

Institution: Plymouth University

Unit of Assessment 1 (Clinical Medicine)

a. Overview

The Peninsula Medical School (PMS, a partnership between the Universities of Plymouth and Exeter) was one of the most successful of the new medical schools in RAE 2008. This success was built on a vigorous and focussed research strategy. Over time, the two partner universities noted changes in the external Higher Education environment and different emphasis on aspects of vision and priorities between the two organisations. As a result in 2012, a joint decision was made to demerge the partnership to allow each University to take its own individual research approaches forward. Accordingly, each University has now developed its own Medical School and the present submission encompasses both phases of this development. It builds on the excellence of research undertaken by Plymouth University staff within PMS and emphasises the development of a renewed strategic vision and the impact of investment since 2012.

The research includes staff from the newly formed Peninsula Schools of Medicine and Dentistry (PSMD) and the School of Biomedical and Biological Sciences (SBSS). PSMD organisation is essentially new, having been created only since the June 2012 demerger. This has involved considerable investment by PU in new staff and infrastructure and the establishment of closer relationships with acute-providers - Plymouth Hospitals NHS Trust (PHNT), South Devon Healthcare NHS Foundation Trust (Torbay) and the Royal Cornwall Hospitals NHS Trust (Truro) - to establish a strong peninsula-wide medical facility. In 2008/9 the Plymouth PMS campus comprised just 8 Senior Research Staff/Investigators; it has grown to 15 (14.5 FTE) by 2013, including staff in a Faculty of Science Centre for Research in Translational Biology (CRTB). This new collective Unit has taken off rapidly with an increase in the volume and quality of both its publications and its research awards. In the current REF period staff have published in the highest ranked biomedical journals (Impact Factor>30): *Cell* (2 papers), *Nature* (3), *Nature Genetics* (12), *Science* (2), *New England Journal of Medicine* (2), and *The Lancet* (3), More than 50 papers have appeared in other high impact journals (Impact Factor>10<30): most notably *Blood* (3), *Gastroenterology* (8), *Gut* (23), *Nature Medicine* (1), *Lancet Neurology* (1), *Nature Neuroscience* (4), *PNAS* (4) and *Journal of Neuroscience* (2). Moreover, grant income earned by the Unit in the period 2008 - 2014 totalled over £7.5M (including £2M for the NIHR Peninsula Clinical Trials Unit (PenCTU) plus PenCLARHC and RDS funding. PSMD has gained 25+ peer-reviewed awards from the European Union, MRC, CRUK, and charity grants in the areas of neurobiology, personalised medicine and clinical trials. Novel 3D cell-neuron culture models, large translational platforms, unique trials, and objective function scoring systems have been developed.

Research is conducted on three principal sites: the PSMD site at Derriford, the adjacent NHS regional acute hospital, and the main PU campus at Drake Circus. The growing co-operation between biomedical scientists both within and without PSMD is a central feature of our strategy. This has been given momentum through the creation of an integrated Institute of Translational and Stratified Medicine (ITSMed) (Director: Hanemann), encompassing world class research strengths in basic, translational and clinical science. This provides a strong environment for effective collaboration and trans-disciplinary links between clinical and non-clinical scientists in an integrative 'bench to bedside' research strategy. ITSMed comprises three Research Clusters with combined facilities and resources that cluster researchers with recognised expertise to achieve critical mass in specific areas whilst also enabling constructive overlap.

Clinical Trials and Population Studies (CTPS). This growing NIHR-registered CTU, with a NIHR Research Design Service (RDS) designs, undertakes and analyses phase 0, 1, 2, 3 and 4 trials. It has a joint R&D strategy with PHNT with shared governance, oversight and delivery. Success is evidenced by its delivery of several large unique studies with community reach: CUPID (Cannabinoid Use in Progressive Inflammatory Brain Disease (n=1000)), SWIMS (South West Impact of Multiple Sclerosis (n=2000)) the EarlyBird cohort Study of 350 healthy children, large mantle cell lymphoma trials (n=450). It has recently taken on large gastrointestinal studies including the ChOPIN genomic study (5,000+ Barrett's Oesophagus patients). CTPS is also the ninth top patient recruiting centre nationally and highest south west recruiter.

Centre for Biostatistics, Bioinformatics and Biomarkers (CBBB). The Centre supports many genomic and biomarker studies that are correlated with key outcomes in medical management, most notably the NHS Fetal Anomaly Screening Programme Down's syndrome screening Quality

Assurance Support Service. Success in translating research into practice is evidenced by its impact on the Public Health National Screening Programme for fetal anomalies, statistical and bioinformatics support for the Fetal Medicine Foundation and numerous government and commercial screening agencies in Europe and worldwide.

Biomedical Research (proposed research centre, CBR). CBR exploits basic cellular and molecular biomedical science (using unique *in vitro* and *ex vivo* models) and translational neurology and gastroenterology to understand common disease mechanisms. CBR also houses the Peninsula Genomics Health Bio-Repository (PenGen), with some of the world's largest collections of disease-linked patient samples with longitudinal follow-up. It translates research into diagnostics, therapeutics, and bio-sensing technology in healthcare. Two CRTB-based staff in the School of Biological Sciences are returned in UoA1 because of their exceptionally close links with CBR. Jarvis is developing viral vectors as cancer vaccines, and Green is collaborating with Jankowski on common single nucleotide polymorphisms (SNPs) and copy number variation (CNVs) in disease.

b. Research strategy

Since the demerger an independent strategy has been developed, building on success to move PSMD forward and take up opportunities created by new investment, thinking, and collaboration within PU and with PHNT and other partners. A PU-wide PSMD Research Strategy Advisory Committee solicits views, concerns and ideas for strategic development from service users, including key partners in Psychology, Biological Sciences (Biomedicine) and the Faculty of Health, Education and Society. Views are taken from teams connected to NIHR infrastructure and with considerable experience with patients and carer involvement in research, including several patient support groups like FORT (Fighting Oesophageal Reflux Together). An Associate Dean for Research co-ordinates these activities, collating action points and emerging ideas for further committee discussion or implementation with the Dean's support. The strategy has been developed in line with the overarching University Research and Innovation Strategy 2020.

The PSMD strategy highlights three areas for development: first, locally focused research themes with several very high impact factor papers; second, closer links with biomedicine at PU to strengthen the basic science and translational science in each theme; and third, cross cutting interdisciplinary activity. Clinical research relevant to local priorities is expressed in three key themes: *Clinical Neurosciences* (Barros, Hanemann, Hobart, Luo, Parkinson, Tieu and Zajicek), *Genomics/Diagnostics* (Cramp, Green, Jankowski, Li, Playford and Wright), and an emerging focus on *Cancer* (Hanemann, Hu, Jankowski, Jarvis and Rule). In 2012, we began to form integrated translational (identifying molecule-target-population, in that order) and reverse-translational (population-targets-molecules/function) structures as a network of clinically facing medical research across the whole range of interventions, from compounds to complex interventions. A well-established Clinical Neurosciences group focuses its work on studies of neurodegenerative conditions. It utilises basic science in *in vitro* models to understand signalling and potential targets (it is one of only three centres worldwide to use novel primary human tumour models), novel statistical methods to understand key outcomes, and large trials to test the novel targets such as cannabinoids. We have also published two key trials with novel agents in large populations: Multiple Sclerosis (*Lancet Neurology*) and Mantle cell lymphoma (*NEJM*). The new group in Genomics/Diagnostics uses reverse translation from samples in large clinical trials like AspECT (a 2,513 patient aspirin chemoprevention randomised control trial, jointly run by PU and Oxford University) to answer complex genomics. Basic experiments using reverse translation have identified unique oesophageal stem cells from clinical trial samples and suppression of expression of key regulators of stem cell fate (i.e. P-cadherin *ex vivo* and *in vivo*) by methylation. This led to the world's first Genome Wide Assessment identification of genes implicated in Barrett's oesophagus with potential for stratification in endoscopic surveillance studies using clinical and genetic composites. In addition, we are using Bayesian statistics for risk-stratification in complex diseases in fetal medicine populations for prenatal screening.

A current priority is to further integrate biomedicine with PSMD thereby strengthening both translational/stratified medicine strategies. A longer-term goal is to extend cooperation with human sciences at PU to build a peninsula wide trans-disciplinary cooperation in such cross-cutting areas as cognition, prevention, and health technology. This has already begun, involving staff returned in other UoAs, and strengthens the basic science, translational science and clinically facing networks. Examples are Lasonder (Biomedicine), who is helping Hanemann with proteomic analysis of brain

tumours before and after therapy (*health technology*), Fejer (Biomedicine), who is collaborating with Cramp on Hepatitis C immunity (*prevention*), and Hyland (Psychology) who is helping Byng (primary care, PSMD) with psychological assessment of chronic neurological disease (*cognition*). The unit has experience of collaborating in multi- and/or interdisciplinary environments. For example, the Benign Barrett's and CAncer Systematic Review Taskforce (BoBCAT) and EAGLE Consortia, which have published in *Gastroenterology* and *Nature Genetics*, involved pathologists, physicians, surgeons, biologists, ethics experts, geneticists, bio-informaticians, bio-statisticians, epidemiologists, health services researchers, trialists, patients, web experts, and endoscopists, creating one of the world's largest integrated groups in gastroenterology.

Five strategic objectives have been identified and are being acted upon for capacity building in the planning period 2012-2020. 60 per cent of a £25m investment in PSMD is being spent on staff recruitment, 30 per cent on extending the Derriford campus, and 10 per cent on infrastructure and core equipment. The objectives and the activities and mechanisms for implementing the strategy are:

1. *Building research infrastructure and collaborative opportunities in translational science and clinical trials.* PenCTU will further deliver expertise in large or complex clinical studies using novel approaches, increasing the number of large randomised trials and population cohorts for prognostic and predictive sub studies. This strategy will deliver larger populations linked to large longitudinal databases. Blood, tissue, collections etc. allow the undertaking of large stratification/translational studies through testing and validating specific targets in *in vitro* functional assays leading to subsequent progression into phase 0-4 trials and epidemiological studies. PHNT already has a large governance structure for running clinical trials and a joint clinical R&D office was established in 2013 to increase capacity quickly. 13 neurology trials are currently running and recruiting successfully, with over 2000 patients (NIHR, MRC funded); 5 cancer trials are now recruiting (NIHR, CRUK funded). Gastrointestinal trials are AspECT, ChoPin and in set up an URSO bile salt chemoprevention trial in colitis (CAPP4). New capacity will allow even larger trials to double recruitment in the next 6 years e.g. the STROBE trial for the 'STRatification Of Barrett's oesophagus' improving the risk management of common complex diseases. Implementation involves expanding the CTU and the NIHR funded research design service (RDS), as well as diversifying expertise into other disciplines from neurology, cancer and GI to primary care and education as well. Translational activity, especially in holistic and other circulating and tissue predictive or prognostic biomarkers, is to be expanded. This will enhance capacity for the assessment of circulating DNA, Proteomics, Genomics and Next Generation Sequencing and build on the recent acquisition of a 40% stake in the Biovault facility. New recruits (Green, Jankowski) alongside further joint appointments will enhance integration in translational medicine with the four local NHS Trusts in a 'spoke and hub model'. Strategic alliances with major UK centres have been forged to enable gaps to be bridged (e.g. transcriptomics with Imperial). In addition the initiation of specialist clinics in GI endoscopy and Neurology are operated by both research and clinical staff.
2. *Developing novel methodologies to analyse large data sets and aid clinical decision making and management.* PU has strong computational expertise and is a recognised UK centre for developing systems to improve quality of care and access to research through utilising routinely collected NHS data (Wright, Ball, Li). Existing strengths in epidemiological studies of maternal and fetal medicine will be expanded to produce original research using novel Bayesian methods for detecting outcomes in clinical trials and new algorithms for risk assessment and stratified medicine. This work improves pregnancy outcomes nationally through targeted interventions and surveillance based on demographic characteristics, and on biophysical, biochemical, and ultrasound measurements. Our regional plans include an ambitious strategy for a region-wide 100,000 patient research sample collection system, Peninsula Genomics Health Alliance (PenGen), enabling greater access to both routinely collected data and sub-populations with particular conditions in order to maximise patient stratification in the post-genomic era. We provide supportive bio-statistical and bioinformatics service activity across PU and will further this through systematic reviews and complex meta-analyses. This objective will be achieved through building on current strengths and recruiting additional senior biostatisticians and bio-informaticians.
3. *Developing unique, functionally relevant and feasible targets for clinical trials.* Hypothesis-driven research in such areas as brain tumours (Hanemann), Parkinson's Disease (Tieu, Anichtchik), and the reverse-translation of identified targets will be developed through enhancing expertise in common disease mechanisms such as cell death (Luo) and epithelial cell differentiation (Hu,

Barros). In particular Axl tyrosine kinase receptor (in neurological cancer) is a potential new target primarily identified by PSMD (Amooun et al Oncogen 2013,) new drug available http://www.nature.com/nbt/journal/v31/n9/full/nbt0913-775a.html?WT.ec_id=NBT-201309. This will be achieved through further updating current facilities which include an imaging suite, micro-dissection, the integration of biomedicine with PSMD, acquisition of new genomic and post-genomic equipment and augmented expertise through key strategic alliances with larger pharmaceutical and academic partners.

4. *Supporting disciplines that are new to PU but have world class potential.* Key areas are studies of cancers such as the oesophagus and mantle cell lymphoma (Rule) and functional imaging for neurology. In the latter case we are investing £2m in MRI scanning and associated clinical research facilities for functional imaging, and in the former case we are creating a cancer centre with expertise in prevention.

5. *Capitalise on selected interdisciplinary research opportunities afforded by the wide range of health-related disciplines in human sciences at PU.* Key areas are health services research, dentistry, and psychology (UoAs 3, 22 and 25). We are creating a coordinating Human Science facility, covering several faculties, which is facilitating cross-theme group working, recruitment, and research strategy formation in 4 key areas; cognition, personalised medicine, new health technology and prevention. This network will also exploit strong links with the local Academic Health Science Network (AHSN), the newly refunded Collaboration for Leadership in Applied Health Research and Care (CLAHRC) and with the University's Institute of Health and Community. We are further developing mechanisms and practices for promoting research, and for sustaining and developing an active and vital research culture. Specifically, we have set up a central system for researcher mentoring. Moreover regional seminars and an annual integrated NHS/Academia Away Day consolidate PHNT and PSMD research activity. At the regional level, we run a monthly seminar programme of clinical and research meetings with 40-100+ attendees. Workshops are run in many aspects of research ranging from practical and technical aspects (e.g. statistics in medicine) to theoretical overviews of topics (e.g. cancer biology). An annual research day, with in-house presentations and poster sessions, continues within PSMD and its scope is being broadened to include other PU academics. In response to new NHS strategies in oesophageal cancer, Jankowski and colleagues have set up a bespoke web-based systematic evidence-based platform for large authoritative reviews to shape NHS policy. This has led to NICE accreditation of the Barrett's dysplasia and cancer taskforce (BADCAT) consensus statements for evidence-based guidelines on management of oesophageal adenocarcinoma and other even larger reviews are in progress. Wright has developed strong links with the application of biomarker technology, particularly in relation to quality assurance for the national prenatal screening programme.

c. People, including:

i. Staffing strategy and staff development

Our strategy is to ensure that the recruitment and promotion of staff is geared towards the pursuit of our research objectives, maximises opportunities for collaborative research, reflects individual career achievements, and meets all necessary equality and diversity obligations.

Staff retention and career development. Policies on staff retention and career development are geared to ensuring leadership succession and capacity building, along with individual recognition. This follows a sequential structure from early career support, through mid-career development, to leadership planning. We also aim to ensure that postgraduate students have opportunities at post-doctoral level to enter research careers. Training Fellowships (TF) have been introduced to develop careers for new researchers, with four currently in post (Ball, Newell, Bailey, Cano). The shortage of UK Medical Statisticians led us to develop specific initiatives to encourage students to pursue this career, including a hugely popular Summer Internship Scheme training Fellows in Medical Statistics. Fellows advise PHNT clinicians in weekly Stats Clinics that have often led to grant applications involving TFs. Early Career Researchers (ECR) are supported by experienced research mentors who operate in relation to the Concordat to Support the Career Development of Researchers, which is embedded in University HR policies and for which PU received the EU HR Excellence in Research Award. ECRs are represented on the School Research Committees and Research Centre Management groups, and on the University Research and Innovation Committee. This involvement is in tandem with a University Researcher Forum that provides additional levels of cross-faculty networking. The Clusters support all researchers through participation in symposia/meetings and local mentoring schemes and by involving ECRs in internal

peer review processes for grant applications, paper writing, and presentations. PU-wide workshops and seminars provide guidance on research governance, ethics and Good Clinical Practice. Mid-Career Researchers and ECRs are supported by dedicated advisers in the Research Gateway who provide help with identifying sources of funding, bid writing, and grant costing. Experienced researchers are encouraged to maintain and develop their research activity through national and international visits, provision of leave of absence for attendance at research, interest-group and grant-provider meetings. Staff with five years' continuous service are eligible to apply to a sabbatical scheme that allows individuals to devote themselves exclusively to research for 6 months in order to achieve defined outputs. All academic staff, including research assistants and postdoctoral researchers, are supported and guided in their career development and towards promotion through the Performance Development Review process, where training needs are identified and supported. Promotion routes recognise and actively support varying staff skills, allowing them to concentrate on research, education, training, and management. Promotion of senior staff to personal chairs is based on the achievement of substantial merit, with five having been awarded for research (three in Neurosciences, one each in GI and Cancer). Promotion is also used to encourage the natural evolution of roles through collaborative cross-theme working, such as Hobart's work on MS in collaboration with PHNT and PU School of Health Professions.

Investment, Leadership and Succession. Critical mass has been created during the assessment period in each of the strategic areas: Hobart and Parkinson were awarded personal chairs in clinical neuroscience and Jankowski was appointed as Sir James Black Professor of Medicine in genomics/diagnostics. Playford and Cramp hold chairs in gastroenterology/genomics, and Rule has received a personal chair in cancer. Further investment in neurosciences and cancer led in 2013 to the appointments of Barros, Hu, Luo, and Tieu. To facilitate closer working and enhance opportunities for inter-disciplinary research, joint appointments have also been made between medicine and biomedicine, including Avent and Jackson in 2010 and more recently Green and Jarvis. Senior researchers are expected to undertake key research leadership roles as Research Centre leads, Institute Director, and Associate Dean for Research. These also sit on the Research Strategy Advisory Committee, which oversees a PSMD-wide mentoring and career planning service to allow proactive career planning and training. Hanemann oversees the Research Output Monitoring and Mentoring (ROMM) process for ITSMed staff. We take a forward-looking approach to succession planning to the internal development of our own staff and are currently seeking additional expertise in biostatistics, bioinformatics, genomics and clinical trial chief investigators to ensure continuity in these key areas.

Honorary appointments. The Medical School has offered a range of academic titles, granted according to the same criteria as university academic appointments, to acknowledge and encourage contributions to its research profile by individuals who do not have substantive contracts. Current examples within this unit include Woolf (Honorary Professor) and Hilton (Honorary Reader). To increase capacity and expertise as the new School develops, new appointments are in progress for Tucker, Professor in Ethics and Translational Medicine at Barts and London, and Bennett, an expert in Systematic Reviews. Support for 16 medical trainees on the NIHR Academic Clinical Fellows and Lecturers programme continues in PSMD.

Equality and Diversity. The pattern of staff appointments is monitored for consideration at School level through an Equality and Diversity Committee. This has highlighted that current senior academics are all male. It is noted that this will change as newly appointed investigators have a better gender balance (one notable recruit is Associate Professor Elaine Green) and women will enter leadership positions in the coming five years. PU has actively engaged with the Athena SWAN process and the new School is currently applying for a Silver award.

ii. Research students

Postgraduate research studentships (PhDs and MDs) are offered in all aspects of translational and biomedicine. Completions by students supervised by unit staff have been increasing from 2008/9 onwards, with more than two thirds of PGR students (26) finishing within 4 years. Recruitment has increased substantially in the last year with 42 PGR students now being registered in PSMD. It is planned to increase this further through a Doctoral Training Partnership and PSMD/SBBS PhD studentships. The quality of the postgraduate student experience is assured by the PhD supervision system. A Director of Studies, usually with two other supervisors and support from the School's Postgraduate Tutor, are responsible for each student. Generic research-skills training is provided through the PU Graduate School and subject-specific training is provided within PSMD

Environment template (REF5)

and SBBS for core technical or academic expertise. Transfer from MPhil to PhD and performance against key targets are recorded in a student-maintained PhD logbook monitored by the Schools' Research Degrees Committee. PSMD actively supports its research students by providing funds for conference travel, including them in research group activities, and encouraging and supporting applications for additional research funding. Each student is provided with the specific laboratory and office facilities needed for their work so that students feel fully embedded within the School's research culture. All students and supervisors attend a School-funded annual conference designed to showcase postgraduate research across the breadth of the unit: the postgraduate community collectively appoint an organising committee, select a keynote speaker and arrange the event, including both oral presentations and posters. Taught programmes serve as a stepping stone to higher level research and feed into our PGR community including Research MScs. This covers a broad range of research skills including experimental design, advanced statistical techniques, programming, and communication skills, writing and scientific debate.

d. Income, infrastructure and facilities

We have £1m/year for recurrent funding to support our successful AHSN, PenCLARHC, PenCTU and RDS services. To facilitate smooth interaction of these resources and others a Research and Innovation Business Partner works closely with senior research teams, providing access to a PU Research Support and Development Team that provides advice and support on: funding opportunities including liaising with funding bodies; drafting and presenting funding applications; obtaining the necessary internal approval for funding applications; reviewing terms and conditions of grants. All grant applications are peer reviewed by a senior academic and approved at PUPSM level to ensure compliance with demand management principles. Research clinics attended by 4-6 senior staff are offered for chief investigators of large grant submissions or when requested by investigators. A dedicated clinical library, with advanced IT facilities, enables ultra-fast access to research information. Centrally provided staff development programmes are accessed to develop individual research skills and local workshops are run to share such skills across the group. Specialist advice on project development and financial matters is utilised by staff. At Derriford, staff also have access to a purpose-built, telematically linked lecture theatre for research seminars and talks. This has facilitated the establishment of an ITSMed programme of weekly lab seminars and external speakers. In addition we organise workshops in key areas of trans-disciplinary research, utilising the teaching space and IT suites available. Dedicated budgets support research activity and infrastructure building through provision for conference travel, small equipment purchases, and consumables - through personal development accounts for senior staff.

PU hosts the largest collections of several unique disease cohorts in the world, including oesophageal diseases, mantle lymphoma, and placenta with clinic-pathological follow up. To support our diagnostics/biomarkers and cancer research, we have increased dedicated freezer space for sample storage with 'fail safe' automatic back up and emergency call out, and with reserve freezers in case of breakdown. The core facilities are an excellent and efficient lab environment with automated DNA extraction and state-of-the-art biorepository with databasing and bioinformatics in collaboration with our commercial partner Biovault. An animal house at Drake Circus allows the use of genetically modified mouse models of Parkinson's disease. A programme for the extension of laboratory space is already underway and planned new office space provision for PSMD is in excess of 300m², with an additional 700m² in new laboratory facilities.

PU, with its principal hospital and commercial partners including Quintiles, has since 2008 built up excellent NHS/academic collaborations in translational and clinical medical research. This has contributed significantly to local NHS research-related infrastructure such as the Peninsula AHSN, Comprehensive Local Research Network (CLRN), CLAHRC and the continued registration of the PenCTU. Furthermore, we have exploited highly productive relationships between PU, the NHS and local biotech companies. Biovault - a licenced fully accredited biobank owned 50% by PU - is at the forefront of human tissue storage and processing with multiple national collections, especially stem cells from umbilical cord, peripheral blood and bone marrow, and now extending to many types of tissues for human application or transplant. This company is working with us to house large collections for other UK organisations including the MRC.

The stable 2.2m population of Cornwall, Devon and Somerset is ideal for both population studies and genomics due to its relative homogeneity. This is already being exploited by the AHSN. In terms of access to clinical facilities, PHNT has the largest acute hospital in the south west (900 beds) but there are also strong links with Truro (657 beds) and Torbay (508 beds). PU is

one of only two areas covering all seven topic-specific clinical research networks. In conclusion, we have had a major strategic realignment since June 2012 refocusing on three themes in order of size and output; **clinical neurosciences, genomics/diagnostics and cancer**. Furthermore, we have three clusters where basic science, bioinformatics/biostatistics and clinical facing science are concentrated in ITSMed. We have also co-operated with centres of excellence in PU (Psychology) as well as forming regional partnerships in the CLAHRC, AHSN and CLRN. There has been significant investment in 3/4* rated staff, state-of-the-art buildings and core equipment to catalyse this dramatic evolution.

e. Collaboration and contribution to the discipline or research base

1. Regional Collaboration/integration with NHS, Industry, Public sector, charities

Locally, collaboration and innovation is important for PSMD in seeking to further its strategy through partnership working. Key roles include Zajicek and Jankowski on the PenCLAHRC Executive Group from 2008-2013 and Playford as a Board Member for the South West AHSN. Zajicek and Woolf are managers in the PenCLRN, where Cramp holds a speciality group lead.

2. National long term contributions: Panel Chairmanships

Jankowski is chair of the NICE Acute and Chronic Diseases Panel, Gastroenterology Advisory Group and NIHR CRN cancer prevention group. Zajicek is chair of the NIHR Nervous System Disorders Speciality Group and a Board Member of the MRC Neuroscience and Mental Health Board. Jankowski is Chair of the ChOPIN/EAGLE world consortia of genomics.

3. International collaborative research, including joint research and international meetings.

There are over 70 different collaborations and exchanges between PSMD and other institutions, 30% of them with the USA. The three main collaborations are maintained by Jarvis with 6 US centres on Vaccine systems, Jankowski with more than 100 centres worldwide on genomics, and Wright with fetal medicine specialists in Denmark. Jankowski is a member of the international Cancer Prevention Network Scientific Advisory Committee as well as the founding trustee of the Fight Oesophageal Reflux Together (FORT) charity. Wright has contributed to many World Congresses of the Fetal Medicine Foundation; Jankowski is joint organiser for national and international meetings of the American Association for Cancer Research, British Society of Gastroenterology, International Society of GI Oncology and International Society of Diseases of the Oesophagus; Parkinson organised a scientific session at an International Society of Neurochemistry meeting; Jarvis organised an International AIDS Vaccine Initiative; and Tieu was Chair of international meetings on Environmental Chemicals and the Parkinson's Disease Phenotype (Int. Neurotoxicology Conf. NY) and Nanosymposium 224 (Soc. for Neuroscience. CA).

4. Contributions to the Research Base.

10 staff hold positions in **Editorial Boards** of international journals, including Jankowski in the *American Journal Gastroenterology* (Associate Editor), *GUT* and *GI Science* (Editor), Playford Associate Editor *Gut* and Jarvis in the *Journal of Virology Vaccine*. 4 staff sit on **Grant Panels**: Jankowski on the National Grant Panel Ireland, Rule in the Leukaemia and Lymphoma Research Fund and the Cancer Research UK Clinical Trials Awards and Advisory Committee, Zajicek in the MRC and Hanemann in the **Deutsche Forschungsgemeinschaft**.

Visiting Professorships are held by Jankowski at deMontfort University, Queen Mary University London and University of Malta. Playford is emeritus Professor at Queen Mary, University London. More than 50 **Fellowships and Awards** include Jankowski as Sir James Black Fellow University of Oxford 2008-2012 and Fellow of American Gastroenterology Association since 2012, Jarvis as holder of Marie Curie Career Integration Grant 2013-17, Rule as Honorary Fellow of Royal College of Pathologists, and Parkinson as Fellow of the Higher Education Academy.

Invited Lectures; over 500+ national/international invited lectures. Highlights are Tieu to Experimental Biology Association, US 2013, Jarvis to European Societies for Immunology and Allergy, Croatia 2011 & 2012, Parkinson to International Society for Neurochemistry, US 2012, and Jankowski as Keynote Speaker, American Society of Clinical Oncology 2010 & 2012.

PhD students and Post-docs destinations: Several PhD students have entered industry (e.g. C Flaiz to Teva Pharmaceuticals), some entered academia (e.g., A Nicholson at Cambridge and A Domingues at Max Planck Institute), and several entered medicine programmes (e.g., E Oh at Case Western Reserve, P Rappold at Rochester University, USA). Similarly, some Post Docs have entered industry (e.g., B Baxter at Olympus Microscopes UK), some stayed in academia (e.g., B Sutcliffe at Cambridge), and several became Assistant professors (M Cui at, Huashan Hospital, Shanghai, China and S Li at Yonsei University, South Korea).