

Institution: Cardiff Metropolitan University			
Unit of Assessment: UOA03 – Allied Health Professions, Dentistry, Nursing and Pharmacy			
1. Unit context and structure, research and impact strategy			
<p>Through sustained and focussed strategic action during the current REF census period, Health Sciences¹ has achieved significant growth across a number of key performance indicators. These include: over 50% increase in research income; a near three-fold increase in the number of staff being returned; and a doubling of both Professors / Readers and externally funded PhD students. The growth in volume and quality of our research was integral to the University being listed in the Times Higher Education (THE) World University rankings for the first time in 2019 and again in 2020, as well as the THE World University Young rankings in 2020. Table 1 provides further details of key metrics in the period.</p>			
Table 1: Growth in Research Metrics REF2014 to REF2021			
	REF 2014 n=	REF 2021 n=	Growth n=
Total research income	£5,030,725	£7,566,561	£2,535,836 (50%)
Number of staff submitted to REF	12	34*	22 (183%)
Female staff submitted to REF	5	20	15 (300%)
Number of Professors	7	15	12 (110%)
Number of Readers	5	9	4 (80%)
Number of peer-reviewed manuscripts	229	410	181 (79%)
Externally funded PhDs	10	19	9 (90%)
Postgraduate Research (PGR) Student completions	36	48	12 (33%)
Number of Honorary / Visiting Professorial appointments	4	11	7 (175%)
* Equivalent to 31 FTE staff with significant responsibility for research, representing 32% of eligible Health Sciences staff.			
Context and structure			
<p>The 2014 Cardiff School of Health Sciences REF environment submission was rated as 87.5% (12.5% 4-star; 75% 3-star) world-leading and internationally excellent based on our established track record in applied science and allied health professions (AHPs). It drew on the success of two internationally recognised research centres: The Food Industry Centre (FIC)² and The Centre for Health, Safety and Environment. Our strategic priorities for the current census period centred on continued growth in volume and high-quality research, specifically to increase:</p>			
<ul style="list-style-type: none"> a) critical mass in concentrated specialist areas of research; b) the diversity of research and innovation (R&I) income; c) research impact; d) interdisciplinary research and international collaboration. 			

¹Cardiff School of Sport and Health Sciences formed in 2017 as a result of a University led merger between Cardiff School of Health Sciences and Cardiff School of Sport. The term Health Sciences refers to this submitting unit and is used throughout the document.

² Known externally as The ZERO2FIVE Food Industry Centre (FIC).

a) *Critical Mass*

In 2017, we revised our research structure into two R&I themes, overarching eleven R&I groups containing cross-cutting expertise and greater critical mass to capitalise on synergies and strengths of the newly merged School. These form the basis of our return (Table 2). The new structure was a conduit for the development of a third Centre of Excellence in 2019 - The Centre for Health, Activity and Wellbeing Research - which draws on expertise from across the School to address priorities around health and wellbeing, economic growth, and sustainable communities.

Table 2: Research Groups Aligned to R&I Themes within Health Sciences

Theme 1: Cardiovascular Health & Ageing					
Cardiovascular Metabolism & Inflammation	Cardiovascular Physiology	Cellular Senescence & Pathophysiology	Nutrition, Food & Health	Stroke Hub Wales	
Theme 2: Population Risk & Healthcare					
Applied Psychology & Behaviour Change	Food Safety	Microbiology & Infection	Occupational & Environmental Public Health	Public Health & Wellbeing	Speech, Hearing & Communication

Throughout the REF period our strategy has been to target the recruitment of staff with a demonstrable research track record aligned to our R&I themes (**Aicheler, Butcher, Connolly, Crone, Green, Hallingberg, Hodgetts, James D, James P, Livingstone, Phillips, and Zhao**), or early career researchers with strong potential for high-quality research (**Blaxland, DeClaire, Rhys, Stubbings, and Taylor**). This has enabled us to build greater critical mass around key research foci and safeguard the allocation of protected research time, both of which were catalysts for our increased research quality, productivity, and income. We have also established Honorary contracts / Visiting Professorships for NHS Consultants (**Anderson, Coulson, Geen, Rees**), esteemed academic colleagues at other institutions (**Akerman, Davies, Evered, Jackson, Sakkas**), and other public health bodies (**Holah, Thomas**) to foster links with healthcare systems and other key stakeholder groups where they align with our specialist research areas.

b) *Diversification of Income*

A second strategic priority was to expand and diversify our income sources and the number and nature of partners we engaged with. We have achieved major success in this regard by capitalising on European Union (EU) funding streams such as the Knowledge Economy Skills Scholarships (KESS 2)³. We secured **19** KESS 2 projects during the period, nine of which were partnered with NHS or healthcare providers, yielding circa **£1.5 million** in external income. To ensure R&I projects were patient-centred, service focussed, and a driver for clinical impact we also strengthened our close ties with the NHS through membership of University Health Board Partnership Committees (**Mathieson, James P, Sykes**). For example, we established the Stroke Hub Wales (**James P**) through Welsh Government (WG) funding (**£240k**) in partnership with Aneurin Bevan University Health Board.

We expanded the number of international research partnerships **32-fold** which led to the further diversification of our funding sources. For example, we secured circa **£700k** through the following European funding streams:

- the pan-European 'FRAILOMIC' programme (£400k; **Butcher, Erusalimsky**), a consortium of six European Universities, the World Health Organisation (WHO), two world-leading research centres, seven small and medium-sized enterprises and four hospital-based research groups;

³ Knowledge Economy Skills Scholarships (KESS 2) are a pan-Wales knowledge exchange initiative supported by European Social Funds (ESF) through the Welsh Government (WG).

- the Horizon 2020, Marie Skłodowska-Curie Actions project 'HIT-LVAD' in collaboration with Columbia University and Industrial Development Medical-Technology Ltd (Germany) (€252k; **McDonnell, Stöhr**);
- the Rights, Equality and Citizenship (REC) Programme, Lights4Violence project (£50k; **Bowes, DeClaire, Watt**) with schools and young people across Europe.

We also achieved a greater than **3-fold** increase in competitive funding from charitable bodies totalling circa **£700k**. This included funding from the British Heart Foundation (£210k; **James P**); the Jane Hodge Foundation (£156k; **Jenkins**); the Waterloo Foundation (£130k; **Jenkins**); Tenovus (£50k; **Evans**); and the Sir Halley Stewart Trust (£50k; **Beeton**).

c) *Research Impact*

In line with the University's R&I strategy, research impact is a cornerstone of our activity. Industrial and NHS partners have been integral to knowledge exchange activities and have provided a critical interface for our translational and impactful research. Our approach is predicated on:

- Centres of Excellence and R&I themes providing a catalyst for the strategic focus of our research activities, collaborations, and stakeholder and end-user engagement.
- supporting programmes of research with potential for immediate, medium, and longer-term impact.
- scoping potential impact case studies so that emerging cases can be identified at an early stage of development and supported to optimise their potential.
- cultivating programmes of applied interdisciplinary research to meet end-user needs.

The research-impact interface has been cultivated widely across Health Sciences, an example of which is the FIC's HELIX project (**Lloyd**). Through its support to Welsh small to medium enterprises, HELIX has yielded an economic impact of **£96 million** and resulted in the development of **305** new food products, provided support to **64** new companies and safeguarded **1120** jobs. Additional research funding and knowledge exchange activities provided a catalyst for improved food processing and product design to minimise contamination in food preparation (**Evans, Lloyd, Redmond, Tatham**).

We have supported research with the potential for impact at an early stage by providing initial pump-priming. For example, a pilot project that led to the WG funded GP Ability study, aligned with diabetic screening across Wales, resulted in the development of an international peripheral arterial disease diagnostic service (**Lewis JE**) - the basis of one of our three impact case studies. Further University funding supported a feasibility study applying a new reflexology technique to reduce breast cancer-related lymphatic fluid in **36** patients, which led to **2400** reflexologists being trained in this technique world-wide (**Whatley**). In each of these instances, early identification of potential research impact enabled strategic deployment of internal funds and support - an integral approach to the development of our current and ongoing impact case studies and programmes of impactful research.

Impact is further fostered through one-to-one support meetings with the REF Coordinator, impact case development meetings to share good practice, and funding to attend specific courses or conferences to maximise global reach and impact potential. Our researchers also have direct access to Public and Patient Involvement (PPI) Group members to ensure that all our research programmes are informed by lay members and end-users at an early stage.

d) *Approach to Interdisciplinary Research*

Several different approaches have been adopted to foster interdisciplinarity in our research. Our staff have been supported to engage with scientific, industrial, and patient / clinical partners by early investment of School funds, the Santander University Mobility fund, and our Patent Development Group. Examples of research, led by our investigators include:

Unit-level environment template (REF5b)

- European Commission, Horizon 2020, Marie Skłodowska-Curie Actions programme - enabled collaboration with Industrial Development Medical-technology Ltd. based in Germany and Columbia University Medical Centre, New York, USA (**McDonnell, Stöhr**). The Haemodynamics Informing Treatment in patients with Left Ventricular Assist Device (HIT-LVAD) trial meant that heart failure patients fitted with an LVAD can have their blood pressure measured for the first time.
- a programme of work on anagrelide (**Erusalimsky**) for the treatment of cancer was undertaken with Sheffield University and the Estonian Biocentre, Estonia. This gave rise to a patent in collaboration with two industrial partners - Aluztra Bio Ltd, UK and SUDA Pharmaceuticals Ltd, Australia.

Further approaches to nurturing interdisciplinary research include staff attendance at a series of cross-University 2-day intensive workshops / sandpits bringing academics together to identify areas of synergy. Examples of active research programmes arising directly from these include research with:

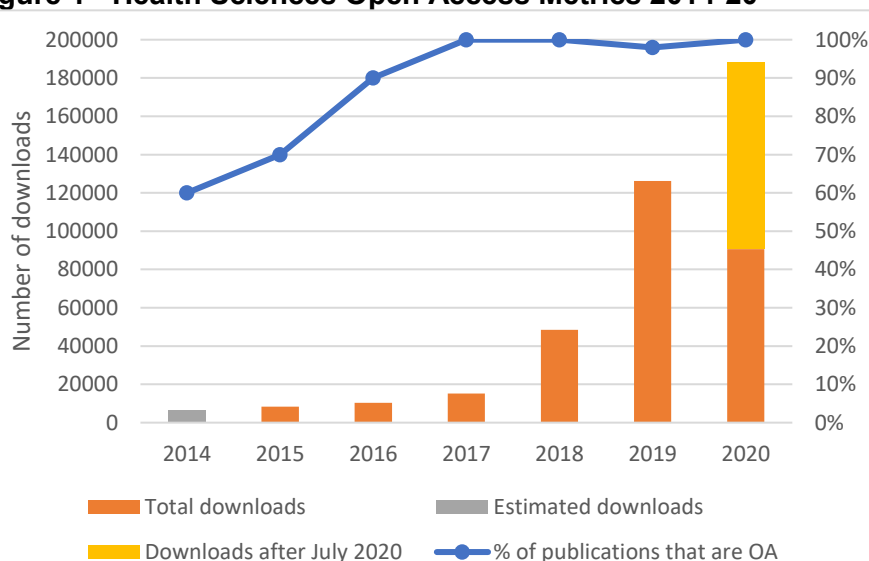
- Cardiff School of Art and Design on the use of eye-tracking technology for understanding consumer and food manufacturer behaviours (**Evans**) and production of 3-D simulated feet for use by podiatry educators (**Curran**);
- Cardiff School of Technologies to design an animation platform to help patients understand / visualise the consequences of hypertension (i.e., stroke) to improve medication-adherence (**James D, McDonnell**).

Open Access

Since 2017, **98%** or more of our publications have been Open Access (Figure 1), evidencing our compliance to the University's Open Access policy, introduced in 2014. Training is provided by the University's Library Services to ensure research outputs are uploaded to the institution's Open Access repository (DSpace) in line with the REF Open Access policy. As a result of investment in training and technology, our increase in Open Access publications has been mirrored by the number of output downloads which increased from circa 48k in 2018 to 126k in 2019 (Figure 1). As a consequence, our research has reached larger audiences year-on-year during the current REF cycle.

In 2018, the University invested in Figshare, a repository for staff to store, share and manage their research. This supports our drive towards an ever more Open Research environment, exceeding current REF requirements. An example of where this software has been particularly useful is the sharing of material for specialist training on breast cancer-related lymphatic drainage provided to circa **2400** reflexologists worldwide (**Whatley**).

Figure 1 - Health Sciences Open Access Metrics 2014-20



Research Integrity

All staff and students engaged in research are required to meet exemplary standards of academic practice and integrity. Mandatory training ensures that practices set out in the University Research Governance Framework are incorporated into their everyday work. Health Sciences has four dedicated Ethics sub-panels (Healthcare and Food, Biomedical Sciences, Applied Psychology and Applied Healthcare) that meet weekly, and sit under the umbrella of the School Research Ethics Committee (REC), chaired by the ADR. REC meets quarterly and reports to the University Ethics Committee (UEC). In 2017, we developed and implemented a SharePoint-based online ethics submission process that ensures efficient processing of **over 1200** ethics applications per year and records data securely in full compliance with General Data Protection Regulation (GDPR). All staff are required to undertake mandatory GDPR online training and staff and students working on clinical- based projects are also required to undertake the Good Clinical Practice and Medical Research Council online training. Our Ethics Framework incorporates the professional codes of conduct of external agencies relevant to our research specialties, for example the British Psychological Society and accrediting bodies for AHPs. Links to the relevant ethics guidance for these bodies are provided in the research sections of virtual learning platforms such as Moodle and introduced formally at undergraduate level to ensure full appreciation of ethical aspects and research integrity at an early stage.

A quality management system ensures that any research involving human participants, or where samples of human origin are taken, conforms to the highest ethical standards. In 2017, the University underwent a successful Human Tissue Act (HTA) audit resulting in license renewal (License number: 12408). This is overseen by the HTA Designated Individual (**Kelly**) who sits within Health Sciences and is a core member of School and University level Ethics Committees.

Future Strategic Aims

Our future strategy is based on capitalising on our distinct areas of expertise to address major and global challenges for health and wellbeing, economic growth, and sustainability. This is predicated on our capacity and ability to deliver research with worldwide impact that aligns to the United Nations Sustainable Development Goals. To help achieve this, the University launched three new Global Academies in November 2020, which bring together expertise from across our five Schools to further facilitate interdisciplinary and creative thinking. Two of the Global Academies are driven from within Health Sciences (Food Science Safety & Security, and Health & Human Performance – see Institutional Environment Statement). **Crone's** appointment to lead the Centre for Health, Activity and Wellbeing Research will enable the School to capitalise on our breadth of expertise for employing multidisciplinary approaches to address major societal issues. Building on these and other developments within the merged School, our objectives over the next REF cycle are aligned to the University's 5-year strategic plan (2018-23)⁴, and include:

1. continuing sustainable growth of 5% *per annum* in research funding, with particular emphasis on applying to cherished sources, such as the Medical Research Council (MRC), National Institute for Health Research (NIHR) and charitable funding bodies;
2. enhancing the quality of our research papers and research impact through ongoing School and institutional strategic initiatives such as coaching and pump-priming;
3. increasing the number of staff with significant responsibility for research from 31 FTE to 45 FTE by the next REF through formal mentoring schemes including the University's 'Women to Professors' and 'Early Career Researcher (ERC)' programmes;
4. enhancing international partnerships through our existing Centres and the new Centre for Health, Activity and Wellbeing Research as well as the Global Academies;
5. optimising the use of emerging practices and platforms for Open Research to promote reproducibility of our research, for example through Figshare;
6. developing new areas of interdisciplinary R&I such as digital health technologies in collaboration with the newly formed Cardiff School of Technologies.

⁴ Underlying all these objectives are specific University and School targets, key performance indicators and workstreams.

2. People

Our strategic priorities for this census period are exemplified by our commitment to research excellence through the appointment, support, and development of high-quality researchers. Targeted recruitment of **18** academic staff (two at Professorial level) with a proven R&I track record has built critical mass and enhanced succession planning in the following areas: Healthcare: **James D, Zhao**; Biomedical Research: **Aicheler, Butcher, James, P, Connolly, Green, Livingstone, Whelton**; Food Safety and Nutrition: **Blaxland**; Applied Psychology: **DeClaire, Hallingberg, Hodgetts, Phillips, Rhys, Stubbings, Taylor**; and Public Health and Wellbeing: **Crone**. Research leadership has been strengthened through our support for internal promotions to Professor (**Curran, James D, James P, Morris**) and Reader (**Bowes, Limbert, McDonnell, Mercer, Zhao**). Our engagement of eminent scholars to Honorary Professor (**Anderson, Coulson, Geen, Rees**) has further enhanced the research leadership of our R&I groups. We have also supported academic staff in their development to become postgraduate research supervisors, with **24** staff having become either Director of Studies (n=10) or new PhD supervisors (n=14) during this census period.

Staff Support and Development

Staff development for research engagement and career progression is supported at all levels and considered key to achieving the School's strategic aims. Staff have protected time for research on their workload which is applied consistently and in proportion to research activity and outcomes. Quarterly staff performance review meetings provide the conduit for the ADR in conjunction with the designated line manager to adjust the allocation of research hours. These reviews focus on establishing the individual's knowledge / experience gaps to signpost training and development opportunities, in tandem with their progress towards agreed outcomes.

The School has a long-established commitment to staff development, typically allocating circa 10% of non-salary budget per year towards staff training and continuing professional development, totalling **£600k** in this REF period. A total of **312** staff attendances have been supported at national (n=269) or international (n=43) conferences. Financial support is also strategically targeted at early- and mid-career individuals. For example, two early career researchers benefitted from funding to attend the WG Crucible developmental programme which has a 20% acceptance rate (**Jenkins, Welton**). The University also funded **Hallingberg, Kelly** and **Fairchild** to attend the Missenden Centre writing / funding Masterclass in April 2020.

All our academic staff align to one of the eleven R&I groups (each with a lead) that provide strategic direction and informal mentorship of early and mid-career researchers. Our two R&I themes also provide a supportive, creative environment for cross-disciplinary advice and internal peer-review for activities such as grant development. This mentorship is complemented by an institutional mentoring scheme for pairing early and mid-career researchers with senior academics from other Schools. Staff are also encouraged to think about the potential enablers for their plans, such as internal and external Advisory Board membership, networking and linking to industry. For example, Health Sciences invested circa **£350k** in seed funding, and staff secured a further **£356k** from University R&I pump-priming initiatives. Staff also accessed other small awards such as the Santander University Mobility Awards (**Bowes, DeClaire, Erusalimsky, McDonnell**) to support national and international exchange activities.

A Health Sciences REF Panel provides a mechanism for ongoing, independent quality review of research outputs, which provides timely feedback to authors. The ADR and REF Coordinator also deliver annual training workshops to all academic staff on rating their research output quality and fostering impact. We also draw on external expertise, for example, in 2017 we delivered a workshop to over 50 research staff and PGR students in collaboration with Editors from Elsevier. University level training complements that delivered by Health Sciences, and includes academic writing workshops, interdisciplinary funding workshops and doctoral supervisory training. Our staff also avail themselves of the University's Organisational Development Unit's range of skills training associated with R&I. These include project

management, networking, chairing examination boards, technical skills for designing electronic surveys (Qualtrics™) and analysing qualitative (nVivo™) and quantitative data (SPSS™).

In a strategic drive to increase the number of staff with Doctoral degrees, we have supported our staff to undertake part-time Doctoral qualifications aligned to their professional practice area. Currently, **18** members of staff are enrolled on Doctoral programmes, each benefitting from an additional workload allocation of a minimum of 271 hours dedicated time for research (equating to a total investment of **£138k per annum**) and fees paid by the School on their behalf (**£99k** during the period).

Several initiatives are in place to cultivate interactions between students, staff, and external partners, including the following:

- Research Capacity Building Collaboration (RCBC) Wales scheme where our staff can work with students from healthcare settings who benefit from a national Community of Scholars for research skills training. Funding was obtained for a total of **9** research projects - **5** PhD scholarships, **1** MPhil and **3** First into Research Scholarship awards during this period (value of **£141k**).
- Doctorate in Forensic Psychology programme for qualified practitioners which is approved by the Health and Care Professions Council. Graduates are eligible to apply to the British Psychological Society register to practice as Forensic Psychologists in the UK (**n=5** enrolled during this period).
- Knowledge Economy Skills Scholarships (KESS 2) programme which provides the opportunity for academic staff to link with industry employees to co-supervise a PhD student to address an unmet research need in their organisation that will lead to a new body of professional knowledge (**19** in this period).
- Health Sciences Professional Doctorate programme which is specifically structured to support change, informed by research, within professional practice or an organisation (**17** enrolments in this period).

Postgraduate Research Students

We have invested **£349k** in PGR student support during this REF period, targeted at personal development, such as presenting research at conferences and attending training events. PGR students also benefit from a dedicated state-of-the-art study room, which received an additional **£26k** investment for refurbishment, where all students are provided with an individual study space and a desktop computer. This physical environment is augmented by the new online Doctoral Academy Portal (launched in April 2020), which is the 'one-stop-shop' for all PGR-related information, resources and online training / event promotion. Each student has a dedicated supervisory team, comprising a Director of Studies and supervisors, who hold formal progress reviews at 3-monthly intervals for full-time and 6-monthly for part-time students. Progress is reviewed annually, approved by School and Institutional Research Degrees Committees, and recorded on PhD Manager, an online database that enables students to track their Professional Development Portfolio, skills training, supervisory meetings, and changes to enrolment.

We have a vibrant PGR student community, with a buddying system for new students, social events and an effective system of student representation on all committees (e.g., Cardiff Met Research Student Committee, School Research Degrees Sub-Committee, and Health Sciences Ethics Panel). We host an annual PGR student symposium at which all PhD students are encouraged to present, alongside keynote presentations by external speakers, which provides additional student training opportunities (**£24k** investment during the period). Monthly, 'Scoff with Prof' meetings provide an informal environment for two-way interaction between PGR students and the Research Degrees Management Team. This was augmented during the first COVID-19 lockdown, where daily online student drop-in sessions were available to discuss any issues.

We are actively engaged in supporting, training and supervising PGR students, offering both traditional PhD (full- and part-time) and Professional Doctorate (part-time) programmes. During

the census period, there were **48** completions, a **33%** increase on REF2014. Indeed, we have achieved considerable growth in successive REF cycles in the number of full-time equivalent research degree candidates with a **40%** increase on REF2014 (**67** enrolments, including **14** international students). The quality of supervision and our support of PGR students across the School is demonstrated in part by the University's recent success in the Advance-HE Postgraduate Research Experience Survey (PRES), where we ranked **first** for supervision and **second** for overall satisfaction. In Health Sciences, **92%** of students felt that their supervisors had the skills and subject knowledge to support their research and expressed an **88%** overall satisfaction.

These PGR student successes reflect a portfolio of initiatives undertaken during the period. For example, **all** research students are active members of the R&I groups which are brought together in our two R&I themes. This ensures breadth and quality of interactions, mentorship, and exposure to large-scale research programmes. Although the character of each research group is unique, the theme structure promotes a wider sense of community and provides additional access to a variety of subject expertise to foster interdisciplinarity.

Further support is available for PGR students to nurture their development as academics and researchers. All students participate in research ethics training within the University-wide Research Student Induction programme. Students can enrol on the Post-Graduate Certificate in Teaching in Higher Education and are encouraged to dedicate 20 hours per year on developing their transferable skills, based on *Vitae*, the Concordat to Support the Career Development of Researchers. We delivered a total of **131** *Vitae*-based training workshops in the period. To further supplement the annual University-wide Research Skills week, a fluid offering supports the training and professional development of PGR students, which includes evening sessions to cater for flexible study. Colleagues from all Schools, including Health Sciences contribute to its delivery with **40** sessions held during the first COVID-19 wave (April to July 2020). Building on this, Health Sciences PGR students are also invited to participate in workshops delivered as part of the MRes module, 'Developing Skills for a Career in Research'.

Support and Promotion of Equality and Diversity (E&D)

Consistent with our University's mission statement, we are committed to all aspects of equality, diversity, and social inclusion. Health Sciences was awarded an Athena SWAN Charter Bronze Award (April 2017), recognising advancement of gender equality, representation, progression, and success for all. We currently have a working group targeting Silver Award status by 2023. Early progress is encouraging, with a recent independently commissioned Staff Survey (2019) reporting **89%** positive School responses for questions relating to E&D.

The University's Recruitment and Selection Guidelines mandate a systematic approach to ensure all staff are selected solely on merit, with discrimination on the grounds of any protected characteristics explicitly forbidden. Notable achievements of the University's Strategic Equality Plan (2016-20) include the establishment of Women's, Disabled and BAME Networks, revised Equality in the Workplace Training, and implementation of Unconscious Bias Training. A review of the Health Sciences REF2014 submitted staff revealed a gender imbalance, particularly at senior level. Several initiatives were introduced to address this imbalance and other issues raised, including:

- legitimising time spent on research by ensuring research objectives are included in all academic staff performance reviews;
- supporting conversations with line managers for arranging research time to fit around caring responsibilities;
- identifying potential research leaders at an early stage and encouraging attendance at the University's 'Women to Professor' workshops;
- introducing 'committee-free periods' at the end of the spring and summer terms, and before school holidays start, to ensure diary space is available for staff to spend time on research;
- restructuring Teaching and Learning roles to free up time for R&I activities;

- applying for a 1-week period for writing, to remove certain student-facing responsibilities and create protected time;
- establishing a University-wide Women's Network, led by a Health Sciences academic staff member (**Freeman**).

These initiatives contributed to 20 of the 34 researchers returned in this submission being female (**59%**, an improvement on the 41% submitted to REF2014). This closely reflects the current gender balance within Health Sciences (**62.5%** female). Furthermore, our staff represented **37%** (**n=16**) of all participants attending the University 'Women to Professors' workshop during 2018-2020. As a result, **11** of our female staff members have been awarded **3** Professorships and **6** Readerships during the period, with **2** having passed the *prima facie* case stage for Readership. Alongside peer support and mentoring, the workshop makes routes and requirements for promotion explicit and encourages attendees to align objectives within performance reviews. **Five** of our female staff are in key leadership positions: School of Sport and Health Sciences, Dean (**Thirlaway**), Centre for Health, Activity and Wellbeing Research, Lead (**Crone**), Graduate Studies Coordinator (**Mercer**), REF Coordinator (**James D**), and HTA, University Designated Individual (**Kelly**).

In line with University policies (*Flexitime* and *Flexiplace*), all essential meetings for staff and students take place within core working hours (10am-3pm) with dates communicated at the beginning of the academic year to ensure attendance can be planned. Work is also ongoing to ensure family-friendly policies, such as making flexible working and parental leave more accessible. Guidance is provided for implementing policies, for example, advice on putting in place arrangements to support parental or planned sickness leave and return to work after an extended period of leave. With **20%** of our REF returned staff working **part-time**, we have embraced the University's flexible working policy to fit around caring responsibilities and remote working options, with many local level agreements put in place to meet the needs of the individual. We have a flexible approach to PGR study and students have the option to suspend or change their enrolment from full to part-time (or vice versa) if their personal circumstances change. This enabled four students to take a combined total of **seven** periods of parental leave during this REF cycle.

Last year, the University launched a new Strategic Equality Plan (2020-24), setting out an approach to exceed legislative requirements, to advance and support equality, diversity and inclusion. Health Sciences is dedicated to following this plan and is committed to implementing and influencing positive change through the promotion of equality of opportunity within the sector and wider community, during the next REF period.

3. Income, infrastructure and facilities

As a result of our strategy to increase and diversify R&I income we secured circa **£7.6 million** in research funding during this REF period. This included a **50%** increase in 'cherished' funding from sources such as Horizon 2020 and UKRI. This growth was supported by a capital investment of circa **£2.8 million** in the infrastructure and R&I facilities, with a further **£349k** in PGR student provision.

Income

Competitive External Funding

The FIC secured **£5.5 million** in research income during the period, including £1.1 million from the European Regional Development Fund for the HELIX project (**Lloyd**). International research collaborations yielded a further circa **£750k**, including: the European-funded FRAILOMIC project (£400k from a total funding of £11.9 million; **Erusalimsky**) to identify biomarkers for diagnosis and prognosis of aging-related frailty; a Horizon 2020 / Marie Skłodowska-Curie Actions project (€252k; **McDonnell**) in collaboration with Columbia University, New York, USA, to support the transformation of methods to assess blood pressure and haemodynamic monitoring in patients fitted with a left ventricular assist device (LVAD); and, the Rights, Equality and Citizenship (REC)

funded Light4Violence project (£100k; **Bowes**) to support work with schools and young people across Europe to reduce domestic violence and help build healthy relationships.

We were also successful in attracting over **£1.5 million** through **19** knowledge transfer projects (KESS 2). This included a **£380k** contribution from external partners that enabled employees to undertake innovative research projects that address organisational need, underpinned by original research. For example, projects with the Welsh Blood Service to increase the shelf-life of blood components for transfusion (**James P**) and to improve blood donation in young people (**James D, Seage**), and with Micro Pharm Ltd to develop an anti-TNF antibody (**Morris**).

Government funding of **£307k** through Health & Care Research Wales, established: The Stroke Hub Wales (£240k; **James P**), a coordinated network and central resource that facilitates stroke-related R&I across Wales; and the GP Ability study (£50k; **Lewis JE**) to pilot peripheral arterial disease screening in diabetic patients attending GP surgeries across all seven Health Boards. Research funding for the development of healthcare professionals totalling **£141k** included: five Research Capacity Building Collaboration (RCBC) PhD (podiatry, pharmacy, dietetics, and occupational therapy); one MPhil (podiatry); and three 'First into Research' (pharmacy, dietetics, and podiatry) Fellowships.

Further funding, totalling circa **£700k**, was secured through charitable bodies. This included: a British Heart Foundation project (£210k; **James P**) that first identified the presence of adipocyte-derived vesicles in the human circulation; Jane Hodge Foundation (£156k; **Jenkins**) and Waterloo Foundation (£130k **Jenkins**) funding to investigate the role of Manuka honey in the management of respiratory infections in cystic fibrosis; two Tenovus funded projects (£50k; **Evans**) to evaluate the acceptability of food-safety and nutrition interventions for carers of chemotherapy patients; and, the Sir Halley Stewart Trust (£50k; **Beeton**) for the development of a rapid, cost-effective point of care diagnostic test for the detection of *Ureaplasma* infection among preterm neonates.

Funding was also secured through contract research and knowledge transfer activities with industry. For example, The Centre for Health, Safety and Environment secured circa **£315k** to monitor and mitigate potential risks to the health of workers following exposure to bioaerosols at waste treatment facilities (i.e., Energy from Waste, Mechanical Biological Treatment, In-Vessel Composting and Waste Transfer Station).

Competitive Internal Funding

We also secured **£356k** in the REF period through several internal University competitive funding streams and pump-priming initiatives:

- *Get Started* (£31k) seed corn funding aimed at early career researchers, which **Beeton** (£1.6k, 2015) used to develop his research to secure Halley Stewart Trust funding (£50k);
- *Accelerate* (£21k) funding to aid early career researchers with grant submission that **McDonnell** (£2.8k, 2015) utilised to nurture his 'HIT LVAD' research, which in turn resulted in securing Marie Skłodowska-Curie Actions funding (€252k);
- *Research and Enterprise Investment Fund* (£77k) to support promising research ideas to bring them to fruition enabled **Lewis JE** (£14k, 2015) to develop a diabetic foot screening trial that led to WG Health & Care Research Wales funding (£50k) for the national diabetic screening intervention (which expanded internationally, to form an impact case study for the current submission).

We have also invested circa **£100k per annum** from our R&I budget to help achieve specific School strategic priorities. Approximately £50k was used for matched funding to support competitively awarded pilot projects. An innovation small grant scheme (circa £20k per year) and research pilot scheme (circa £30k per year) supported intellectual property protection; teaching replacement; equipment purchases; and external engagement activities. Projects benefitting from these early start-up monies (**Erusalimsky, Evans, Kelly, Lewis JE, Maddocks**,

McDonnell, Zhao) have all developed into full, impactful research programmes. In addition, we provided match-funding for external part-funded PhD Studentships. For example, up to 50% funding was awarded to two successful *Coleg Cymraeg Cenedlaethol* (CCC) PhD Scholarships (£30k).

Infrastructure

The infrastructure in place at University and School level has been integral to us realising our strategic priorities. Responsibility for leading and fostering research within Health Sciences lies with the ADR (**James, P**) who, in conjunction with the School's Executive Management and Planning Team, is responsible for operationalising the School's strategic priorities for research, driven by the University strategy (2018-2023). Health Sciences also has an Associate Dean Innovation (ADI; **Sykes**) who, works closely with the ADR to coordinate R&I strategy and governance. Advised by a strong team of senior staff, including a Graduate Studies Coordinator (**Mercer**), a HTA Designated Individual (**Kelly**) and a REF Coordinator (**James, D**), research is integral to our strategic planning processes. This is operationalised through research group leads, individual staff performance reviews and annual monitoring through the setting and reviewing of key R&I targets (i.e., Measures of Success). A School R&I Committee is responsible for overseeing all R&I related activities including policy, strategy, facilities, operations, and performance. The Research Degrees and Ethics Committees feed into the R&I Committee. A pan-University R&I Committee, chaired by the PVC R&I is responsible for overseeing all University R&I activities and is supported by a centralised Research and Innovation Services (RIS) Unit.

R&I and Technical Support Staff

We have a well-established infrastructure for supporting R&I. A dedicated R&I Manager coordinates administrative and governance support, providing advice and assistance to staff and PGR students on ethics approval, research funding and research governance processes. The R&I Manager is supported by two additional administrative staff who have principal responsibilities for finance / budgets, and ethics / REF, respectively, and who provide a range of services to staff in support of their R&I activities.

We also have a Technical Support Unit consisting of eleven FTE staff, four of whom are dedicated to R&I projects. Technical staff also provide support to the HTA Licence Designated Individual (**Kelly**) and Person Designate (**Duggan**) to operationalise a robust human samples quality management system.

Capital Investment

The strategic allocation of capital funding (circa **£400k per annum**) is central to us achieving our research priorities. This includes purchase of new equipment, for example £70k on a new Cytoflex Flow cytometer, a £32k Nanoparticle Tracking Analyser (Malvern NanoSight Ltd) and a £35k Microplate Reader (BMG Labtech Ltd). We dedicated £60k per year for maintenance of existing IT resources, £50k for the maintenance of scientific equipment and £25k to matched funding for laboratory costs during the period.

Our commitment to the next generation of researchers is illustrated in the increased investment of School funds into our PGR cohorts. Between the beginning and end of the REF period, we increased our annual investment in PGR students **2.5-fold** (Table 3), with an overall investment of **£349k** since REF2014. Importantly, £500 per year is ring-fenced for every PGR student for personal development activities such as attendance at training events or presenting their research at academic conferences.

Table 3: Health Sciences Investment for PGR Students

Financial Year							Total
2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	REF-period
£22,394	£32,275	£56,417	£59,022	£56,454	£68,201	£54,710	£349,473

Facilities

Since 2014, our research environment and facilities have been strategically enhanced through capital investment, for example, the refurbishment of bespoke Biomedical Sciences (£350k) and Dental Technology laboratories (£70k). This builds on considerable investment during the latter part of the last REF period where purpose-built specialised R&I units were co-housed in adjoining units. The benefits of co-localisation have gained considerable traction during the current REF period. For example, the FIC has a Sensory Analysis Suite, a fully equipped Simulated Food Production Plant, and an Observation Kitchen to facilitate video recording of food hygiene / preparation which acts as a catalyst to bring together expertise across food manufacture, product design and food science technology.

The Health Assessment Suite, a purpose-built facility comprising a reception area, a clinical laboratory, and consulting rooms, are in close proximity to the Biomedical Sciences research laboratories. With patient safety in mind, the facility is located with easy access for the elderly, those in wheelchairs or those requiring ambulance transport. Since 2014, the facility has supported the successful completion of **10 clinical trials**, including a COVID-19 antibody screening trial (**740 staff**) initiated in March 2020 in response to the global pandemic. Overall, the Health Assessment Suite has facilitated the participation of circa **5,700** individuals (both patients and public) in R&I projects. This is in addition to hosting specialist podiatry, speech and language therapy, and complementary healthcare clinics. The facility comprises:

- the Wales Centre for Podiatric Studies, delivering eight NHS podiatric clinics per week, a Gait Laboratory, Orthotics Laboratory and the Anatomy and Physiology Skills Laboratory to support podiatric research (**Curran, Gwynne, Lewis JE**).
- a Clinical Cardiovascular Facility, with state-of-the-art equipment to assess the complex interactions between cardiac, large artery, small artery, microvascular structural and functional measures of circulatory health. Clinical trials completed within this cycle include ARCADE (**150** chronic obstructive pulmonary disease patients), ACCT (**250** hypertensive patients), AMUS (**250** healthy ageing individuals), and Health MOTs (circa **500** staff and members of the public) (**McDonnell**).
- a Clinical Simulation Suite provides researchers with a small-scale representation of a hospital ward. It houses clinical consultation / observation rooms, a mock ward area, clinical laboratory and computer monitored simulation manikins. The area is fitted with cameras and recording equipment which facilitate the observation and study of communication / counselling skills, infection control, hand hygiene, and training in Good Clinical Practice (**Evans, Fairchild**).
- the Complementary Healthcare Suite includes two bodyworks treatment rooms that supported over **800** appointments per year, with around 50% at the reflexology clinic. Three funded feasibility studies into breast-cancer-related lymphoedema, recruited **36** women with post-mastectomy lymphoedema (**Whatley**).
- the Speech and Language Therapy and Hearing Science Laboratory contains a full range of speech recording equipment and audiological facilities, with recent WG funding for an advanced computer with Artificial Intelligence technology. Currently, more than 600 clinical data points have been collected from **300** children with otitis media with effusion (OME) which is being used for developing machine learning tools that will enable automated diagnosis of childhood OME. The laboratory is also regularly used for speech perception and production experiments, such as a recent accent perception study involving **75** participants (**Mayr, Zhao**).

R&I Biomedical Research Laboratories are purposely distinct from the Teaching and Learning Laboratories and house specialist laboratory space for nine principal investigators (**Adams, Aicheler, Beeton, Erusalimsky, James P, Livingstone, Maddocks, Morris, Webb**). They include a purpose-built tissue culture facility, licenced human tissue freezer bank, chemical analysis suit, and laboratory space for R&I projects. These provide support for core techniques, with most analyses undertaken in-house. The Psychology Postgraduate and Research Centre (PARC), a purpose-built suite of dedicated research cubicles, and an observation / focus group room are utilised by a wide range of qualitative researchers across the University (**Clayton**,

Etheridge, James D, Mercer, Phillips, Rhys). Designed to carry out cognitive and psychophysiological investigations, the PARC also facilitates quantitative research that employs techniques such as eye-tracking and contains hardware / software for physiological experimentation for example, BIOPAC, Open Sesame and E-Prime (**Hodgetts, Perham, Watt**).

Researchers in Health Sciences also benefit from the use of other specialist facilities, both within the School and across the University. Examples include:

- a purpose-built School Biomechanics Research Facility, an enhanced physiology laboratory for software analysis of cardiac and vascular mechanics, respiratory analysis equipment for cardiopulmonary exercise tests and equipment for a new cardiac rehabilitation centre. These facilities enhance our cardiovascular physiology research capability.
- in collaboration with the University's International Centre for Design and Research, our Dental Technologists have made use of 3D design and manufacturing technology to design bespoke maxillofacial implants.
- the **£147k** Perceptual Experience Laboratory, a mixed reality laboratory that can simulate real world environments using immersive sound, smell, temperature, and vision, and which enables FIC researchers to investigate consumer behaviours.

External strategic alliances have also facilitated access to a wide range of world leading facilities, for example: Columbia University Medical Centre, New York, USA (**McDonnell**); Washington University, Washington, USA (**Maddocks**); Zhejiang Chinese Medicine and Sichuan Universities, China (**Zhao**); Cardiff University's Brain Research Imaging Centre (**McDonnell**), Centre for Neuropsychiatric, Genetics and Genomics (**Kelly**); and Rheology Centre, Morriston Hospital, Swansea (**James P, Morris**). Additional alliances enabled us to benefit from the loan of thermal imaging equipment from London Fire Service for tracking lymphatic fluid movement for reflexology research (**Whatley**). We also benefitted from a collaborative research agreement with Baker Technologies to beta-test and house hypoxia chambers within our R&I facility. Moreover, we loaned two state-of-the-art Polymerase Chain Reaction (PCR) instruments to the Government to run COVID-19 PCR-tests at its Centre in Milton Keynes.

4. Collaboration and contribution to the research base, economy and society

Health Sciences has collaboration at its core and fosters a thriving network of national and international partnerships to engage in world-leading research. Our global reach across **172** different projects extends to **56** different countries (73 Europe, 35 Asia, 28 Americas, 19 Oceania, 17 Africa) during the census period. Our research makes a substantial contribution to the economy and society through our high-quality impactful research and agile infrastructure, which is responsive to our partners' priorities and public health challenges. For example, in response to the COVID-19 pandemic in March 2020 we secured two *Sêr Cymru*⁵ research projects: COPE-Cymru exploring public perceptions of the pandemic and impact on health-related behaviours (**Phillips, Crone, Hallingberg, James D, Perham, Seage, £102k**); and the impact of COVID-19 on the effectiveness of angiotensin-converting enzyme (ACE) inhibition in patients with hypertension (**McDonnell, £98k**).

Collaboration / Partnership

Underpinned by our strong commitment to and established track record in applied science and allied health disciplines, we are strongly integrated within a large network of external stakeholders, enabling our research groups to nurture high-quality, outward facing, impactful, collaborative, and interdisciplinary research. These partnerships broadly encompass a) industry, b) healthcare, and c) academic institutions, all of which have direct influence on society, public health, policy, and government.

⁵ Ser Cymru is part funded by the European Investment Structural Funds (ERDF- European Regional Development Fund)

a) Industry

FIC's membership of the prestigious European Institute of Innovation and Technology (EIT Food), Europe's leading food innovation initiative, enables access to some of Europe's leading food industries and Universities for collaborative research. The Centre has collaborated with numerous partners including the International Association of Food Protection, 3M, Food Standards Agency, and Institute of Grocery Distribution. As an example of one of FIC's funded projects, HELIX delivered circa **150** interventions *per annum* within food companies (**Evans, Lloyd, Redmond, Tatham**). Further contributions of this programme are summarised in Table 4.

Table 4: HELIX Project Outputs

Indicator	Number
Jobs safeguarded	1120
Jobs created	214
Participants in training	234
New products	305
New markets accessed	129
New companies supported	64

Wider examples of our R&I collaboration with industry partners are evidenced by the global 'May Measurement Month', a blood pressure screening initiative (**McDonnell** is the British and Irish Hypertension Societies UK and Ireland lead) funded by Servier Pharmaceuticals™, Omron Healthcare™ and the International Society of Hypertension and supported by the British Heart Foundation. Recognised globally for fostering understanding of hypertension prevalence and management worldwide, between 2017 and 2019, **22,000** members of the public from the UK and Ireland were screened as part of this study. More recently and in response to urgent societal need, a collaboration with Confirm BioSciences (USA) and the Specialist Virology Centre (University Hospital of Wales), initiated a COVID-19 antibody testing programme of research across the University to identify thrombotic risk in **740** asymptomatic staff (**James P**).

b) Healthcare

Our primary collaborating partner and key stakeholder is the NHS, where we serve as an enabling academic partner for conducting robust research. This has yielded **six** Honorary Appointments / Visiting Professors for NHS employees to undertake research at our University. Two of our clinical research staff have also been awarded honorary clinical contracts (**Lewis JE** podiatry, **Stubbings** psychology).

Our staff (**James P, Matthieson**) are members of Partnership Boards (*Cwm Taf Morgannwg, Aneurin Bevan, and Velindre University Health Boards*), integral to developing successful, translational research. Crucially, this supports the award of WG's 'University' status for these organisations. Furthermore, membership of the Welsh Wound Innovation Centre (**James P**, Board Director) and Welsh Blood Service have yielded partnership agreements, strengthening existing research collaborations. Successful outcomes of our range of partnerships include **nine** PhD / MRes studentships. We have also contributed to Health Board activities across community dentistry (**Lewis J**), dietetics (**Squire**), applied psychology (**Heggs, James D, Seage**) and podiatry in relation to wound healing in the diabetic foot (**Lewis JE**). Lewis' work is integral to the Wales Centre for Podiatric Studies, based in Health Sciences, where other research activities include assessment of foot-type, foot-function, and their relationship with proximal musculoskeletal pathology (**Curran, Gwynne**).

Stroke Hub Wales, funded by the WG, is a coordinated network and central resource led by and based in Health Sciences (**James P**). This Hub facilitates support for stroke research and communication between Wales' seven Health Boards, Wales Ambulance Services Trust, and all Welsh Higher Education Institutions. The Hub has set up a stroke-specific Public & Patient Involvement (PPI) Group that links research to patient and public understanding for co-production, attended by **65** individuals and runs monthly.

Public health and wellbeing policies and practice are central tenets of our research activity, nationally and internationally. Examples include:

- Research focussed on social prescribing (art, physical activity) for health and wellbeing (**Crone**) has had direct impact on practice and policy, resulting in commissioning of bespoke interventions. This has resulted in representation on expert advisory panels for Public Health England's 'Every Mind Matters' campaign and a Canada-wide initiative for the development of national guidelines for the use of physical activity for people with depression.
- Research within forensic settings (**Bowes, De Claire, Watts**) has informed the management of alcohol-related violent behaviour in prisoners and attachment styles of adults in secure mental health care settings. The Rights, Equality and Citizenship (REC) funded Lights4Violence project worked with schools and young people across Europe to reduce domestic violence and help build healthy relationships.

c) *Academic Institutions*

Our staff have collaborated with **105** Universities outside of the UK, across all continents, during the census period, often in partnership with other agencies. For example, our world-leading FRAILOMIC research partnered a consortium of six European Universities, the WHO, two world-leading research centres, seven small and medium-sized enterprises and four hospital-based research groups and resulted in the discovery of a frailty prognostic indicator [patent WO2020/01235152A1] (**Butcher, Erusalimsky**). In addition to this is the European Cooperation in Science and Technology (COST) funded Vascular Ageing Network including academic institutions from across **35** countries globally, to refine, harmonise and promote the use of vascular ageing measures in clinical practice (**McDonnell**). We also collaborated with:

- University of Washington, Seattle, USA, on a programme of research to develop novel topical antimicrobial treatments for chronic wound infection (**Maddocks**);
- Bond University, Australia, to develop High Intensity Interval Training protocols to reduce cardiovascular risk (**Adams**);
- University of Western Australia, Perth, on using an ovine model to understand the impact of *Ureaplasma* infection *in utero* and examining possible novel treatments (**Beeton**).
- Middle Eastern and African Universities to develop sanitation and hygiene practices to reduce diarrhoea occurrence among schoolchildren (**Karani**);
- Zhejiang Chinese Medicine University and Sichuan University, China to test the application of machine learning to predict noise induced hearing loss (**Zhao**).

We also engaged widely in research with Wales and UK-based Universities, including:

- Cardiff and Swansea Universities, a collaborative Cardiovascular Research Network Wales programme in vascular disease, arrhythmia, and large patient databases (**McDonnell, James P**).
- Cambridge University, three large-scale hypertension clinical trials; The Anglo Cardiff Collaborative (ACCT), The Assurance Medical and Underwriting Society (AMUS), and The Ancestry and Biological Informative Markers for Stratification of Hypertension (AIM-HY) (**McDonnell**).
- Bournemouth University, on the use of a virtual reality app for simulation of dementia to help podiatry students understand its impact on gait (**Curran**).

Contributions to Research Base and Society

Our staff contribute to the wider research base through board memberships and advisory roles with policy makers, research governing bodies and beneficiaries. Examples during the census period include:

- **Sykes** played a key role within the WHO-Collaborating Centre for Chemical Incident Management, undertaking research and development into the public health implications of maritime chemical incidents. Sykes was also Chair of Waste Industry Safety and

Health (WISH), the Bioaerosol Sub-group of WISH and the National Resource Wales Universities Wales Research Group.

- **McDonnell** is Vice-Lead and the Ambassador for Wales for the Global Vascular Ageing Network.
- **Lloyd** is Vice-Chair of the Welsh Food and Drink Industry Board which advises the Minister for Environment, Energy and Rural Affairs (MEERA). Lloyd also provided strategic direction for the Welsh Food and Drink Industry Strategy and headed a review of the sector's 'operational health' during the initial COVID-19 outbreak. Lloyd was also commissioned by WG on behalf of MEERA to lead a COVID-19 Food Clusters taskforce resulting in several industry-driven interventions to support the recovery of the food sector as a result of the pandemic.
- **Adams** is Vice-Chair of both the Engineering Subject Panel and Food Sustainability Panel of the European Commission Research Executive Agency.
- **Seage** provided expert review for the NICE pre-referral briefing for the treatment of Pernicious Anaemia.
- **Crone** is a Non-Executive Director for Public Health Wales.
- **James D** is an Expert Member of NHS Wales Research Ethics Committee.

Over **40** members of staff contribute to professional bodies and learned societies and are recognised for substantive contributions through Fellowships and elected Memberships. For example:

- Fellows: **Erusalimsky, Adams, Webb** (Royal Society of Biology), **James D** (Royal Pharmaceutical Society), **Maddocks** (Institute of Biomedical Sciences), **Mercer** (British Psychological Society), **Sykes** (Chartered Institute of Environmental Health)
- Honorary Fellows: **McDonnell** (Australian School of Advanced Medicine, Sydney, Australia and Columbia University, New York, USA – one of eight Ivy League Schools in the USA and a Global Top 15 University).
- Honorary Academic Positions: **Lewis JE** (Senior Lecturer, School of Medicine, Cardiff University; Clinical Academic, Cardiff & Vale University Health Board), **James P** (Professor, Dartmouth Medical School, USA; Professor Adelaide Medical School, Australia), **McDonnell** (Adjunct Professor, Columbia University, New York, USA) and **Morris** (Professor, Swansea University).
- Reference Group Membership: **Adams** (WEFO European Expert Group; International and Cross-Border sub-group; Welsh Assembly Cross-Party Group for Medical Research) and **Lewis JE** (International Working Group for Diabetic Foot).
- International Network Memberships: **Karani** (Qatar Ministry of Defence and Ministry of Interior), **Thirlaway** (Banco Santander W30 Program, University of California) and **Kelly** (Network for European CNS Transplantation and Restoration).
- National Research Network Membership: **Bowes** (Offender Health Research Network Cymru), **Phillips** (Health Psychology Exchange National COVID-19 Group; Public Health Wales Physical Activity and Nutrition Network), **Thirlaway** (Wales Public Health Improvement Research Network) and **Watt** (Offender Health Research Network Cymru).

Further evidence of contributions made by staff and their research standing is evidenced by the following indicators of esteem (Table 5):

Table 5 – Staff Contributions to Wider Research Base

Indicators of Esteem	Count
Journal Editor / Associate Editor	9
Journal Editorial / Advisory Board Memberships	26
Journal Reviewer	169
PhD External Examiner	96
The Conversation UK Authorship	66
Referee for Research Grants / Funding Bodies	44
Membership of Boards of External Advisory Bodies	29
External Research Committee / Society Membership	44
Invited Keynote Lectures / Symposia	74
Books / Book Chapter Authorship / Editorial	19

Our staff are sought to provide expert review of grant applications for prestigious funding bodies such as: Medical Research Council (**Adams, Erusalimsky, Green, Kelly, Zhao**); Wellcome Trust (**Adams, Erusalimsky**); British Council (**Adams**); National Institute for Health Research (**Morris, Zhao**); Economic and Social Research Council (**Thirlaway**) and British Heart Foundation (**Erusalimsky, James P**). Further evidence of our staff's international standing and contribution to the research base is reflected in the number of invited keynote addresses and presentations. Staff have delivered over **70** keynote lectures during the census period, most at international conferences, including: **Beeton** (European Mycoplasma Conference, 2019), **Maddocks** (International Meeting of Antimicrobial Peptides, 2015) and **Zhao** (Pacific & Asia Speech, Language and Hearing Conference, 2015). A further **nine** staff have hosted or served on the organising or scientific committees of a wide range of international and national conferences, including: **James P** (Chair, International Nitric Oxide Society Conference, 2018); **Crone** (EU International Congress Physical Activity and Public Health, 2018); **Mayr** (International Congress of Phonetic Sciences, 2019); and **McDonnell** (Asian Pacific High Blood Pressure Congress, 2019). Furthermore, **Lloyd** hosted a visit from Hu Chunhua, Vice-Premier of the People's Republic of China (2019).

Our wider influence is evidenced by contributions to outreach and research communication activities, which include:

- our seven STEM Ambassadors (e.g., **Blaxland, Kelly**) engaged with schools regularly to promote STEM subjects, while as part of Soap Box Science, **Maddocks** contributed to public outreach events promoting women in science.
- our staff (e.g., **Aicheler, James, D, James P, Kelly, McDonnell, Seckam**) hosted quarterly public engagement events, with over 100 attendees, including: clinicians, researchers, patients, carers, and members of the public.

Awards

Staff have been the recipients of a number of prestigious awards, including: **Phillips** (winner of the paper of the year award, Royal College of General Practitioners, 2019); and **Lewis JE** (winner of the Excellence in Patient Care International Category, Royal College of Physicians, 2018). Examples of our Doctoral student awards are: **Samuel** (Rising Star Award, Chartered Institute of Environmental Health Excellence, 2018); and **Burnley-Hall** (The Ian Williams Prize, Welsh Cardiovascular Society Annual Meeting, 2017).

Media Influence

Our staff use a variety of traditional and non-traditional platforms to disseminate their research. Underpinned by their subject-area expertise, **35** staff published **66** papers for The Conversation UK which together have been read over **2.5 million** times. Five articles resulted in subsequent international and national media attention (e.g., **Seage** – Radio Sydney, **Evans** – BBC Radio). Other staff have provided invited expert opinion for television news and current affairs programmes. For example, **Evans** and **Lloyd** on food safety (BBC; ITV), **Green** on manic depression (BBC's Newsnight), **Karani** on land reclamation and marine environment (Qatar TV,

reported in Arabic and English newspapers), and **Perham** on the effect of listening to music on reading and comprehension (BBC Radio Scotland; BBC Radio Wales). Our staff have also contributed to national and international print media, for example **Adams** on the impact of microplastics found in the food and water system (The National, UAE).

Our supportive and enabling environment provides a sustainable and vibrant platform for achieving high-quality impactful research that has global reach. Over the period, this has ensured that Health Sciences has a culture in which research and researchers thrive, and make a significant contribution to the research base, economy, and society.