. Drugs: Forensic analyses and evidence reviews of drug use (Atkinson, Beynon, Brandt, Hay,

McVeigh and Sumnall) have contributed to international decision making on this global public health issue and to the development of the National Drug Strategy and NICE guidance. CPH also coordinates the UK arm of the European Early Warning System (EWS) on novel psychoactive drugs feeding into UK monitoring systems. Research on novel psychoactive drugs (see REF3) is a cross Faculty collaboration with Brandt (PBS). Future plans include working with Russia to establish modelling techniques for drug user populations and the development of increased international collaborations on drugs prevention, doping and performance enhancing drugs.

Computational Chemistry: This team (Cronin, Enoch, Madden and Leach) have benefited from the targeted investment in new posts by the University (Leach, 2012) and the recruitment of Enoch. Significant external funding (£1.5m) has been obtained through involvement in and leadership of several consortia funded by the EU, industry and DEFRA. Computational alternatives to animal testing were developed to support toxicity prediction and the group has contributed to internationally accepted guidance documents and has published of over 65 papers since 2008. In addition to four on-going EU projects; collaborations with the Organisation for Economic Co-operation and Development (OECD) will continue in 2014 with the OECD QSAR Toolbox Phase 3. The mid-term review of eTOX was well received in Brussels and a two year extension has been granted until 2016. In November 2013, Enoch was awarded the Lush prize for the development of computational methods for predicting skin and respiratory sensitisation in a regulatory environment and the University's Research and Innovation Services (RIS) will match this funding to enable a PhD studentship to be established. This match-funding scheme also supports a PhD studentship initiated by Leach in conjunction with Astra Zeneca. Enoch and Leach have also jointly been awarded an internal studentship to broaden the computational research portfolio.

Formulation and Drug Delivery: The overriding aim of this team (Davies, Giuntini, Hutcheon, Roberts, Saleem and Seton) is towards the successful delivery of therapeutics in a controlled and targeted manner. The NIHR funded collaboration with Alder Hey Children's Hospital to investigate the Manipulation of 'adult' dosage forms for accurate administration of doses to children resulted in the publication of the Manipulation Of Drugs Required in Children (MODRIC) guidelines, (http://www.alderhey.nhs.uk/departments/pharmacy/). The nanoformulation group have developed a respirable carrier system to deliver nanoparticles to the lung and in collaboration with Liverpool School of Tropical Medicine (LSTM) are currently applying this delivery system to the pulmonary delivery of vaccines and exploring the commercialisation of this technology with RIS. Giuntini, (ECR, 2013) has expertise that crosses the boundaries of drug design and formulation and this will enable the future development of new collaborative drug delivery projects. Other goals include strengthening external national and international collaborations, for example with LSTM, Assuit University, Egypt, and King Saud University, Saudi.

Medicinal Chemistry and Natural Products Research: Central to this theme is the prevention and cure of human ailments. Researchers (Brandt, Davies, Giuntini, Ismail, Leatherbarrow, Lowe, Powell, Rahman, Ritchie, Wainwright and Young) with expertise in the areas of medicinal chemistry, natural products, and nutraceutical research are now led by Sarker who was recently appointed as Director of PBS. Medicinal and natural products research focuses on drug discovery and design for example for anti-colon cancer, wound-healing, anti-MRSA, anti-malarial, photoantimicrobial and antioxidant applications. Toxicology researchers have developed a novel application of an *in vitro* assay to assess the antioxidant properties of phytochemicals and future research aims to identify suitable novel phytochemicals with anti-cancer properties. Nutraceutics research has led to a successful collaboration with Wakunaga of America Co. Ltd, (£90K 2008-2011) on aged garlic extracts and with Lycocard (EU FP6, €420K 2006-2011) determining the benefits of processed tomato products on cardiovascular health which led to TSB funding in conjunction with Boots (£250K) to develop a health supplement rich in lycopene. Collaborations with the UK Glycoarray consortium (2009-2011) led to further development of protein expression and array platforms for glycan interaction screening (EP/G037604/1).

Biomedical Sciences: This new research team is the amalgamation of several small groups of researchers with similar interests (Evans, Faulkes, Hobbs, Moore, Powell, Randle and Ross) to provide a critical mass for research development and support. In collaboration with Mast Diagnostics, PHE and the University of Liverpool, microbiology researchers have developed rapid nucleic acid tests that can be used as a point of care diagnostic tool for sexually transmitted

infections. Future goals are to develop nucleic acid testing to rapidly and cost-effectively develop tests for antibiotic resistant organisms. Biochemical research linking the deregulation of microRNA expression in psoriasis with the IL-22 pathway has led to collaboration with Liverpool and Broadgreen Hospital and the submission of a joint grant proposal (National Psoriasis Foundation, October 2013). Biochemistry researchers, in collaboration with Imperial College, contributed to the development of software for the analysis of heparan sulfate that (supported by funding from RIS) directly led to a subsequent collaboration (with Oxford University Clinical Research Unit, Vietnam and Massachusetts Institute of Technology, USA on heparan sulfate and dengue fever pathology.

Natural Sciences: Four recent appointments to NSP (Perez de Heredia, Post, Rae and Wilding) have research interests within the general areas of nutrition, genetics research, evolutionary biology and human infectious disease. The ECRs within this group have been provided with laboratory space in the new Max Perutz building and support from senior staff to help them establish programmes of research and collaborations with experienced researchers across the unit. Post is currently working on programmes run by the Ministries of Health of Uganda, Tanzania, Burkina Faso and Ghana under the sponsorship of the WHO and funded by the Wellcome Trust (co-investigator at Imperial College, £381K, 2009-13) and the Carter Center (2012-14, $16K) to improve disease control operations.

Planned Activities and Goals for Research 2014-2020

Generating and identifying new research ideas and opportunities is the key to the future strength of our research. The number of external partners/stakeholders we engage with will increase as we embrace a cyclical bench to bedside approach; whereby we not only provide solutions to improve health but also work with stakeholders to identify key strategic problems and develop appropriate research agendas. We will encourage and enable knowledge transfer between our six research themes via research meetings and workshops promoting further interdisciplinarity within the projects we undertake. Internal peer review will be used to increase the quality of our research papers enabling researchers to submit to higher quality journals. With support from RIS, researchers will consider the potential intellectual property and commercialisability of their findings at the project conception stage and engage with external stakeholders at the earliest opportunity to secure the maximum impact from their research and capitalise upon opportunities to create impact.

We will focus on improving submission and success rates for external, competitive funding bids by increasing awareness of, and responsiveness to, external initiatives, national and international priorities by increasing dissemination and support from within research teams; mentoring of ECRs; undertaking peer review of bids; sharing best practice and attending RIS grant bid clinics. Grant submissions and successes will be reviewed as part of the annual personal development and progress review (PDPR). We aim to utilise our network of industrial contacts and increase the focus on applied research to grow the number of collaborative bids with industry and health service providers. We will consolidate and advance our existing research base by expanding our collaboration with others (academia, external partnerships/organisations) to attract further research and development funding, thus securing the sustainability of high quality applied and fundamental health research. Staff within the unit have an extensive professional network encompassing academia, industry, the NHS and the public sector. Further opportunities for collaboration will be exploited by encouraging staff to cross traditional research boundaries and undertake multidisciplinary research fostering links with researchers within LJMU (for example with the Research Centre for Brain and Behaviour and the Research Institute for Sports and Exercise Science), with other Universities and Research Institutes and with international stakeholders and industries.

The recent review of our research themes and the forthcoming review of the IHR structure (2014) will further strengthen the research culture across the board but will be of particular benefit to postdoctoral researchers and ECRs where mentoring by an experienced academic will engage them in independent research at the earliest opportunity. We will continue to grow the number of PGR and postdoctoral researchers to further enhance the vitality of the UoA. A priority will be to increase the international profile of the unit as a whole and of individual members. This will be achieved by: (a) focusing on publishing research in high quality international journals; (b) presenting at appropriate international conferences; (c) supporting researcher exchanges and hosting research visitors; and (d) developing dual/joint PhD projects with international institutions.

c. People, including:

i. Staffing strategy and staff development

The UoA staffing strategy complies with the University Research and Scholarship Strategy (2012-17) including measures for encouraging, supporting and rewarding staff for excellent research. Its implementation is evidenced at both Faculty and School levels where there has been a strategic focus on the recruitment of staff specifically to expand and broaden existing research areas. In 2011 LJMU launched its strategic investment 'Inspire' Campaign to recruit outstanding academic researchers to the university and subsequently the selective recruitment of research active staff has been applied to all new positions within the unit. A strategic focus for recruitment within this unit is to further support excellent research; for example, recruiting Leach from Astra Zeneca with his industrial expertise and Hay from the University of Glasgow to develop work on modelling hidden populations, and to develop new areas of excellence, for example by recruiting Giuntini with expertise which crosses the disciplines of medicinal chemistry and nanoformulation. Staff changes since RAE 2008 include retirement (Ford, Rostron, Mottram, Billington) and career progression (Kryska, Bellis, Tocque, Cook, Morleo) yet our capacity for high quality research has been expanded by the recruitment of established senior academic researchers (Hay and Post) and ECRs to the unit (Atkinson, Giuntini, Hardcastle, Leach, McKay, Perez de Heredia, Rae, Randle and Wilding) in both identified pockets of excellence and to strengthen emerging areas. We have a number of honorary professors with St Helens and Knowsley Teaching Hospitals NHS Trust coverage (e.g**.,** Consultant Physician of Diabetic Medicine; Clinical Director/Consultant Plastic Surgeon; Deputy Director of nursing; and Consultant in Critical Care and Emergency Medicine); an Industrial Professor of Pharmacy, (Royal Liverpool Children's NHS Trust, Alder Hey); and Honorary members of staff currently include the; Director of Public Health Knowsley, Director of Public Health Shropshire) and Regional Director of the Health Protection Agency). These relationships promote knowledge transfer, encourage collaborations and facilitate the timely dissemination and application of our findings.

In order to achieve the strategic aims for 2014-2020, RIS, Faculty of Science, PBS and CPH provide a number of structures, initiatives and activities to support and develop staff and researchers. Institutional support for career development is informed by outcomes from the Careers in Research Online Survey (CROS) and underpinned by the EC HR Excellence in Research Award (2012) which acknowledges the institutional alignment with the European Charter for Researchers and Code of Conduct for their Recruitment. This also encompasses the QAA Code of Practice for Research Degree Programmes and the Concordat to Support the Career Development of Researchers. The University endorses and actively promotes the principles of the Concordat for Career Development of Researchers through the Concordat Task Group with oversight from the University's Research and Scholarship Committee. The University is also an active and committed member of the UK Vitae North West Hub, mapping its training provision against the Researcher Development Framework (RDF), supporting researchers to attend Vitae events and hosting Vitae workshops that are open to researchers from other institutions. The RDF and the Concordat principles are also at the heart of this units' strategic plan and all staff (ECR to senior academics) are encouraged to participate in training courses and workshops run by RIS. External staff development requirements (e.g. training, conferences, CPD) are coordinated by the individual Schools and are funded strategically from staff development budgets and research and enterprise accounts. The identification of research goals and the support required by individual staff is an important component of the PDPR process where staff can identify training opportunities to progress their research skills and identify barriers to the effective development of their research. Management then considers solutions and financial commitment on a case by case basis. The University operates a workload allocation model with a research allowance designed to facilitate research activity by providing relief from teaching based on quality and volume of output and income generation. New staff receive the full research allowance for the first three years of employment and ECRs also enjoy lighter teaching and administrative duties for the first two years.

The University organises annual on-line training events on equality and diversity for all staff in the unit. Academic appointments and promotions are routinely monitored and reported in terms of equality and diversity. Staff are managed in accordance with child-friendly HR policies with an emphasis on flexibility and support, particularly for those returning from a period of maternity leave. The University holds membership of the Athena Swan Charter and is working towards achieving

the Bronze award by April 2014 in accordance with its Equality Objectives and Action Plan 2012-2017.

New staff and ECR support and development: In addition to a formal LJMU induction process, a series of informal events is run by RIS to orientate new starters with procedural frameworks relating specifically to research (e.g. strategy, funding, and ethics) and to provide an opportunity to meet with existing research staff. Events targeted at ECRs include; coaching; sessions on 'being an effective researcher'; workshops on collaboration, creativity, writing skills and postgraduate supervision. RIS operates an ECR Fellowship fund to specifically foster collaborative research and mentoring with other leading academics at external institutions or research centres world-wide. Within the unit, ECRs are assigned mentors/buddies providing opportunities for integration within well-established research teams and participation in research supervision and joint funding applications. Where appropriate, new staff are provided with start-up funds to establish themselves within a laboratory and competitive bids for small items of equipment are announced when funds arise. The development of career pathways to build the capability of Research Assistants (pre- and post-doctoral) is considered essential. New staff are eligible to compete for Faculty and School funded PhD studentships that compliment research direction within groups and 17 studentships have been awarded to staff over this REF period with. A further eight have recently been awarded for 2013-14; two to newly appointed staff in PBS (Leach; Enoch and Guintini) and five to staff in CPH (covering substance use (4), and mixed martial arts) to increase capacity and develop future CPH researchers. The University runs a matched funded PhD student programme that is targeted at new staff and ECRs, to which Leach made a recent successful bid alongside an industrial partner, Astra Zeneca. Finally the University supports ECRs through the award of research and mobility allowances that provide periods of study cover, travel, subsistence and some consumable costs to develop national and international collaborative partnerships.

Established staff development: A range of research development and support mechanisms are in place to enable mid-career and experienced staff to develop as researchers. These include training programmes, internal and external career development opportunities and mentoring. RIS disseminate information about internal and external training opportunities in a dedicated electronic research bulletin. Two-day grant bid clinics for principal investigators with well-developed research proposals, targeting competitively awarded funding streams are held to provide in-depth peer review and contextualisation to enhance quality prior to submission. Grant Incubator workshops are also held for researchers seeking guidance on how to develop their research ideas into more formal proposals. Recently (2013) the University launched a staff sabbatical scheme to support high quality research activities and the development of strategic external collaborative links. The annual professorship and readership conferments as well as professorial pay enhancement scheme offer promotion opportunities and reward excellent research performance. Since 2008 several staff in the unit have been promoted in this manner (Professorial appointment: Hughes, Morecroft, Rahman, Sumnall and Wainwright, and readerships: Brandt, Hay, Hutcheon, Jones, Lowe, Madden and Seton).

ii. Research students

The core of our research activity is centralised around the recruitment and training of exceptional postgraduate students from around the world. Flexible modes of delivery attract a culturally-rich student population that includes both full and part-time candidates and a good mix of international (Egypt, United States, Saudi, Thailand, Libya, India) and home/EU students. Our training embodies traditional MPhil and PhD routes and PhD by published work for members of staff; and overtly demonstrates a commitment to nurturing and rewarding the aspirations of research students. We are currently expanding overseas recruitment by participating in dual channel exchanges, and establishing new PhD programmes with universities in Thailand, and Malaysia. Funding streams are diverse and range from external funding from grants (industry, charity, sport, government, and health service), overseas government grants and some self-funding.

Postgraduate research student induction is compulsory and is provided by the Graduate School, and Faculty Research Offices. A postgraduate admissions and progressions tutor (PGAPT) in each school liaises with the Faculty Research Office and Faculty Research Degrees Committee to oversee student application, enrolment, induction, registration and the various milestones. These groups also oversee overseas student attendance monitoring to comply with UKBA regulations for Tier 4 visas. An elected postgraduate representative sits on the Faculty Research Degree's

committee to provide two-way communication between the student body and School/University. Student representatives also chair research meetings and seminars. The University's Research Degree Regulations require that all supervisors complete the University's Research Supervisors workshop and all registered postgraduate research students and their Directors of Study complete annual progress reports that are collated at Faculty level and reported to the University Research Degrees Committee. Students who have excelled in their studies are sent a letter acknowledging this from the associate Dean. Institutional data from the Postgraduate Research Experience Survey is analysed at Faculty and School level.

Laboratory-based researchers have access to appropriate laboratory bench space, Faculty facilities and shared office space supported by computer laboratories within the Faculties and in Learning Resource Centres. Non-laboratory based students have their own office space. The Avril Roberts Learning Resource Centre provides hard and/or digital copies of key research resources.

All students are encouraged to engage in all educational, scholarly and social activities and, to facilitate a research ethos, students are encouraged to publish their research during the course of their studies rather than at the end and are required to present their work at internal and external events, usually at a national conference in their first year of study and an international conference by the time of completion. Our students have won several prizes over the REF period (e.g. First prize poster at the 6th Mid European Clay Conference [2012], The Aerosol Society – CN Davies Award [2012], Prize poster at Children's Nursing Research Unit Annual Conference [2013], and best presentation at the CALN Conference [2013]). They are encouraged to apply for travel grants to attend more conferences than their funding may provide for. Successful grants include: The Aerosol Society Travel Grant (2012), Amgen Travel Grant (2012) and AAPS Pharmaceuticals Global Health Focus Group Travelship Award (2013). RIS manages a conference travel fund specifically to enable eligible postgraduate research students to attend a conference (UK or overseas) and disseminate the findings of their research and our students have benefited from this. Our students join external bodies, we have student representatives on various Royal Pharmaceutical Society groups (Education expert Panel, Social Media expert Panel, RPS workforce working group) and the UK Clinical Pharmacy Association: Member of the Infection Management specialist interest group; and they represent us, for example, in the role of United Kingdom & Ireland Controlled Release Society (UKICRS) Postgraduate Student Representative and Ambassador for the British Pharmaceutical Students Association. Many PGRs participate in paid undergraduate demonstrating and benefit from mandatory training in teaching techniques (3i' training) provided by the University's Academic Enhancement Unit enabling them to become Associate Fellows of the Higher Education Academy, a qualification useful for a future academic career.

d. Income, infrastructure and facilities

Income: Research income of £25m has been generated over this REF period compared with £15.8m in RAE2008. We have been very successful in obtaining funding from UK central government bodies, local authorities, health and hospital authorities (£20m), EU government bodies (£1.9m) and industry (£0.7m). For example; the National Drug Treatment Monitoring System provided funding of £1.83m; eSBIRTes supported two projects on referral to treatment in emergency services (€542,433); the Drug Prevention and Intervention Programme (€926,904) supported three projects covering Internet Tools for Research in Europe on New Drugs (I-TREND); Promoting Excellence in Drug Prevention in the EU; and EU Standards in Drug Prevention (EU, €621,000) around young people and families Adolescents as Customers; and European Family Empowerment: Improving family skills to prevent alcohol and drug related problems; and five projects have been supported by over £1million of EU FP6 for computational alternatives to animal testing. Future research bids will focus on funds from public sources, National and Local Government grants, EU Horizon 2020, RCUK and via collaborations with industry.

Infrastructure: RIS, under the leadership of the PVC, is responsible for the management of infrastructure and LJMUs overarching research strategy providing leadership for staff and quality assurance support for research and PGR programmes. In addition to its code of practice, RIS operates formal protocols for research governance and the investigation of alleged misconduct in research. Core principles and expectation with regard to the curation of publically funded research data and outputs are explicit in LJMUs research data management policy. The organisation and management of this unit is overseen by the Faculty of Science Research Strategy Committee and

the CPH Management Team whose primary aims are related to the management and yearly review of research activity as well as 'upward and downward' communication of research-related information. All Faculties have an Associate Dean for Scholarship, Research and Knowledge Transfer and within PBS, NSP and CPH senior research managers provide leadership. The Institution's Digital Research Repository allows for deposit of outputs for Open Access (OA) and some funds are available to assist with meeting Gold OA requirements. Financial support is available for staff and PGRs to present their research findings at conferences. The Research in Focus e-letter is produced quarterly by CPH providing updates on research outputs and activity, as well as profiling members of research staff and students.

Facilities: The management, review and identification of infrastructure needs are the responsibility of the host Faculties, with oversight from RIS, in terms of allocation of research capital against institutional strategic priorities, (e.g. the refurbishment and equipping of the Max Perutz building described below). The unit has a wide variety of research facilities primarily spread over two sites with the laboratory-based sciences on one site and the public health facilities on another. Our research capability has been increased via the development of expansive new research facilities.
In CPH, RCIF infrastructure investment of £300K has been used to develop the Analytical Resource Centre (ARC), which means that we can offer the highest standards of information governance and have the capacity to deliver complex analyses of large and multiple datasets. The ARC is also used for training and education and as a small conference facility. Non-university based resources that we have access to or host within CPH include the North West Public Health Observatory (now Public Health England) and a number of associated monitoring and intelligence systems which together with systematic evidence reviews, provide us with a comprehensive library of public health data sources and a wealth of academic/scholarly evidence and materials.
A major development to support life sciences research was completed in the summer of 2013, the Max Perutz Building. This large 2,100m² building represents an institutional investment of £7.4m, with a further initial spend of £1.1m to equip the research laboratories and support facilities it contains. These purpose-built specialist units include molecular genetics laboratories, animal cell tissue culture suites and facilities to support stem cell research. The imaging unit is equipped for a wide range of microscopy and contains SEM, TEM and confocal microscopes. Also located in the building is a new life science support unit that houses rodent-breeding colonies and holding facilities for non-mammalian vertebrates. In PBS, fifteen chemical and pharmaceutical research laboratories house a range of equipment including analytical facilities (e.g. NMR, Mass spectrometry, XRD, HPLC, GC, and DSC) and formulation and tableting equipment. Access to shared facilities throughout the Faculty of Science is also available. Computational Chemistry research is based within a dedicated laboratory featuring work spaces for up to six researchers. Software for molecular modelling, the estimation of physicochemical properties, molecular orbital calculations and structural indices, and toxicity prediction and statistical software for QSAR and model development is available.

In terms of benefits 'in-kind', we enjoy good relations with local hospital laboratories and can often use their pathology laboratories for high throughput analyses of samples (a capacity that enhances our responsiveness). We are in receipt of equipment to a value of £145K including a Waters Quatrro Premier Triple Quadrupole LCMS, Thermo X Series II ICPMS, a UPLC from Alder hey, NHS Trust) to develop new methods of high speed insulin analysis and use of a CEM SP-D microwave digestion system from Astra Zeneca.

e. Collaboration or contribution to the discipline or research base

Staff within this unit collaborate; internally, across the University, nationally and around the globe with academic and industrial partners. Examples of important, long term partnerships pursuing world leading research with academic and industrial partners across Europe include; FP6 (ReProTect, CEASAR and OSIRIS, LYOCARD) and FP7 (IMI eTox, COSMOS and ERANID, Promoting Excellence in Drug Prevention in the EU) projects, and the WHO Violence Prevention Collaborating Centre. Individual staff and research groups produce shared outputs with scientists around the globe (over 75% of outputs submitted to REF2 have at least one external author) and collaborative research activity has occurred with colleagues in multiple European countries and globally, for example; Brazil, Canada, Egypt, Ghana, Kuwait, Malaysia, Saudi Arabia, South Africa, USA and Vietnam.
The external recognition of staff and their activity is apparent in various academic formats: a) peer-

review journal editorial and referee roles; b) requests for grant reviewing; c) invited conference presentations; d) participation in a wide range of committees, advisory boards and policy groups; and e) miscellaneous academic activity such as external engagement and PhD examinations. Markers of esteem and contribution to the field are high in both volume and quality.

a) Over this REF period staff have held positions as Editors (e.g. Drug Testing and Analysis; Phytochemical Analysis; Dyes and Pigments; Photochemical and Photobiological Sciences), Editorial Board Members (e.g. Journal of Addiction; Research and Therapy; Journal of Addictive Behaviours; Journal of Substance Use; The Science World Journal; Current Medicinal Chemistry; Expert Opinions in Drug Metabolism and Toxicology; Protein Engineering, Design and Selection; Journal of Photochemistry & Photobiology B; Drug Delivery Letters; Chromatographia; International Journal of Phytomedicine; Pharmaceutical Methods), and as Guest Editors (e.g. Advances in Pharmacological Sciences; Natural Product Communications; Crystal Growth and Design). All experienced staff make significant contributions to the peer review process for numerous journals in their respective fields.

b) The majority of staff also undertake grant reviewing in the UK (e.g. RCUK, NIHR Programme, TSB, NC3Rs, The Royal Society, Diabetes UK), and worldwide (e.g. French National Research PNRA; Biomedical Science and Engineering Council, Singapore; Czech Science Foundation; Health and Medical Research Fund, Hong Kong Government; UK India Education Research Institute; National Science Foundation, USA; ETH Zurich Research Commission, Switzerland; Fulbright, USA; Research Fund for Control of Infectious Diseases, China).

c) Across all research groups researchers are regularly invited to present keynote and invited lectures in the UK and across the globe. Most notably, staff in the Computational Chemistry group have given 50 such presentations. Other notable keynotes include: European Monitoring Centre for Drugs and Drug Addiction, Lisbon 2013; 12th Annual meeting of the Reitox Early-warning system network; Psychedelic Science in the 21st Century, California, 2010; RSC Glycomics conference, UK, 2008; PEER V: interventions in recreational settings. Portugal, 2013; Alcohol Policy Network Conference, Sweden, 2009; 12th Congress of the International Society for Ethnopharmacology, India, 2012. CPH hosted Safety 2010: the 10th World Conference on Injury Prevention and Safety Promotion, a major conference that brought together stakeholders in the prevention of unintentional injuries and violence from around the world, illustrating work from over 90 countries. They also hosted Harm Reduction 2010: Harm Reduction International's 21st International Conference, which brought together 1,100 delegates from 80 countries around the world, Since 1999, CPH have hosted and been integral in the organisation of the biennial Club Health Conference: International Conference on Nightlife, Substance Use and Related Health Issues. PBS co-organised CrystallisAbility; a Symposium organised by the EPSRC Directed Assembly grand challenge network (2013).

d) Staff serve on several scientific committees (e.g. President of the European Society for Prevention Research [Sumnall], Chair of the UKQSAR group [Leach], Secretary of British Association of Crystal Growth [Seton], Chair of RSC protein and peptide science group [Leatherbarrow], Member of the Executive Committee and honorary treasurer of the Phytochemical Society of Europe [Sarker]; Secretary of the European Society for Photobiology, [Guintini]) and provide professional support and participate in a wide range of national and international advisory and policy groups, for example; Member of the Violent and Unintentional Injuries Prevention Programme Board (Hughes), UK advisory council on the misuse of drugs (Sumnall), Expert advisor for research briefs on elder abuse and social norms (Hughes); Expert advisor to World Health Organization for Europe (Hughes), Independent Scientific Committee on Drugs (ISCD), Faculty of Public Health Drugs Policy. They are also invited to act as scientific advisors' for example; External expert scientific advisor to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), [Brandt]; and UK Scientific Expert to the European Monitoring Centre for Drugs and Drug Addiction and United Nations Office on Drugs (Hay). Invited external expert at SCCS Europe Assessment of Substances with Low Oral Bioavailability meeting, November 2012 and 2013 (Madden).

e) We have delivered technical workshops and training courses to industry (e.g. Medimmune, Novartis) and community pharmacists. Since 2008, we have run 21 outreach events for schools and support the annual Nuffield scheme enabling gifted and talented students to gain research experience in the laboratories.