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| **Institution:** Swansea University |
| **Unit of Assessment:** 3a – Allied Health Professions, Dentistry, Nursing and Pharmacy |
| **a. Overview** |

Swansea University's College of Medicine (CoM) trains tomorrow's doctors and life scientists in a supportive research environment offering an interdisciplinary approach to translational medicine, from basic laboratory science to health care delivery, and an innovative approach to building the knowledge economy.

The CoM was formed in 2004 as a strategic initiative of the Welsh Government and Swansea University, building on the Clinical School established in 2001. UKCRC data shows Swansea is the fastest growing UK medical school. Research contracts in the 5 year REF period total £40.8m, more than double the total in the 7-year RAE period. Teaching and learning are tightly integrated, with the graduate entry medicine course receiving GMC approval for its final year in 2013.

Within the College, **research efforts** are housed in the **Institute of Life Science** (**ILS**). Over £100 million has been invested in the ILS research infrastructure through the European Funding Office in two phases: ILS1 (£52 million), completed in July 2008; and ILS2 (£50.8 million, with the Centre for NanoHealth), delivered in 2012. Together these provide over 12,000m$^2$ of interdisciplinary research facilities to support our flagships: the **EPSRC National Mass Spectrometry Facility**; the **Centre for NanoHealth** (in partnership with the Colleges of Engineering and Science); and a **UK Centre of Excellence in eHealth and Informatics** (CIPHER), which is one of four major centres that comprise the new **UK Farr Institute for Health Informatics**, recently awarded > £9 million through an MRC-led funding consortium. Pioneering work on informatics has been further recognised by a new award of £8 million to host the Centre for Administrative Data Research and Evaluation (CADRE), part of the **ESRC Big Data Network** (again one of only 4 major UK centres).

Research across the ILS is driven by four core strategic research themes that are central to translational medicine. These form our major research groups in: 1) **Biomarkers and Genes**; 2) **Devices**; 3) **Microbes and Immunity**; and 4) **Patient & Population Health and Informatics**. Researchers belong to a specific theme group, but are encouraged to be active *across themes*, and can achieve this by accessing our six core ILS major infrastructure facilities: **CIPHER** and **The Farr Institute** (ehealth and informatics), **Mass Spectrometry**, **The Centre for NanoHealth**, **Biomedical Laboratories**, **Joint Clinical Research Facilities** (trials, imaging and patient research), and **Commercial Incubators**. Research within the groups has a clinical and biomedical focus on arthritis, cancer, diabetes, epilepsy, injury, mental health, emergency care, bioinformatics, cell biology, immunity and allergy, mass spectrometry, medical physics, microbiology, infection, molecular neurosciences, and physiological sciences.

Our interaction with both clinical and commercial innovation begins on-site. The ILS opens directly onto one of the two major hospitals in Swansea, helping us to maintain very strong links with the NHS. Crucially, both ILS buildings have 25% priority incubation space for product and technology development. Hence clinical and commercial enterprises are all located within the heart of ILS, which continues to mature and build on its early success.

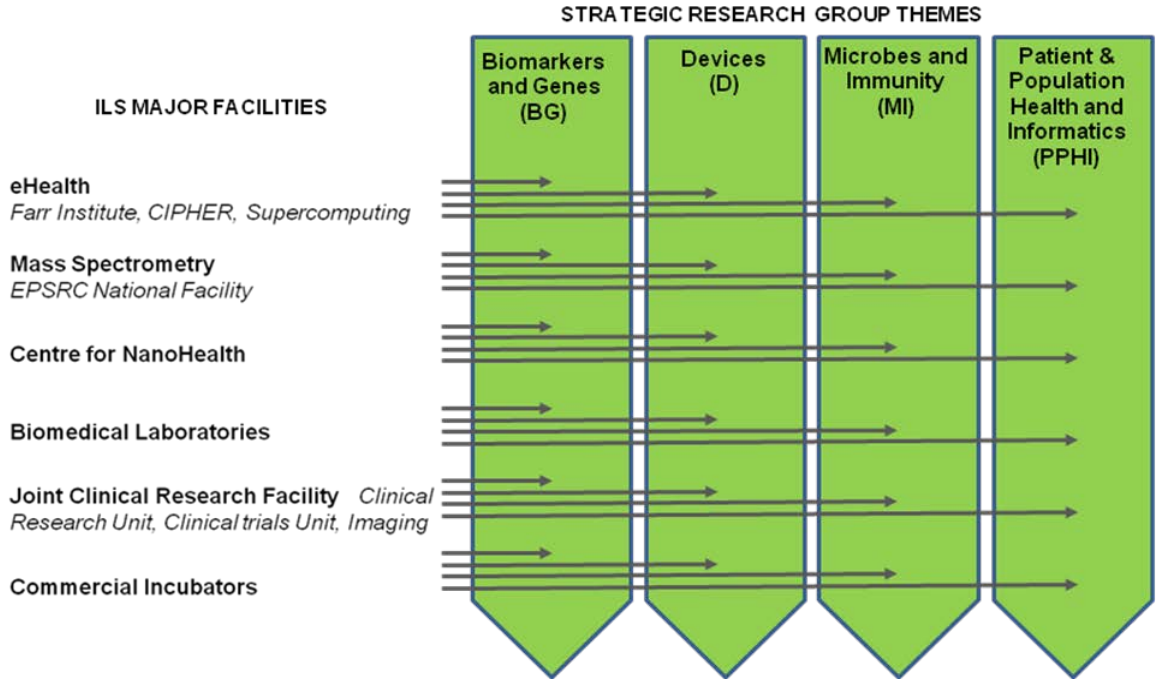
## b. Research strategy

Swansea University aspires to be a UK top 30 and a world top 200 university by 2017, working with industry and practitioners to broaden its impact. The College of Medicine has embraced these aims with a vision to be a highly interdisciplinary, research-led, internationally focussed centre of excellence that enhances, supports and sustains medical and allied health science research of the highest calibre. To achieve this, a College Executive was established to develop and deliver the ambitions set out in the College's research strategy. The team includes senior academics with responsibility for Research, Internationalisation, Commercialisation, and Research-led teaching. Science strategy is advised by an External Board: Dame Jean Thomas, Royal Society Vice-President (Cambridge), Professor Peter Dobson (Oxford), Professor Terry Fossum (Texas A&M).

The College's research strategy since 2008 has been based on an ambitious plan of growth implemented through continuous investment in research facilities and staff. The strategy aims to: (a) maximize impact by focussing on research at the intersections of the research centres and

themes; (b) develop staff and particularly Early Career Researchers to enable them to excel in their research areas; (c) secure research income from a diverse range of private, public and third-sector sponsors; (d) establish research collaborations with world-leading institutions, and (e) nurture a successful postgraduate research community.

During the RAE period, research was delivered by a diverse number of research teams and groups. Recognising the opportunity to implement a more focussed approach, the Research Committee and Head of College approved the **consolidation of ILS's early successes in its strongest areas**, with the strategy yielding targeted focus on 1) **Biomarkers and Genes** (**BG**); 2) **Devices** (**D**); 3) **Microbes and Immunity** (**MI**); 4) **Patient & Population Health and Informatics** (**PPHI**) The result has been to create an environment where the core themes provide the structure for collaborative research within the UoA, and with researchers from other disciplines. Each research group makes use of each of the Institute's major facilities in **eHealth** (Farr Institute, CIPHER, supercomputing), **Mass Spectrometry**, the **Centre for NanoHealth**, **Biomedical Laboratories**, and **Joint Clinical Research Facilities**. **Commercial Incubators** and business support facilitate the exploitation of research and intellectual property in each theme.




An exemplar of our strategy and investment success is the evolution of health informatics from pioneering work on eHealth at the Clinical School (linking data bases on defining rigorous standards for medical records) to the establishment of the Health Informatics Research Unit (2006, ~£4m), to CIPHER in 2012, the Farr Institute Centre in 2013 (£9m), and CADRE (£8m) in 2013.

Success since 2008 can also be evidenced across all 4 themes. For example, the new Haemostasis Biomedical Research Unit (BG theme, 2011, £1.5m); extensive expansion in industry linked projects (e.g. Calon Cardio-Technology in Devices) and senior appointments in Microbes and Immunity (with significant research council funding). Work leading to REF Impact Case studies has been cross theme (BG, D, PPHI themes including industry-linked case study in Devices), with benefit to patients, carers, the general public and many health professions, notably doctors, nurses, paramedics and pharmacologists. The CoM has delivered the Centre for NanoHealth (2012, £22m) involving all themes; succeeded in obtaining UK CRC clinical trials unit registration / senior appointments in the Clinical Trials Unit (themes D, MI, PPHI); and developed the new Joint Clinical Research Facility (2012, themes D, PPHI). Across all themes we are heavily involved with clinical research networks, many directed by ILS staff. Crucially, to bring these facilities together, we delivered the over-riding infrastructure of the ILS building with facilities designed to deliver the interdisciplinary, translational and commercial components at all themes.

The working strategy is based on maintaining communication between all key links in the research theme / facility matrix and monitoring specific objectives through the staff PDR process (see

Section C). Each theme is headed by a co-ordinator whose remit is to ensure that researchers using the different facilities work closely to deliver their roles for a successful theme. Evidence that our individual research projects are delivering across themes and facilities can be provided by 3 exemplars. 1). Jenkins' NISCHR funded work combines analysis of patient pathology samples (within the Biomarkers theme in the Biomedical Laboratories), with electronic cohort data on NHS clinical outcomes via our Informatics facilities (PPHI theme) resulting in novel prostate and oesophageal cancer biomarkers. 2). Rees' MRC, NISCHR and Epilepsy Research UK funded work has led to biomarkers and gene discovery in neurological disorders and is based on fundamental work at the Biomedical Laboratories. However, it is performed in combination with advanced clinical imaging (Joint Clinical Research Facility), molecular modelling, eHealth and Informatics facilities to deliver additional impact on the PPHI theme (drug side-effects, social deprivation, educational attainment and prescribing trends). 3). Thornton's TSB/MRC funded work draws on the methodological strengths within the MI theme (Biomedical Laboratories facility) analysing the human inflammatory response to support commercial activity of an ILS client company who are developing a low cost implantable heart pump during its design and preclinical testing phases (combining Commercial Incubator facility with Devices theme).

Future growth in the core research themes is planned in alignment with RCUK, UK Government, and EU priorities. The ILS will continue to deliver translational outputs across the 4 themes, based on consolidation and expansion of our facilities, and continued clinical interface with the NHS and industry. We envisage this as a process of **Invention** (supported by major ILS infrastructure facilities and partners), **Evaluation** (supported by the Joint Clinical Research Facility), **Adoption** (supported by the 7 clinical research networks, and **Diffusion** (supported by NHS and ILS partners, and feeding back into **Invention**). In each theme the broad strategic focus is as follows:

i) To discover novel genetic, immunological, molecular and geno-toxicological **biomarkers** and deliver their practical application in drug development, the treatment of neurological disorders, allergic diseases, cancer and diabetes. ii) To develop novel medical **devices** and diagnostics and to support bio-entrepreneurship to bring them from the laboratory to the bedside. iii) To discover mechanisms of infection, host **immunity**, and antimicrobial resistance, and to exploit **microbes** for drug development and for novel approaches for the treatment and prevention of disease. iv) To lead state-of-the-art developments in the management, privacy protection, storage, access and analysis of big data for the improvement of **patient and population** care and services.

Recent UK priorities in **eHealth** will be mirrored in the **Data Science Building**, due for completion in 2015. In addition to being the home for CIPHER and the Farr Institute, it will house another exciting future development: the recently confirmed £8m Swansea Centre for Administrative Data Research and Evaluation (CADRE). One of 4 major UK centres funded by the ESRC to comprise its **Big Data Network** (Administrative Data Research Network or ADRN). Professor Paul Boyle, Chief Executive of the ESRC, said: "We are delighted to have played a leading role in the development of the national ADRN that will strengthen the UKs competitive advantage in Big Data. The core aim of the ADRN is to facilitate linkage of routinely collected administrative data, thereby stimulating opportunities for innovative research and policy-making. There will be benefits for researchers, government, local communities and the public – indeed there is the potential for a *revolution in our ability to answer a host of questions that were previously intractable*." This reflects the leading role played by the CoM in developing and exploiting novel informatics environments, and an expansion of our research community to encompass **social science**, **economics** and other **non-health administrative data**. The bringing together of these projects under one roof will complete the third phase of ILS (ILS3).

To follow, the College is actively seeking further funding to expand its facilities and capabilities in all themes by making use of regional, UK and European funding. In addition to seeking EU Horizon 2020 funding to support major research initiatives, the College will target EU Convergence Funding to support substantial capital and infrastructure developments such as an expansion of the ILS ecosystem. A fourth phase (ILS4) bid is already in preparation, which aims to strengthen links with the College of Science, and increasing our skills and training agendas in **bio-entrepreneurship**, **innovation** and **health informatics**. The ILS will also benefit from Swansea's new, £250m Science and Innovation Campus. The 31,000 $m^2$ facility will open in 2015, co-locating industrial R&D activity with academic research in Engineering and Business. It has been described by the

European Investment Bank as a "European exemplar for how a research-intensive university can work effectively with industry". Given the multidisciplinary nature of the ILS and its existing close links with the Colleges of Engineering and Science (nanomedicine, medical devices, medical physics, human-computer interaction), the ILS plans to maximise the R&D and industrial engagement opportunities presented by this development.

The primary objectives for the College's development over the next five years are therefore to deliver a truly integrated, multidisciplinary research environment in purpose-built facilities that continue to attract talented staff and students, and which fosters even stronger industrial links to further increase the quality and quantity of novel and rigorous applied research that has international reach and significance.

**c. People, including:**

**I. Staffing strategy and staff development**

The College's staffing strategy since 2008 has been based on a continued and ambitious programme of investment to enhance its research position. The College has recruited internationally leading academic staff and promising ECRs, and supported career development from within. Success of ECRs can be seen in the period, with 19 staff moved from fixed-term to permanent positions; 10 staff have been promoted from Lecturer to Senior Lecturer. In addition, six staff have been promoted to Reader and five to Professor. In line with the research strategy the following key appointments have been made: 2 new professorial and 1 associate professor (new grade equivalent to senior lecturer/readership) appointments have been made in eHealth (CIPHER); an associate professor of Imaging (Joint Clinical Research Facility), Chair in Plastic and Reconstructive Surgery (with links to the Centre for NanoHealth), a professor of Cardiology (cross-themes, and bringing stronger links with the NHS Trust), a Chair in the Centre for NanoHealth, and associate professor in Microbes and Immunity.

The University's **Performance Enabling** process is based on individual staff KPIs relating to specific goals within our research themes (such as project income, publication and monitoring impact) delivered via an on-line Professional Development Review form. In 2012 the University won a Times Higher Leadership and Management Award and a UHR Excellence award for this initiative. The University is committed to the **Concordat to Support the Career Development of Researchers**, being one of the second tranche of HEIs to be awarded the HR Excellence in Research Award from the European Commission (retained 2013). A cross-institutional training unit, (Academic and Professional Enhancement Centre) coordinates a comprehensive skills development programme. Aligned to the Vitae Research Development Framework, it represents a significant investment tailored to supporting researchers in the post-Roberts environment.

The CoM provides a **supportive environment that encourages research**. Teaching and administration duties through the College are allocated in a manner that recognises the research contribution of staff. This ensures staff with a large portfolio of research activity are not overburdened by commitments whilst still making a contribution to teaching and leadership (consistent with the aim to provide research-led teaching). **Sabbatical leave** is available through request to the Research Committee; 7 staff members have benefitted from sabbatical leave of at least one semester, with 14 international colleagues making reciprocal extended visits.

The College supports early career academic staff through a number of initiatives, including prioritising the use of **Doctoral Training Grants** to support early career staff. ECRs are allocated a mentor and a probation supervisor, both of whom will assist them in developing and implementing a successful research strategy. In addition, the College seeks to minimise teaching loads on new academic staff to allow them to establish independent research activities. The University is actively involved in its Vitae network, being represented on the regional steering group (until 2012). Having run CROS (national Careers in Research Online survey) and PIRLS (Principal Investigators and Research Leaders Survey) in 2009 and 2011, the results portray a positive picture demonstrating that activities undertaken in support of research staff have been effective, with research staff at Swansea feeling better supported, more valued and more engaged than the national trend.

**Equality of opportunity**: the University makes every effort to promote equality of opportunity through its Strategic Equality Plan, which recognises the importance of managing a diverse and

multicultural organisation and helps address different needs of staff. Commitment to gender equality is further evidenced by its retention of the University **Athena SWAN Bronze Award in 2013**, which recognises excellence in the areas of Science, Technology, Engineering, Mathematics and Medicine for Women in the Higher Education Sector. Three members of the College contributed to the University application, including the Chair of the self-assessment team for the renewal. Building upon this, The College is preparing its application for a **Departmental Bronze Award** (for submission in Nov 2013), led by an Athena Swan champion and committee. The team has surveyed opportunities and attitudes within the College (for example 94% of female staff were aware of College initiatives to support women), and performed extensive analysis of the changing demographics of the College since its founding, to identify key career transition points. Early career promotion (such as postdoctoral to academic positions) has been highlighted as a priority, along with progression to clinical professor, and a mentor system introduced. Progression to lecturer, senior lecturer, reader or professor is good, with no significant difference in success rates at promotion panel between male and female applicants.

The College supports the Women in Universities Mentoring Scheme (WUMS), an initiative to enhance women's academic career progress. Two female ILS researchers have been awarded Daphne Jackson Trust Fellowships (for re-training of scientists after career breaks). College meetings, seminars and events have been moved to within hours where child-care is provided by schools/nurseries. Experience with a graduate-entry degree means that the College is very familiar with the needs of students with dependents. Staff take advantage of onsite nursery facilities and participate in the University's Childcare Voucher Scheme, supporting affordable childcare provision. All academic vacancies are advertised as suitable for job share, part-time or flexible working, enabling a balance of work and home requirements. Promotions data for academic staff is monitored annually by protected characteristics and any resulting trends are highlighted for action. The University is a member of Stonewall's Diversity Champions Programme, and the College has established its own Diversity and Equality Committee to promote equality in areas of age, religion and belief, disability, gender, race and sexual orientation.

### c. II. Research students

In the previous RAE period the College averaged 8.1 doctoral degrees awarded per year. This increased to 13.5 per year by 2012/13. Our research student base continues to expand, with an average of 27 students per year enrolling for research degrees leading to PhD or MD since 2010.

In 2012 the College introduced an MD by published work, and MSc by research, with an option of transfer to PhD and hence support research capacity. The College has also introduced several new taught MSc courses that have significant research components (e.g. Health Informatics) that promote collaboration across learning platforms, provide modules to train PhD students and **assist in the recruitment of doctoral students**. Strategic initiatives have led to **studentships with significant industrial / international involvement** through the Knowledge Economy Skills Scholarship (KESS) scheme (funded through the European Social Fund and Convergence Programme), RCUK Industrial Case Awards (NERC, BBSRC) and a novel **collaborative PhD programme with the Methodist Hospital Research Institute in Houston**. The College hosts four prestigious Welsh Clinical Academic Track (WCAT) Fellowships. These are 8-year (PhD to Lectureship) training positions in Academic Medicine established by the Wales Deanery, with the aim of equipping trainees with the range of skills required to compete as independent investigators in translational medicine and leading research from 'bench to bedside'.

Postgraduate students are treated inclusively, as members of the research team. Facilities include individual workstations, free on-site poster printing/photocopying, a hub in ILS1 with meeting area and cafe, a hub in ILS2 with digital presentation facilities and kitchen and a respite room in ILS2 (e.g. for return from maternity leave or return after illness). Students benefit from greatly extended access to scientific literature at the adjacent NHS library system.

Research students are supported by a dedicated College research office team and Higher Degrees Committee, with progression being closely monitored. All PhD students undergo a '1st year viva', preparing a written report and presenting, in a 45 minute viva voce, to a panel of 4 academic staff who assess the written work, understanding of the project, and proposed work plan. The recommendation of the panel determines progression from MPhil to PhD status. Attendance at all

ILS seminars / presentations is encouraged for all PhD students, for exposure to presentation practice and wider fields of interest. Attendance is assessed at the viva as part of progression.

All students present at an annual 'postgraduate week', the aim being to develop presentation skills and practice dealing with (and asking) questions in a friendly, but realistic research environment. Attendance of College staff is strongly encouraged at all levels, to provide student feedback. Prizes (£500) are awarded for oral presentations and posters and are intended to support attendance at relevant conferences during the candidature. Attendance at relevant seminars across campus is also encouraged, as well as participation in international conferences. The Higher Degrees Committee awards **bursaries (£500) for travel to conferences** at which the student has been accepted to present (awarded competitively if over-subscribed). All students attend an in-house statistics and data presentation course (20 hours of modules plus exam).

The '1st year viva', postgraduate research day (including prizes), travel bursary and statistics course were all developed after **requests, consultation and feedback from the research student body**. There is a staff-student consultation committee. Two student representatives sit on the Higher Degrees Committee, and two on the Research Committee.

## d. Income, infrastructure and facilities

In the previous RAE period (2001-2007) the unit averaged £3.3m of research income awarded per year. In the REF period this has increased to £8.2m per year. The increasing trend in research income is shown in the table below and reflects the College's commitment to (and success in) delivering a research-led institution.

*Research income since 2001* ***(£ millions)***

| RAE 2001-2007 | | | | | | | REF 2008-2013 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00/1 | 01/2 | 02/3 | 03/4 | 04/5 | 05/6 | 06/7 | 08/9 | 09/10 | 10/11 | 11/12 | 12/13 |
| £0.6 | £1.2 | £2.4 | £2.4 | £4.8 | £5.4 | £6.2 | £8.6 | £5.2 | £8.6 | £8.4 | £10.3 |

Income has been secured from **a wide range of prestigious funders**: MRC grant awards (13), BBSRC (16), EPSRC (10), NERC (1), ESRC (3), Wellcome Trust (7), Melinda and Bill Gates Foundation (2), NIHR (12), Royal Society (5), TSB (3), DoH (7). In addition ILS houses the St David's Medical Foundation, an independent charity raising funds to support work in medical education and medical research in the College. The Foundation has holdings of over £750,000 and directly supports 40 projects. The College Rector acts as Trustee.

In addition to grant capture, the College has attracted **significant (>£100m) funding to develop the ILS infrastructure** to underpin its research efforts. The following six major facilities are housed within the ILS. It is the linking of these facilities that enables the unit to deliver its activity across the four multidisciplinary **research theme groups**.

***1. eHealth and Health Informatics facility****:* The ILS offers an exceptionally strong infrastructure for the development, storage, access, analysis and commercial development of electronic health records. The NISCHR-funded *Health Information Research Unit* (HIRU) has developed a platform to harness the potential of routinely collected electronic data by developing novel methods for privacy protection, linkage and access. The HIRU flagship platform is the **Secure Anonymised Information Linkage (SAIL) system**, a world-leading technology and facility that allows routinely collected patient data at the individual level to be used in research while maintaining the highest standards of patient anonymity through a novel anonymisation process, even when linked to **geographic** and **environmental data**. There are currently over 4.5 billion anonymised person-based events. These can be linked to geographic, educational, social service, transport and environmental data creating an exceptionally rich information base that is a unique international resource for e-health research and evaluation. Building on HIRU, and increasing the focus on the international arena, *CIPHER*, the *Centre for Improving Population Health through E-Health Research*, is Swansea University's first multi-funder (MRC-led) Centre. One of four e-health research UK Centres of Excellence (and closely networked to the partners in London, Manchester and Dundee), it brings together a collaboration across the UK with key involvement from NHS, Government and international partners. Professor Sir John Savill, Chief Executive of the MRC, commented on the new Centres "This is a watershed moment for data research and for the Medical Research Council which I believe will

deliver the benefits of e-health research, improving patient care over the coming years. The way in which the partner organisations have come together to invest in e-health underpins its importance and will help establish the UK as a world leader in this field." The research council commitment to these projects was further strengthened in 2013 by the announcement of an additional £20m capital investment in the new Farr Institute for Health Informatics, a doubling of UK investment in this field, with one of the 4 Farr Institute Centres based at Swansea CoM with a new building underway for 2015. The research councils are again set to support our leading achievements in this area with the announcement of ESRC investment in a UK Big Data Network, with a £8m centre at Swansea (CADRE) which will allow our eHealth and informatics expertise to expand to include social science and economic data.

Closely aligned with Health Informatics, are our *Supercomputing* facilities. Research is further supported by a **supercomputing collaboration with IBM** that began in 2005 with the installation of a capability cluster based on a set of p-series simultaneous multithreading nodes. Successive updates moved the system from power4 to power5 to the current power7 technology and a maximum 2.7 teraflop performance. The IBM system also houses the state-of-the-art databank for SAIL. ILS also draws strongly on the new **£44m HPC Wales project,** gaining access to world-class, secure and easy-to-use high-performance computing technology. ILS projects are among the top 3 highest users of HPC Wales clusters, have secured a Fujitsu-funded PhD studentship, and companies based in ILS incubator space are using the capacity cluster. Three full time HPC Wales staff are based in ILS.

***2. Mass Spectrometry**:* The Institute for Mass Spectrometry combines a research and training arm with the UK EPSRC National Mass Spectrometry Facility (continuing a project of over 30 years, which demonstrates Swansea's key role as an established centre of excellence in mass spectrometry). The National Facility offers a range of mass spectrometry services and support to UK industry and has a significant outreach, teaching and training programme for postgraduates, technicians and staff in universities and industry. In 2011/12 alone, the Centre's work was acknowledged in 330 publications.

***3. Centre for NanoHealth (CNH):*** A joint initiative between ILS, Engineering and Science, in partnership with industry and the Abertawe Bro Morgannwg University Health Board. Located in the new ILS2, CNH offers a bio-suite (for nanotoxicology, cell imaging, tissue engineering, molecular biology, microbiology); and nano-suite (class 100/1000 'dirty' clean room, bio-clean room, nanostructure growth, scanning electron microscope, atomic force microscopy, scanning near-field microscopy, NMR spectroscopy, rheology, printing and coating). A crucial feature of CNH is co-location and direct access to the Clinical Trials Unit, patient imaging, ILS1 laboratories, Clinical/Biomedical/Engineering staff and commercial support for translation.

***4. Biomedical Laboratories**:* This is one of the largest and most diverse of the ILS facilities, based over the five floors of the 5000m$^2$ ILS1 building, offering custom-designed bench laboratory space, including a category 3 lab, tissue culture, microscopy (confocal, fluorescent, laser capture) and flow cytometry facilities. Recent additions include XF$^e$24 extracellular flux analyzer, Bruker BioScope Catalyst (on Nikon Eclipse) and illumina MiSeq benchtop sequencer. BioMed laboratories deliver research across all major themes. A linked facility (based within the emergency department of Morriston Hospital as well as ILS) is the NISCHR funded (£1.5m) Clinical Haemostasis and Biomarker Research Unit.

***5. Joint Clinical Research Facilities**:* ILS houses several linked facilities for undertaking patient research, encompassing Phases II-IV studies with potential for Phase I. All facilities share joint governance with the Health Board. **The Joint Clinical Research Facility** covers two state-of-the-art dedicated clinical areas, in ILS2 (on the doorstep of Singleton Hospital) and within Morriston Hospital. These offer access to patients and the ability to offer timely recruitment, with a track record of first-in-patient globally, and first-in-patient in Europe. The facility provides efficient support to academic and commercial projects in novel therapeutics and devices. A separate, but linked enterprise is the **Clinical Trials Unit** offering support for design, regulation, recruitment, data collection, management and collation. There are distinct trials groups in: diabetes; emergency care; epilepsy; gastroenterology; mental health; oncology; paediatrics and rheumatology. These groups have made major contributions to 67 multi-centre trials since 2008. The JCRF has been chief investigator in 15, highest UK recruiter in 5, exceeded target

recruitment in 27, and seen the drug brought to market in 9 trials. JCRF also include an **Imaging suite,** opened in 2012, housing a Siemens 3T Magnetom Skyra, Siemens Somatom CT scanner and Syngio Viao image processing server, plus contrast injection systems for MRI and CT, a cannulation suite, image processing/reporting room, interview room and fully accessible changing facilities. The systems available allow the application in both conventional and advanced fields of medical imaging, which require custom designed imaging protocols.

***6. Commercial Incubators**:* Very close links with industry are maintained through the co-location of ILS researchers and SME companies. ILS has dedicated (at least 25%) space for company activities. There are currently 10 full tenant companies within ILS (with 5 'graduated', including the Boots Centre for Innovation), and 7 affiliate companies with desk space (45 graduated). In ILS phase 1, 135 companies were assisted in R&D collaborations, 22 new companies created, 20 new patents registered and increased turnover in companies assisted totalled £14.7M. To date in ILS2, 216 companies have been assisted in R&D collaborations, 17 new companies created, and 21 new products / processes / services registered.

**e. Collaboration and contribution to the discipline or research base**

The vitality of ILS is evidenced through its leadership and engagement with many international initiatives, and the international reputations of its staff. Its sustainability can be seen in the contributions made across many disciplines and at all career stages. The table summarises our records of activities undertaken in the census period by REF2 researchers (n = 46, 44.9 FTE). The subsequent section highlights key contributions of named individuals across the College.

| Indicators of collaboration/contribution | Count |
|---|---|
| Formal visiting positions at other Universities / Institutions | 42 |
| Journal Editorial Board Memberships | 21 |
| Membership of the Boards of External Advisory Bodies | 151 |
| Conference Organisation | 50 |
| Plenary and Keynote Lectures | 62 |
| Invited Lectures | 281 |
| Other conference presentations | 300 |
| Personal Fellowships awarded competitively | 32 |

**Notable visiting positions include:** Adjunct Professor, Monash University, Australia (**Lyons**); Distinguished Chair as Professor, Xian Jao Tong University, China and Senior Affiliate Member of the Methodist Hospital Institute, Texas (**Conlan**); Honorary Research Fellow, Dept. Public Health, University of Oxford (**Roberts**); Visiting Professor, Chinese Academy of Sciences (**Dyson**). **Lamb** has held 4 visiting Professorships at Vanderbilt University Medical School, Nashville, and one at the Department of Biological Science, Woods Hole Oceanographic Institute, USA (all sponsored either by the Leverhulme or Wellcome Trusts).

**Mechanisms to promote collaboration at national and international level: Lyons** is Director of the MRC-led multifunder e-health informatics centre of excellence, Co-Director of UKCRC funded DECIPHer Public Health Centre of Excellence, Chair of the International Collaborative Effort on Injury Statistics and Methods for US Centres for Disease Control and Prevention. CoM staff are directors of 7 NISCHR funded research networks: Epilepsy (**Rees**), Diabetes (**Bain**), Children's (**Morgan**), Mental Health (**Lloyd**), Lung (**Harrison**), Cardiology (**Halcox**), Emergency and Unscheduled Treatment (**Snooks**). **Rees** is the Director of the Global Reference Centre for Hyperekplexia. **Morgan** supports links with the MRC International Nutrition Unit in The Gambia. **Conlan** is Co-Director of the Swansea Centre for NanoHealth. **Brenton** held the Chair of the British Mass Spectrometry Society. **Weston** is Associate Director of the Myocardial Infarction National Audit project, NIHR. **S Kelly** was a member of the Centre of Excellence in Biorefinery, Foreign and Commomwealth Office Trade Mission to USA on Biorefinery. **Clement** is a board member of the $10m IBM Network Science Research Centre, in partnership with Harvard and the MIT International Development Initiative. As a member of the EPSRC **Building Global Engagements in Research** project, ILS has formal partnerships with Université Joseph Fourier in

Grenoble, Soochow University in China, The Methodist Hospital Research Institute Houston, University of Pennsylvania School of Medicine, Rice University, and Texas A&M University.

**Full journal editorial positions include** (selected IF>3.0, out of 21): *American Journal for Reproductive Immunology* (**Sheldon**); *Biology Letters* (**Gravenor**); *British Journal of Psychiatry* (**Roberts**); *Drug Resistance Updates* (**S Kelly**); *Heredity* (**Skibinski**); *Mutagenesis* (**Jenkins**); *NIHR Health Technology Assessment Journa*l (**Snooks**); *Journal of Lipid Research* (**Griffiths**).

**Board memberships of advisory bodies:** The College is represented on many bodies and played a key role in the eHealth technologies and strategies through **Williams'** roles as Director of the Health Informatics Unit at the Royal College of Physicans, the National Institute for Clinical Excellence R&D Advisory Committee, and Chairman of UKCRC Board on use of patient data for research; and **Lyons'** role as Chair of the Record Linkage Group: 110,000 UK Birth Cohort Study. **Lyons** and **Williams** held Membership of the Office for Strategic Coordination of Health Research (OSCHR) Health Records Research Board. **Williams** was also a Member of the REF Impact Pilot Expert Panel and Founding Chairman of the British Society of Gastroenterology Information & Technology Committee. **Evans** is a UK College of Emergency Medicine representative. **Bain** is a Royal College of Physicians Specialty representative for diabetes and endocrinology, Advisor to the National Institute of Clinical Excellence, and a former member of UK Human Genetics Commission and National DNA database. **D Kelly** is a member of the Biotechnology and Bioinformatics Theme Panel of the Biochemical Society. **Morgan** sits on the Board of the UK Medicines for Children Research Network, and the Wales Royal College of Paediatrics and Child Health Executive Committee; **Allen** is a Member of the UK Medicines for Children Clinical Steering Group for General Paediatrics; **Kanamarlapudi** is Cell Biology Theme Panel Member for The Biochemical Society UK. **Wagstaff** has been Director of Wales Cancer Trials Network, a Member of UK National Cancer Research Network Operational Steering Group and the National Cancer Research Institute Renal Studies Group. **Taylor** is a Member of the NCRI Brain Tumour Group. **Clement** is Chair of the Welsh Assembly Government Panel on Resource Management. **Jenkins** is a member of the UK Government Department of Health Committee on Mutagenesis. **Weston** is a Member of British Heart Foundation Expert Advisory Board.

**Contributions to funding organisations***:* **Russell**, **Rees**, **Lloyd**, and **Lyons** are 'Senior Faculty' of the National Institute for Social Care and Health Research (NISCHR). **Williams** served as Director of Wales Office of R&D (now NISCHR) and on NIHR Health Services Research Committee, and **Lloyd** was Director of NISCHR. **Rees** is Chair of the Epilepsy Research UK Scientific Advisory Committee. **Lyons** has been a Member of the Wellcome Trust Peer Review College, the Wellcome Trust Expert Group on Population and Public Health Research, the MRC College of Experts and the Health Research Board Interdisciplinary Capacity Panel, Ireland, the Canadian Institute for Health Research International Review Committee. **Sheldon** is a member of the BBSRC Innovator of the Year Panel, Deputy Chair of BBSRC Committee E, and BBSRC Excellence with Impact Panel. **Brenton** has acted on the EPSRC Chemistry Panel and is an EPSRC College Member. **Snooks** has had membership of the HTA Emergency/Trauma panel, and the MRC College of Experts. **Skibinski** served on the NERC Marine Sciences Peer Review Committee, the NERC Peer Review College, the NERC Antarctic Funding panel and the NERC Molecular Genetics Facility Steering Committee. **Archer** is a member of the Arthritis UK and Action Medical Research committees. **Ford** is a panel member of the MRC/ESRC Extending Working Lives Initiative.

**Supporting national and international initiatives:** The ILS project (**Hopkin**, **Morgan, Clement** and others) is itself a European priority initiative to develop the knowledge economy. **Williams** advised the House of Commons Select Committee on Electronic Patient Records, and contributed to the 'Francis Report' on The Inquiry Into Care Provided By Mid Staffordshire NHS Trust. **Sheldon** is Leader of an Emerging Infectious Diseases ERA-Net award (€3.2m). **S Kelly** and **D Kelly** are partners in the Centre of Excellence in Biorefinery, part of the £20m ERDF BEACON project. **Clement** was appointed to the board the £250m National Endowment for Science Technology and the Arts independent charity, acted as Deputy Chair of Boots' Centre for Innovation in ILS, and sits on the board of Directors for Arthurian Life Sciences, managing a £100m Life Sciences Investment Fund. **Hopkin** was convener of the initiative to create the new

Abertawe Bro Morgannwg University Health Board. The Welsh Government has committed up to £50 million to the **Sêr Cymru programme** to enhance and build upon the research capability, **Lloyd** sits on the Governance Board, and **Clement** on the Management Board. **Owens** established the national retinopathy screening initiative (and acts as diabetes advisor to the government) in Mauritius and Trinidad and Tobago (MRC and Johns Hopkins funded).

**Presentation at, and organisation of, international meetings:** Notable Plenaries include the International Health Data Linkage Conference, Perth (**Ford**) Symposium of the European Network for Oxysterol Research, Dijon (**Griffiths**); National Trauma Research Institute Conference, Melbourne and American College of Surgeons, Chicago (**Gabbe**); Canadian Injury Prevention and Safety Conference, Montreal and Joint ESRC/MRC/Wellcome Trust Frontiers Meeting (**Lyons**); Royal College of Physicians of London and British Cardiovascular Society Annual Scientific Conference, Manchester (**Weston**); Seelye Foundation Public Lecture, Auckland, International Child Neurology Congress, Brisbane, British Paediatric Neurology Association Annual Meeting, Edinburgh (**Rees**); International Federation Health Records Organisations, Milan and British Society of Gastroenterology, Glasgow (**Williams**); International Symposium on Cytochrome P450 Biodiversity and Biotechnology, Torino and International Conference on Cytochrome P450: Biochemistry, Biophysics and Structure, Manchester (**Lamb**). **Involvement in conference organisation** includes **S Kelly**, FEBS Summer School on Cytochromes p450, Slovenia, and Symposia on Cytochrome P450 Biodiversity and Biotechnology (3 meetings: Nice, Woods Hole, Turin). **Brophy** brought the European Diabetes Epidemiology Group Conference to Swansea in 2012. **Lyons** organised the 2010 Injury Forum with funding from WHO and World Bank (via Harvard University). **Halcox** acted on the programme committee for the Annual Congress of the European Association of Cardiovascular Prevention and Rehabilitaiton (2009-2013).

**Notable fellowships and awards: Hopkin** received a CBE and was elected Fellow of the Academy of Medical Sciences and the Learned Society of Wales. **Morgan** was elected Fellow of the Royal College of Pathologists. **S Kelly** was elected Fellow of the Royal Society of Chemistry, and the Society of Biology, along with DSc. **Russell** was awarded Honorary Fellowships of the Royal College of General Practitioners, Royal College of Physicians, Faculty of Public Health and Hon DSc (Aberdeen). **Rees** was elected fellow of the Royal College of Pathologists, and DSc. We have been awarded a large number of research council and other prestigious fellowships including: **Mason** (Royal Society Belcher Memorial Prize); **Lamb** (Wellcome Fellowship, and DSc); **Jenkins** (MRC People Exchange Fellowship) and **Sheppard** was awarded first a Royal Society University Research Fellowship, subsequently accepting a Wellcome Trust Career Development Fellowship.

Evidence of the future sustainability and success of the unit's career development strategy is provided by exemplar contributions from early / mid career researchers (achievements listed here all at the Lecturer or Senior Lecturer level). **Johnson** was awarded the Environmental Mutagen Society young scientist prize, a Hoffman-La Roche fellowship, and gave the plenary lecture at the Japanese Mutagen Society annual meeting. **Wang** has obtained 2 BBSRC awards as PI. **Davies** won an MRC Discipline Hopping Award and the Parkinson's UK Innovation Award. **R Thomas** was named Promising Young Investigator (Epilepsy & Behaviour journal), the Alwyn Lishman Award (British Neuropsychiatry Association) and Gower's Young Physician Award (International League against Epilepsy). **Khan** was awarded an Orthopaedic Research Fellowship. Amongst many conference awards by young researchers, **Howell** won best young investigator at the 2009 Congress of the European Committee for Treatment and Research in Multiple Sclerosis, Germany. **Chung** was awarded an Epilepsy UK Fellowship and selected as 'Rising Star' – The Future of Epilepsy Translational Research by *Epilepsy & Behaviour*. **Doak** was guest editor for a special issue of *Mutation Research*, won the UK Environmental Mutagen Society Young Scientist Award, and the European Environmental Society Young Scientist Award. **Francis** held an Adjunct Professor position at Rice University Faculty of Natural Science, Texas.

In 2014, the College celebrates its tenth anniversary. These highlights demonstrate that it has rapidly established a vibrant and innovative research environment. This is an environment in which the staff make significant contributions to their research base, and which ensures the sustainability of the ILS project's impressive growth to date.