Institution: University of Brighton

Unit of Assessment: A3 – Allied Health Professions, Dentistry, Nursing and Pharmacy

1. Unit context and structure, research and impact strategy

1.1. Context and Structure

This joint submission, between University of Brighton (UoB) and the Brighton and Sussex Medical School (BSMS), represents a sustained history of returning healthcare research from the two universities of Brighton and Sussex (UoS). UoB has submitted to the current A3 subject boundaries since RAE1992. BSMS, a joint venture between UoB and UoS, was established in 2003 and made a joint A3 submission with UoB in REF2014. Our REF2021 submission reflects a strategic decision to grow the volume of our researchers in the health sciences and integrate further across the two universities. It comprises researchers from three schools: Pharmacy and Biomolecular Sciences (UoB, 36.1 FTE), Health Sciences (UoB, 20 FTE) and BSMS (UoS 63.9 FTE). The research presented cuts across school boundaries and illustrates a 'translation continuum' from fundamental laboratory-based pharmacy and biomedical science to intervention development and the translation of health research findings into practice.

Our research and impact are underpinned by leadership and operation of significant research infrastructure across the health sciences, including: leading three of the eight workstreams in the £9m Kent, Surrey and Sussex NIHR Applied Research Collaboration (ARC) (with £1.7m to UoS); hosting and directing the £1.6m NIHR Research Design Service (RDS) South-East; leading the prestigious Wellcome Trust Brighton and Sussex Centre for Global Health; hosting the Sussex Health Outcomes Research and Education in Cancer (SHORE-C) and the Clinical Imaging Sciences Centre (CISC). This research infrastructure has allowed us to grow and internationalise our research in infection, dementia, ageing and health systems, lead programmes of co-produced research on reduction of barriers to health services for the homeless, sexual minorities and other vulnerable populations in the UK, and has stimulated research partnerships with the NHS to deliver priority research.

The cross-institutional health-related research returned in this submission focuses on four themes:

- ***Ageing and dementia*** - data informed care and biological aspects of ageing and stress, dementia, patient centred care, medicines optimisation [20.30 staff FTE; 28 current and graduated PGRs].
- ***New technology and devices in healthcare*** - innovation in biomaterials, applications in wound care, chronic diseases, neonatal care, new medical device development and technological applications [12.30 staff FTE; 42 current and graduated PGRs]
- ***Disease and chronic conditions across the lifespan*** - rehabilitation, cancer and survivorship, quality-of-life improvements in chronic diseases [47.75 staff FTE; 42 current and graduated PGRs]
- ***Public health, policy and ethics*** - whole-community resilience, public health interventions for health inequalities, neglected tropical diseases, biomedical ethics [39.65 staff FTE; 33 current and graduated PGRs]

These themes, reflect regional, national and international priority research agendas, and draw on researchers with a mix of clinical, professional, applied and practice-based expertise.

1.2. Research and impact strategy

1.2.1. Achievement of research aims set in REF2014

Guided by a thematic approach to focus effort, our five strategic aims addressed during the REF2021 census period were to:

Aim 1: Translate fundamental scientific knowledge to practice with development of new interventions and technological innovations - through our theme on new technology and devices we are actively translating our fundamental science into practical applications such as

Santin's work on functional biomaterials for clinical diagnosis, **Patel** and **Yeoman**'s sensors for faecal incontinence diagnostics, **Dymond** and **Sandeman**'s research on nanomaterials in intraocular lenses, **Macfarlane'**s portable microgravity system for islet transportation, and contributions to porous polymers for new medical device technologies by **Sandeman** and **Savina**.

Aim 2: Engage with national and international priorities and initiatives - in response to the UK's ageing society Grand Challenge, **Daley** and **Wright** are co-investigators in the £1.2 million *Time for Dementia* (TfD) healthcare programme, which increased the number of students receiving TfD training from 764 to 4181 across 5 HEIs since its 2015 inception; **Farina** is a major partner in the UKRI GCRF STRiDE Project contributing to new understanding of the impact and cost of dementia in seven LMIC countries and **Galvin** leads the €4.3m H2020 MSCA ITN INNOVATEDIGNITY project to train the next generation of leaders how to implement dignified sustainable care for older people.

Aim 3: Promote an active and multidisciplinary research culture – our underpinning ethos is to drive collaborations across both institutions supported by infrastructure and underpinning institutional investments (REF5a(s)). Interdisciplinary projects involve staff across our themes eg **Allan, Ferns** and **Santin**'s work on cardiovascular stents, **Flint**, **Jenkins** and **Shilling**'s cancer and stress project, C-Stress. Cross-disciplinary sensory neuroscience collaborations between **Lukashkin, Levic** and **Russell** have demonstrated how hearing loss can be reversed, and its onset halted, through new genetic insight about the auditory system which has also led new ways to deliver drugs to the cochlea. Research success is celebrated through annual award ceremonies as well as newsletter, podcasts, public lecture series and blogs. Researchers engage in multiple cross-institutional events such as 'Sussex Impact Day' and annual 'Festivals of Doctoral and Postgraduate Research'.

Aim 4: Develop public engagement to promote and disseminate our research – we enabled diverse initiatives, for example, **Dean** led a project that produced a toolkit for universities to develop and promote novel public engagement (UKRI, £107k). As former Chair of the British Society for Research on Ageing, **Faragher** gave evidence to the House of Lords Science and Technology Select Committee on healthier living in old age (2019). UoB-UoS jointly hosted the British Science Festival in 2017, with 18,500 attendees, where six submitted staff shared their research at public events across Brighton. Events ranged from a demonstration of gold nanoparticles for diagnostic medicine by **Cragg** to a panel discussion on personalised medicine hosted by **Mukhopadhyay**. The *Brains at the Bevy* initiative, supported by UoB's Community University Partnership Programme, has featured public talks from **Dean, Faragher, Flint, Patel, Shahvisi** and **Yeoman** in a Community-run pub. The initiative was highly commended in the Universities Association for Lifelong Learning awards 2017.

Aim 5: Prioritise research through four thematic areas – to better reflect our cross-institutional ethos we created four thematic research groups to stimulate interdisciplinary work and facilitate focused research effort. Our research encompasses the spectrum of health-related science from biochemistry of disease through the effects of treatment in animal models to interventions in patient behaviour and tools to assess clinical outcomes. We have launched and lead the Brighton and Sussex Clinical Trials Unit (BSCTU), the NIHR ARC and a Joint Clinical Research Office (JCRO) (Section 3.1.1) to extend clinical research, and our thematic strategy guides our translational chain of research endeavour allowing us to respond to complex challenges in our four priority areas.

1.2.2. Success and achievements in priority research

Example achievements and intellectual contributions include:

Ageing and dementia – research in the broad area of age-related conditions address the governmental Grand Challenge on ageing and resulted in:

- a programme for prevention and management of frailty in older people with HIV, by which **Levett, Vera** and **Wright** generated a new screening model through a multidisciplinary partnership with increased research capacity in ageing and HIV in Zambia.

- **Suddick**'s use of patient-led knowledge for stroke care, **Galvin**'s process to enhance dignity in services led by older people, resulting in a new assessment tool (HCAT), **Kersten**'s development of new models for person-centred care for service delivery and fatigue management in multiple sclerosis.
- the first validated tool to predict the absolute risk of an older person experiencing medication related harm (MRH) post discharge, PRIME, developed by **Ali** and **Rajkumar** with data from 1,280 older adults across five NHS organisations, contributing to the WHO campaign to halve the incidence of MRH by 2022.
- **Farina** and **Daley**'s freely available C-DEMQOL research instrument, produced to measure awareness of dementia and its impact on carers.
- **Middleton** and **Jones**'s research on the neglected burden of infectious disease in UK care homes, highlighting links between dementia and transmission, cited by the working group advising SAGE on Covid-19 care home outbreaks, contributing to production of national Covid-19 guidelines.

New technology and devices in health care – we are exploiting the potential of our basic research including at the macromolecular level to develop new medical devices and propose interventions, for example:

- through multicentre FP7- ACROBAT IAPP and NIHR-i4i-ADEPT consortia, nanoengineered biomaterials have been developed by **Sandeman** and **Savina** to remove bacterial toxins and inflammatory molecules from biological media. This has informed the manufacture of clinical grade products by liver disease company Yaqrit Ltd for a clinical trial to treat patients with advanced liver disease, Impact Case Study [ICS_LiverDisease].
- peptides that mimic the body's natural biochemistry have been designed by **Santin** to bind stem and tissue cells for therapy and diagnosis; when added to hydrogel polymers, they stimulate stem cell differentiation and stimulate healing.
- through **Macfarlane**'s partnership with Cellon International, opportunities for diabetes care are being transformed through the first portable microgravity cell enhancement system, to transport islets to transplant centres, and the first perfusion microgravity cell culture system allowing real-time testing of islet function [ICS_Diabetes].
- a faecal pellet sensor has been created by **Patel** to monitor muscle dynamics during defecation, showing how chemical signalling in the gut changes with age leading to new evaluative methods in incontinence.

Disease and chronic conditions across the lifespan – we are making a difference through our multidisciplinary research culture through delivery of new understandings of the biochemical basis of disease, promotion of interventions and assessment of patient outcomes, for example:

- **Flint** discovered new links between cancer and stress that revealed stress hormones can reduce the efficacy of cancer treatments and that management of psychological stress can improve cancer patient outcomes.
- **Newbury**'s patented RNA biomarkers for myeloma, sepsis and motor neurone disease show how tumours migrate. This has resulted in a tool to predict which patients will not respond to current therapies to determine care options.
- through the Sussex Health Outcomes Research and Education in Cancer (SHORE-C), a major initiative concerned with psychosocial outcomes in cancer research, **Catt, Harder, Jenkins** and **Shilling** added a new process to the global FACIT measurement system, one of the most extensively used Patient Reported Outcome Measurement tools.
- our major studies have impacted the management of childhood conditions; **Dean**'s cohort study on diet diversity and allergy development in the first 10 years of life showed that hypersensitivity incidence dropped by 10% for each additional food introduced by six months and **Mukhopadhyay**'s study on prescribing asthma medication by genotype, involving 4,226 children, resulted in self-reported improvement of symptoms and changed guidance issued by the National Asthma Council in Australia [ICS_Asthma].

Public health, policy and ethics – we have sought to influence public health through national and international initiatives, to tackle socially determined inequalities while offering practical solutions for example:

- through a 'Universal Test and Treat' trial in South Africa, the impact of pre-treatment HIV drug resistance on virological outcomes, and guidance for groups at particular risk of low uptake, **Iwuji** informed new WHO guidelines on antiretroviral treatment for HIV.
- **Vera**'s one-stop clinical memory service, providing comprehensive management and monitoring of people with HIV and cognitive difficulties, has been implemented in UK, Japan, New Zealand and Zambia. **Vera**, with **Llewellyn**, have also contributed to UN AIDS 2018 targets being met in Brighton through a community located digital vending machine project.
- **Sherriff** with **Zeeman** informed a UK government inquiry, resulting in the UK Government 2018 LGBT Action Plan, and, in 2020, underpinned training recommendations in the first EU LGBTI equality strategy [ICS_HealthInequalities] and by leading policy change for the European harmonisation of bio-behavioural indicators used to monitor HIV/STI infections we improved care access and targeted interventions for disadvantaged groups.
- **Newport,** with **Deribe** provided the first accurate prevalence data for policy on stigmatising and disabling skin disease by mapping podoconiosis magnitude and distribution in Ethiopia; resulting policy changes enabled governments in Ethiopia, Rwanda and Cameroon to become first in the world to include podoconiosis in their long-term health plans and strategies.

1.2.3. Facilitating interdisciplinary research

Underpinning these research achievements, an ethos of interdisciplinary working is facilitated through our thematic approach, and initiatives such as cross institution 'sand pit' events promoting interdisciplinarity within intersections of health, arts, technology, ecology and sustainability. Collaborations with artists in residence, hosted in laboratories, investigating new concepts of 'body integrity' using electron microscopy and citizens' perspectives of innovation in implant and cell-based therapies, with subsequent public art installations and exhibitions. Collaborations allow MRI data to drive tissue engineered bioprinting of intervertebral discs; fluid dynamics to inform novel TB diagnostics, and fluid flow optimisation in bioartificial liver devices. Engineering and biomedicine combine to develop smart surfaces and 3D bio-printing platform technologies for personalised medicine.

Our five interdisciplinary themes at UoB (termed *Brighton Futures* – see REF5a) https://www.brighton.ac.uk/research-and-enterprise/organisation/brighton-futures/healthy-futures/index.aspx promote external partnerships, our *Healthy Futures* brings researchers and 50 businesses, local authorities and charities together every term to build innovations in healthy living. This initiative has resulted in the €4m EU-Interreg project EMPOWERCARE (**Galvin** and **Huber**) with 13 European partners (businesses, care industry partners, local government organisations) to co-create and test social and digital health solutions to address ageing societal challenges in the '2Seas' area. Our cross-campus interdisciplinary capability is further enhanced by shared use of Clinical Imaging facilities (CISC), Joint Clinical Research Office (JCRO), the NIHR RDS and ARC (Section 3.1.1) which forge interdisciplinary teams, including with the local NHS Trusts, and stimulate cross fertilisation of ideas.

1.2.4. Achievement of our strategic aims for impact since REF2014

1: Translate our research to deliver improvements to patient outcomes and care. Through patient and public experience informing our research problems, our researchers have changed clinical management: in paediatric asthma and eczema through a person-centred approach [ICS_Asthma]; by reducing risks of pre-term death with delayed cord clamping in preterm births [ICS_DelayedCordClamping]; by providing new choices in breast cancer treatment [ICS_PrefHER] and by improving outcomes for older people with hypertension [ICS_Hypertension].

2: Diversify our research partnerships with healthcare industries, charitable organisations and NHS Trusts. Our ability to deliver societal benefits is dependent on extensive collaborations

with non-academic partners and industry. Partnerships with non-HEI entities are facilitated by Research Services, and access to university-based partnership hubs develop and sustain relationships with national and international communities and partners. (See Section 4.1, 4.2). For example, ICS_Hepatitis-C partnering local hostels, GPs, charity and industry; **Flint** and **Yeoman**'s collaboration with Age Concern, supported by Big Lottery funding, to evaluate the physiological impact of outdoor activity and recreational space to alleviate loneliness; and **Macfarlane**, with Public Health England, identified bacterial/cell molecular interactions allowing novel targeting of agents responsible for blockage and encrustation of urinary catheters, a clinical challenge costing the NHS £2.5 billion annually through innovation with industrial partners at Cellon and UKITC.

3: Increase the protection and exploitation of research outcomes. With Biocompatibles, a subsidiary of BTG (acquired by Boston Scientific), **Lloyd** established novel vandetanib-eluting radiopaque beads as a frontline tool to treat liver cancer [ICS_LiverDisease]. **Santin**'s two start-up companies in biomaterials capitalised on research outcomes during the census period: Tissue Click Ltd provides bespoke products enabling researchers to use in-vitro cell culture in applications related to regenerative medicine; Brighton Wound Dressings Ltd exploits two university patents on soybean-based biomaterials in wound dressings field and cosmetics in partnership with Xiangcheng Meilian Medical Technology, China. Commercially valuable intellectual property, such as **Newbury**'s miRNA diagnostic and prognostic biomarkers, is protected by patents. **Lukashkin**'s drug delivery method to the inner ear, and tissue-specific contrast agents, deriving from a recent PhD, which has been licensed to Novara Therapeutics Ltd.

4: Increase the volume of ongoing collaborative R&D to deliver new healthcare products to market. Our knowledge transfer support and innovation awards have resulted in: a novel HIV self-test vending machine, brought to market by **Vera** and **Llewellyn** with design consultancy Diptico that won a 2018 BMJ Innovation award; **Santin**'s Tissue Click Ltd secured an Innovate UK grant for a rapid, operator-friendly, cost-effective Covid-19 diagnostic kit and is negotiating IP licencing with a multinational company covering the UK, Europe and China; DC Bead® Technology is being used to treat liver disease [ICS_LiverDisease] in 250 hospitals across 18 countries with approximately 100,000 reported procedures; **Henry Joseph**'s recent product development of a nerve function testing device which is now in market testing for diagnostic efficacy in clinical settings.

Notable ICSs submitted to REF2021 have evolved from multi-agency partnerships built over 20 years with charities, NHS Trusts and health industry sector. We have improved the lives of people living with diabetes [ICS_Diabetes] with Cellon International; increased market infiltration of biomedical devices to improve patient outcomes [ICS_LiverDisease] with Biocompatibles UK; simplified the complex HCV care pathway [ICS_Hepatitis-C] with Gilead Sciences Ltd; improved physiotherapy regulation and practice in the private sector [ICS_Physiotherapy] with BUPA and Physio First; and improved management of asthma and allergy in children [ICS_Asthma] through an extensive network of GPs. Our aim has been to build on these successes through long-term, meaningful alliances alongside co-designed projects with local, regional, or international partners and communities. We scale-up knowledge generated through these engagements to transfer impact in other contexts. We brought value to local charities (eg diabetes support groups, Cancer Research UK patient Groups, Alzheimer's UK, Age Concern, Martin Fisher Foundation), and influenced NHS Trusts (eg improved psychosocial assessments and breast cancer treatment options [ICS_PrefHER]. Our research tackled societal challenges including health inequalities in Europe [ICS_HealthInequalities] and addressed HIV treatment guidance in South Africa and governmental policy in Ethiopia, Rwanda and Cameroon**.**

We reinforce routes to impact by targeted support at all stages of research by:

- developing researchers' skills and capacity to respond to funding opportunities through events (Introduction to Research Impact, Sussex Impact Day and the Sussex and Brighton Impact Awards), training, professional services support (with dedicated Impact Managers), focused networks targeted at all career levels including PGRs and our Impact Development Fund;

- facilitating the delivery of user-led research through established research/community/NHS partnerships where the public provide expertise through their own experience eg [ICS_Asthma], [ICS_PrefHER], [ICS_Diabetes];
- developing future innovators through PGR engagement in our thematic Brighton Futures; regular industry partner 'cafes', impact focused teaching programmes and School-based research impact days including external facilitation, such as with Fast Track Impact.

1.3. Future Research and Impact Strategy 2021- 2026

Capitalising on our disciplinary overlaps, we have identified five objectives to increase our contributions to society, to strengthen and expand our global influence, to develop our staff and increase our PGR base, facilitated by our staffing and staff development strategies (Section 2.1.1, 2.1.2):

Consolidate and support areas of excellence and grow new opportunities. We will capitalise on our infrastructure for new regional alliances (Section 3.1), their co-location and integration with health services benefits research through the whole translational continuum. We will integrate larger groups of A3 researchers and external partners which will enable us to secure large programme level funding to tackle related areas of enquiry under each theme. We will invest contract income and indirect costs from research in the Clinical Imaging Sciences Centre (including a planned substantial addition to the MRI scanning suite), establish mobile MRI scanning facilities in collaboration with the private sector and expand our custom-designed Brighton Genomics laboratory resources. The next REF period will see completion of the £485m 3Ts (Tertiary, Teaching, Trauma) development at the Royal Sussex County Hospital to provide clinical research facilities that will support our thematic research strengths.

Enhance our existing centres of excellence. Two new Centres of Excellence (COREs), STRAND and CRMD were established in 2017 while CDS and SHORE-C were consolidated. We will invest in this underpinning focus to deepen our research while expanding our global health and infection programmes through bids to NIHR, Wellcome Trust and other major international funders. This facilitates expansion to further LMICs in line with our strategy which saw matched funding of £1.9m and £1.1m received by NIHR-funded Units in Global Health (GHRU and 5S Foundation, respectively) as part of investment in capacity building. Quality-Related funds (QR) are focused through thematic calls, targeted pump-priming investments or to match fund large grants and consortium bids, enabling researchers to respond rapidly and at scale. To enhance our outreach, we will prioritise a range of research driven community and public engagement programmes with marginalised communities.

Respond to regional, national and international healthcare challenges through targeted research and impact in our areas of strength. Building on our existing research strengths, we will forge new opportunities where we can invest or exploit existing capacity to address key challenges that map against our areas of consolidated expertise, eg SHORE-C will adapt its work on optimising communication to emerging clinical pathways in cancer care catalysed by the Covid-19 NHS response. We will also optimise our knowledge exchange interface with NHS and NIHR, working closely with the Kent, Surrey, Sussex Academic Health Sciences Centre.

Support our researchers at all levels in developing and practising research and impact excellence in partnership with patients and the public. Our Centres of Excellence are drivers for increasing research capacity, partnerships and leading research programmes with central, School and A3 level initiatives offering key developmental support (eg targeted leadership development for black and minority ethnic and female staff, promotion workshops, universally offered externally accredited research mentoring, impact training and Impact Days). To add further value, we will increase our development opportunities to embed a broader and more inclusive approach to support all career levels of research excellence and mentor ECRs for development to PIs; all to achieve larger scale research with competitive funding and planned sabbaticals. We will grow the volume and diversity of our PGR cohort (Section 2.2) and systematically link ECRs and PGRs to a Centre or research team to support their development.

Enhance the dissemination of our research. Co-production of research with the public has always been central to enabling impact of our health research. We will develop our programme of research-led, public-facing events to raise the profile of health research in, for example, arts and social research through our Centre for Arts and Well-being. We will stimulate new partnerships in the creative sector and extend the reach and public relevance of our research through multiple cross sector partnerships. We will build on our membership of ARC to strengthen a stronger culture of co-production with local communities, such as the recent ARC support for a study to improve access by Nepali and Indian communities to relevant, credible and high quality Covid-19 information. We will continue to encourage researchers to work with patient and public panels supported by the NIHR RDS, Sussex Partnership NHS Trust and University Hospitals Sussex NHS Trust.

1.4. Open research environment

Positive action to share research findings and data in line with Open Access and Data Management policies includes, research bulletins, workshops, induction and training sessions offered across our institutions ensuring staff awareness of expectations, processes and support for open access and open science. Our staff access central university and school level open access budgets for high priority publications and where the Gold route can enhance impact. Of the 300 outputs from this Unit, 81.7% are open access over the full REF census period.
Research training workshops and communications encourage best practice to maximise ***reproducibility*** to our A3 focus. Pre-registration of systematic reviews with NIHR sponsored PROSPERO, of clinical trials in trial registries and of all study protocols is strongly encouraged. Extensive use is made of institutional repositories and pre-publication is encouraged, for example BSMS researchers published 34 preprints on medRxiv in 2019-2020 and 17 in bioRxiv in 2019-2020.

In support of open and collaborative science, depositing ***open data*** is strongly supported. Researchers comply with funder requirements to use Research Council repositories or archive data to make it available through the Brighton/Sussex Open Research repository. Staff have made 49% completed project data available through our, or external, repositories. Publication of computer coding, codelists, and other reproducibility tools is expected through repositories such as GitHub, if not available as appendices to scientific publications or archived in institutional depositories.

1.5. Research Integrity

Ethics and integrity are integrated within processes that ensure all researchers engage with University-wide policies and ethics management systems (described in REF5a(s)).
Researcher obligations are set out in both University's policies on Research Integrity and Research Ethics and procedures for Research Misconduct. Our research leads engage with Ethics and Governance Managers to promote the Research Concordat to support research integrity via workshops and awayday sessions. A dedicated research governance officer supports NHS Sponsorship applications together with the JCRO (Section 3.1.1), overseeing audit of studies where there is no external requirement (eg MHRA) and providing pre-review of applications to the Health Research Authority for approval of NHS research. Our codes of practice for storage of human tissue are aligned with the Human Tissue Authority.

The BSMS Research Governance and Ethics Committee also provides ethical review for all higher risk studies across UoS. At UoB, a three-tier ethics review system reflects a *Code of Good Practice in Research Guidance* and a *Guide to Good Practice in Research Ethics and Governance* which are reviewed regularly by the University Ethics and Governance Committee, approved by the University Academic Board. We operate a joint university 'pre-IRAS' ethics and governance review system, and all NHS-related research is reviewed by an NHS Research Ethics Committee following internal review. All researchers receive regularly updated training in GDPR. Postgraduate research student induction focuses on publication ethics including data storage, criteria for authorship, data fabrication and plagiarism. NHS based researchers undertake Good Clinical

Practice training, and complete NHS information governance training, through NHS and NIHR partners.

2. People

2.1. Staffing strategy and staff development

2.1.1. Staffing strategy

Supporting staff at all career levels is key to maintaining the vibrancy of our culture, research and impact. An inclusive environment that supports all staff to reach their research potential is underpinned by national frameworks such as Athena SWAN (BSMS and PABS hold Silver and SHS Bronze Awards), the Concordat Implementation Plan to Support Career Development of Researchers (which is now in its 10th year for both Universities), and the Race Equality Charter Mark (UoB holds a Bronze Award). This is evidenced through the diversity of the profile of Category A submitted staff. Of the 120.0 FTE staff: 25.1 FTE (21%) are Professors, 74.6 FTE (62%) mid-career and 20.3 FTE (17%) are currently ECRs; 59.1 FTE (49.3%) are female; 101.45 FTE (84.3%) are on T&R contracts; 13.8% work part-time in line with Flexible Working and Work-Life Balance policies and, of those declaring their ethnicity, 18% identify as Black, Asian and Minority Ethnic (BAME). This profile includes a gender-balanced staff composition (49.3% female and 50.7% male) compared with Advance HE sector average by subject (subject norm: 74.4% female), a lower proportion of part-time staff (sector norm: 43.1%) and aligns with the proportion of BAME staff in A3 subject areas (sector range: 7.8-19.1%). We integrate clinical academics and NHS-employed active researchers by a policy of encouraging medically qualified, category C staff to apply for honorary titles and/or contracts reinforcing robust research links with NHS partners through creation of an 'NHS faculty'. For BSMS this has resulted in a significant growth in our NHS 'Faculty' comprising 10 Professors, 8 Readers, 69 Senior Lecturers and 21 Lecturers since REF2014. Whist these are not included in REF2021 they have substantially increased our reach and collaboration with major partner Trusts to enhance research and overall academic activity supporting the transformation of NHS partners into effective and rounded academic clinical centres of excellence.

Since REF2014 our staffing strategy has continued to deliver its strategic aims to:

1) Recruit outstanding researchers with demonstrable potential to conduct internationally excellent research. Our groups have been strengthened through the professorial appointments of **Dean** (epidemiology), **Davies** (internal medicine), **Kersten** (physiotherapy), **Galvin** (nursing), **Huber** (psychology/public health) and **Van Marwijk** (primary care). Advertisements for all posts include statements encouraging applications from under-represented groups and are distributed to corresponding group-specific networks. The A3 staff base has been expanded through the appointment of 56 new staff (of whom 22 were ECRs) who invigorate interdisciplinary links between biomedical sciences and health professions. **Flint, Henry Joseph, Kudsiova, Mackenzie, Morrison, Sawyer** and **Staines** focus on non-communicable diseases. **Davies, Eccles, Ford, Levett, Manville, Mullen, Nagai, Paudyal, Shahvisi** and **Terrazzini** have enhanced our research in diabetes, heart failure, the central nervous system, drug efficacy and immunology. These new targeted appointments enhance existing research into ageing and dementia, provide continuity to our research themes and open up new multidisciplinary avenues. Targeted investment has allowed us to grow new areas through appointments such as **Smith** and two associated genomics Experimental Officers, who expanded our research into genomics by setting up Brighton Genomics with Research Council Capital Infrastructure funding.

2) Retain and reward staff whose research interests fall within our core areas of research strength. We support staff to enhance retention through development opportunities (See 2.1.2); minimising the number of staff in fixed-term posts (See 2.2.1), and promoting our staff including the development of our administrative and technical teams.

For example, since 2014, 34 academic staff across the grades have been promoted (15 female). **Sawyer** to Senior Research Fellow; **Edelman** and **Rosten**, to Principal Research Fellows; **Bush,**

Sarker, Suddick and **Zeeman** to Principal Lecturers; **Davies, Eccles, Ford, Levett, Nagai, Mullen, Paudyal Shahvisi, Waddell** to Senior Lecturers. **Aranda, Flint, Morrison, Patel, Sandeman,Tabet** and **Zaman** to Readers; and **Bozzali, Dilley, Harrison, Jenkins, Llewellyn, Memon, Newbury, Ostler, Patel, Smith, Verma** and **Wright** awarded Professorships. Similarly, following completion of PhDs, six staff were recruited to our technical support team, and three staff moved from technical roles to research.

2.1.2. Staff development

Our approach to staff development is inclusive, long term and facilitated through several mechanisms:

Infrastructural support for career development. Since REF2014, new management and induction processes have been created to ensure new staff are introduced to the research and enterprise structures of the Universities. The appointment of Deputy Heads of School for Research and Enterprise during this period has significantly supported this process and ensured staff and PGRs are alerted to opportunities across both universities. All new staff meet with the Deputy Head to discuss their research plans. University policies on research integrity, research ethics, open data and open access publishing are discussed and followed up during the probation period. Following induction, researcher development is managed formally at School level through annual Staff Development Reviews (SDRs) undertaken by a member of School Management Team (SMT). Additional support and training are available through our Researcher Development Programme. We offer paid Keeping in Touch days for staff taking parental leave and a Returning to Research fund, providing £5k awards to support staff returning to work after an extended absence (eg parental leave or ill health), 6 staff benefitted through £30k invested in the Returning to Research fund in A3.

Research mentoring. Introduced in 2016, the Research Mentoring Framework is central to support provided in both Universities and delivery of the Research Concordat. Research mentoring is co-ordinated at School level by a dedicated Research Mentoring Lead, a senior member of research staff and an accredited mentor through KMP+ House of Mentoring (Copenhagen). The scheme provides research mentoring training and development opportunities for mentors and mentees. All existing and new staff, ECRs, and fixed-term staff are offered research mentoring. Of our staff, 36 received mentoring support during the last year and 50 during the census period (21 female). Additional research mentor training with guidance on supporting research active women and staff identifying as BAME, has also been undertaken through targeted activities such as writing retreats and conference travel support. **Dean** was shortlisted for ‘Women of the Future’ mentor of the year (2015), a national scheme for both the public and private sector.

Support for ECRs. ECRs are supported through cross-Universities initiatives that form a key focus for implementation of the Research Concordat and support development of successful externally funded bids, and publication and impact activities (further detail of investment is given in REF5a(s) and range of schemes described below). A University-wide early career researcher network enables a wide range of staff to engage in, and lead, research for the first time while providing support, networking, supervisory and/or undergraduate teaching experience, and collaboration opportunities. Governance and policy structures ensure ECR representation at School and University level. For example, ECR representatives sit on School Research and Enterprise Committees (SRECs), there is ECR representation on all University committees and CORE management boards to ensure that career development is integral to the CORE delivery plans. Policy mechanisms also ensure new staff receive remission from teaching in their first year to focus on their research development. Furthermore, we prioritised PhD supervision capacity building for ECRs; where possible supervisory teams comprise an ECR as a third member who receives training on the supervisory process. The lead supervisor takes responsibility for ensuring that the ECR participates fully in the supervisory process. In REF2014, 2.80 FTE of submitted staff were ECRs; currently it is 20.3 FTE (17%).

Support for research leaders of the future. Our environment enabled us to retain talented academics. For example: **Patel** completed his UoB undergraduate degree in 2002 before undertaking a PhD at Imperial College and was subsequently awarded a two-year EPSRC Overseas Life Sciences Interface Fellowship (£139k) at the Universities of North Carolina, Michigan State and Calgary. He returned as a Research Fellow in 2019, collaborating with **Yeoman**'s BBSRC project on age-associated neuronal and enteroendocrine changes in bowel function, and appointed lecturer in 2010. Following numerous successful funding bids (EPSRC £90k and £110k; CRUK £222k), publications and awards (2013 GSK Emerging Scientist Award, 2015 Royal Pharmaceutical Society's Science Award) he was promoted to Professor of Clinical and Bioanalytical Chemistry in 2019. **Bryant** studied for an undergraduate degree (1996 – 1999) and completed an EPSRC-sponsored PhD at UoB in 2004. After a research leadership post at Sussex Community NHS Trust, she returned to UoB as research officer collaborating with **Hebron** and **Ridehalgh** before being mentored by **Sherriff** and promoted to Senior Research Fellow**.** She currently leads the Data for Impact (DfI) project, partnering Physio First [ICS_Physiotherapy]. **Deribe,** co-mentored by **Newport,** supported by a Wellcome Trust PhD training grant, contributed to mapping historical distributions of podoconiosis in Ethiopia. This led to Wellcome Trust Intermediate Fellowship to create the *Global Atlas of Podoconiosis* and prestigious awards (See 4.4).

Internal research and enterprise funding awards for staff development. QR is directly allocated by Schools to provide targeted research support, of which ~40% is prioritised for ECRs. A Research Investment Fund (~£100k annually) is available for equipment purchase and pump-priming activities; 10% of the 2020-21 budget was ring-fenced to support colleagues whose research was impacted during the Covid-19 pandemic, of which £36k was made available directly, with 3 staff supported for Covid-19 impacts. During the census period over £3m direct QR-funded investment was made to A3 staff. This underpinned a suite of initiatives to promote researcher development for staff to increase number and impact of their research outputs is targeted through: publication support (eg writing retreats, and funds for 'gold' open access); research and enterprise bid development; conference support and Strategic Research Investment Fund (for equipment required to complete a specific piece of research). Funding was received by 43 staff (23 female) through our internal awards schemes.

Four staff (3 female) benefited from research sabbatical (worth up to £14k each); 18 staff (11 female) received Rising Stars awards (£10k per project); 9 staff (7 female) were awarded Sussex Research Development Funds. Four staff (2 female), were awarded £107k of International Development Challenge Funds. Sussex Sustainability Research Programme and Sussex Neuroscience investments of £269k supported 3 staff, enabling new research partnerships, for example, in Papua New Guinea. Internal investment has supported external competitive funding applications and published outputs for REF2021 for ECRs, for example, £104k in Rising Stars awards to 11 of the staff above enabled 13 submitted published outputs and secured £438k in external funds.

To ensure resource allocation fairness and transparency, initiatives are subject to equality impact assessment on an annual basis. We channel 20% of QR income allotted to A3 directly to staff to pump-prime research, with fixed-term contract staff having equal access to permanent staff. ECRs are prioritised through the allocation of £5k per year. In addition, the COREs (with budgets of £10k each) provide funding for their members (staff and PGRs) to host conferences/symposia, develop research networks and external bids, invite Visiting Fellows, and develop impact activities. Of £55k invested in school level initiatives 51% was awarded to female staff.

QR funding also supports regular seminar series and monthly Lunch and Learn sessions where central Research Services staff lead training workshops for staff and PGRs; annual celebration events with external speakers; outreach events for local schools; and regular research focused PGR recruitment events. Our researchers take an active part in research events at both universities and together contribute to the Sussex Impact Day.

2.2. Research students

We have a thriving PGR community of 61 PGR students, with 136 Doctorates awarded since REF2014. Students access supervisors across three Schools, and access training in both institutions as well as co-supervisory teams. All PGRs are registered through Brighton Doctoral College (BDC). Our PGRs are consistently satisfied with supervision; in the 2018 Postgraduate Student Experience Survey (PRES), satisfaction with supervision across our A3 area ranged from 80.4% - 90.2% against the sector benchmark of 85.6%.

2.2.1. PGR recruitment

A Director of Postgraduate Study (DPS) oversees the application-to-graduation process, with local support provided by School PGR Coordinators. PGR recruitment over the census period has been enhanced by Doctoral Training Collaborations, two PGRs from Horizon 2020 funded INNOVATEDIGNITY Innovative Training Network (ITN), and 10 from overseas government funding (including for example, Saudi Arabia, Iraq, Kuwait, Malta, Sri Lanka, Estonia, Italy). NIHR global health programmes focusing on Neglected Tropical Diseases (NTDs) partnering Ethiopia, Sudan and Rwanda support 10 studentships and eight PGRs were recruited through the NIHR-RIGHT funded, 5S Foundation project. We invested in a further 12 studentships, and NHS Trusts directly funded three studentships.

To attract a range of health professionals into the PGR pipeline, we deliberately expanded our Master's in Research (MRes) pathways across A3. For example, SHS includes both a clinical (NIHR Master's in clinical research; Clinical MRes) and non-clinical pathway (MRes Health Research). In PABS, we launched two new MRes programmes in 2018 specifically linked to our Centres of Excellence. We graduated 115 MRes, with eight Academic Clinical Fellows who have moved on to higher degrees including MRC, NIHR, PHE, Wellcome and Fulbright Fellowships.

The delivery of externally funded doctoral training partnerships (DTPs) adds to our supportive context. We participate in 5 externally funded DTPs:

- Wellcome Trust Collaborative Award *Facilitating ethical preparedness in genomic medicine* which includes 14 studentships;
- NIHR Applied Research Collaboration Kent Surrey Sussex (five local studentships);
- Wellcome Trust Doctoral Programme in Global Health (one PGR jointly supervised with LSHTM);
- INNOVATEDIGNITY MSCA Innovative Training Network (ITN) (two early-stage researchers), and
- MSCA EU COFUND (two Doctoral Training Alliance studentships in Applied Biosciences for Health).

2.2.2. PGR training and support

We operate equitable policies on training and access to resources to support our PGRs. All new students receive training-needs analysis to establish their skills profile, mapped against the Vitae Researcher Development Framework. Methods and impact training are provided by the Doctoral College's Postgraduate Researcher Development Programme. Supervision is complemented by annual formal review points to ensure satisfactory progress is being made, and that supervisors are fulfilling their responsibilities. Progress is monitored via PhD Manager, an online administrative system and documented supervisory meetings. All PGRs have dedicated workspaces and computing facilities on their campus base.

PGRs benefit from a series of cross-institution support strategies that include full membership of COREs/REGs, (REF5a(s)), shared office space, cross-school supervision, secondments, international visits and opportunities to present and engage with local academic communities through research group meetings, and Lunch and Learn sessions. Latest PRES results (2018) show that our Professional Development opportunities are well received, especially by medical school PGRs with a high point of 86.2% against the overall sector benchmark of 79%.

Further networking connects our PGRs with each other and externally, provided by the Doctoral College's annual Festival of Postgraduate Research and DTP/ITN cohort events throughout the academic year. In 2019 we introduced a Postgraduate Research Society and monthly informal social sessions to complement the suite of support available. As a result, student achievements include leveraging external funding through fellowships resulting in a UK Occupational Research Foundation fellowship, 1851 Royal Commission Fellowship and 18 NIHR Postgraduate Research Fellowships.

PGRs can apply for the UoB's Research Student Conference Support Fund and/or the UoS Doctoral Overseas Conference Grant, a Researcher Led Initiatives fund and the Adam Weiler Doctoral Impact Award. All PGRs are supported to attend at least one international conference. Emergency funding and IT access was made available in 2020 to support 10 students who needed extra equipment to work remotely during the Covid-19 pandemic. Additionally, stipend extensions were given to four A3 students (See REF5a(s) appendix). Weekly drop-in sessions for PGRs were initiated during the March 2020 lockdown.

2.2.3. Influence on research decision-making

Elected PGR representatives sit on SREC and CORE Management Boards, BSMS Academic Board, the Joint Award Research Degree Board of the two Universities, and BSMS Research Subcommittee, thus contributing to decision making processes for internal funding supporting research activities. PGRs influenced allocation of £10k pump priming to support research activity. PGR representatives regularly meet the Doctoral College which, during Covid-19, has been weekly, and are represented on Athena SWAN and Race Equality Steering Groups. PGRs influenced University wide initiatives eg Black Lives Matter research project and BAME internships. PGRs access a dedicated counsellor to support mental health and wellbeing, are provided with a standardised approach for PGR teaching opportunities, suggest speakers for PGR seminar programmes, contribute to organising and presenting at Doctoral College and School research conferences, and engage with external training collaborations (See Section 4.5).

2.2.4. Achievements of research students

PGRs are encouraged to publish their work throughout their doctoral studies and, since REF2014, 103 PGRs co-authored outputs within the A3 remit and across our four themes. Since 2014, graduates have secured jobs with senior roles in UK industrial and healthcare practice sectors (eg Roche Pharmaceuticals; Dasman Diabetes Institute, Kuwait; Rayner Intraocular Lenses Ltd; Asieris Pharmaceuticals; Sussex Community Foundation Trust; NHS Blood and Transplant; Brighton & Sussex NHS Trust). Recent graduates have progressed to NIHR Academic Clinical Senior Lecturer and taken up post-doctoral research associate posts at the University of Virginia and Max Planck Institute.

2.3. Ensuring Equality, Diversity and Inclusivity (EDI)

Both Universities hold institutional Athena SWAN Bronze Awards and are in process of applying for Silver Awards in May and November 2021. Both are Stonewall Diversity Champions, Disability Confident committed employers and members of the Race Equality Charter. Our EDI commitments are formalised in both University's action plans including a gender equality action plan and an LGBTQ+ action plan (UoS); inclusivity is a core value in the UoB University Strategy (2017 – 2021), supported by the EDI Strategic Plan (2017 – 2021). In line with this and the UoS Equality, Diversity & Inclusion Strategic Plan, Race Equality Action Plan and Inclusive Sussex strategy, we are committed to developing a diverse inclusive community – not only within the Universities but in local, national and international communities alongside our research partners. Progress towards action plans for our Athena SWAN awards is overseen by Athena SWAN Implementation Groups (ASIGs) in each School and discussed annually at all-staff away days. **Edelman**, part of this submission, chairs the ASIG in SHS and **Macfarlane** in PaBS. **Dean** sits on the REF2021 Equality and Diversity Advisory Panel (EDAP) and is leading the Athena SWAN portfolio at UoB. Our commitment to EDI matters is further supported through a new senior leadership post in 2016, a

Deputy Pro-Vice-Chancellor for Equalities and Diversity, that provides strategic leadership for a dedicated EDI Unit staffed by specialist professionals at UoS.

At School level, inclusion is overseen by School Equality, Diversity, and Inclusion Committees (SEDIC). **Galvin,** Chairs the SHS SEDIC, and **Shahvisi** the BSMS Inclusivity Working Group, with representation from PDRF, administrative and technical staff and PGR students, and report directly to School Management Groups. In November 2020, BSMS renewed an Inclusivity Statement, re-affirming a commitment to promote an environment where everyone is treated with respect and dignity. Its Inclusion Team is establishing an Ethnicity Working Group, a LGBTQ+ group, and an Antiracism Forum. Mandatory training is monitored by Heads of School or, for clinical staff, via Inclusivity-dedicated teams within NHS Trusts.

Our staff undertake mandatory online Equality and Diversity Essentials, Unconscious Bias and Dignity at Work training. Those in management positions are required to complete additional Managing Diversity training and those on recruitment panels training on Interviewing and Recruitment. Both Universities provide targeted equality training, for example, supporting researchers with protected characteristics.

Female staff are additionally supported through targeted workshops focused on academic promotion. Academic promotions and staff development policies ensure that career progression and research support is not disadvantaged by disruption due to factors such as ill health, care and family commitments, maternity/paternity/adoption leave, disability, religious commitments or contractual status. As an indicator of our research support, over 20% of grant applications submitted were by female staff during the census period rising to 41% in 2019-20 and overall, 36% of successful grants were awarded to female researchers.

Equality and diversity issues in REF submission construction. Since 2017, equalities impacts are considered explicitly for policy-related papers developed by all University committees. Part of our output selection process for A3 submission involved reflection on gender equality balance such that the percentage of outputs by female authors is 45%, in addition 16% of outputs are from ECRs. REF submission data shows gender parity for staff submitted in A3 (49.3% female). Guided by Institutional REF Codes of Practice, all staff on REF Output Review panels and UoA Leadership teams were required to undertake Equalities and Diversity, Unconscious Bias, Information Security Awareness and GDPR Training. We have gender parity with full membership of our UoA Leadership Team and the lead for our submission is female. Our Output Review Panel reflects the gender balance of the wider staff pool ie variation is <10%.

3. Income, infrastructure and facilities

3.1. Overview of our approach to income, infrastructure and facilities

Sustaining a balanced funding portfolio alongside improved funding trajectories in priority research areas is critical to the success of A3 research and impact activities. Staff across grades have secured over £37.67 million in research income from a wider range of funding bodies compared to £14.4m in 2014. Peer support through seminar and grant application workshops and regular 1:1 advice surgeries undertaken by experienced staff including statisticians, provides targeted support for funding applications. Mandatory peer review, mentoring and financial support underpin our income generation strategy. By drawing together multidisciplinary expertise in four thematic groups, we have sought to respond to global, European, and national research priorities in health in particular through NIHR, major charities (medical and health sciences), EU funding streams and UKRI (health and biomolecular sciences). To facilitate consortia engagement and stimulate successful applications, we initiated a series of research ‘sand pits’ (2017) with the world-leading Institute of Development Studies (based on the Sussex campus). We have encouraged focus on UKRI GCRF and NIHR Global Health relating to UK effort on global challenges, for example, the NIHR Global Health Unit for Neglected Tropical Diseases (£5.7m) increased its reach with a new NIHR 5S grant (£3.4m) for stigmatised skin diseases.

Our annual research income has increased by 27.6% over the REF period, from £5.4m in 2013/14 and rising to £6.9m total in 2019/20. Our most successful trajectory is NIHR funding (£6.99m overall; increase by >400% from £461k in 2013/14 to £2.36m in 2019/20) followed by UK Industry (£2m overall; increase by >230% from £143k 2013/14 to £480k 2019/20). We have sustained our successes with UKRI Research Councils (£7.1m overall), UK Charities Open Competition (£9.4m overall) and EU Government Funding (£5.6m overall) over the REF period. This, together with non-UK Industry funding (£1.29m overall) demonstrates a diverse and productive funding landscape with increased global challenges focus.

3.1.1. Strategies for generating research income and delivering research with impact

The REF period has seen substantial development of our research infrastructure, in line with the strategic priorities summarised in 1.2.4. The following added strength to our research income generating strategy:

Optimising the configuration and mass of our thematic research groupings for step change in the scale, reach and quality of research undertaken with the NHS and other partners. The promotion of concentrated research effort across our four themes (See Section 1.3) acts as vehicle for delivering major consortia grants focused on societal challenges and optimises readiness to engage with urgent research priorities (eg NIHR/UKRI Global Health initiatives, ageing, chronic conditions). These alongside BSCTU and JCRO investments demonstrate targeting more ambitious programmes and consortia at national and international level and has enabled delivery of high-profile clinical trials, both in the UK and internationally.

Supporting researchers at all career stages through our support strategies has resulted in bids developed during the REF period, which will have impact in the next, including:

- mid-career **Mullen**'s recent MRC grant (£448k 2021-23) to investigate predisposition towards osteoarthritis
- ECR **Staines** successful follow up MRC grant (£250k 2021- 2024)
- mid-career **Cameron'**s four-year programme 'Resilience Revolution Blackpool' whole town approach to mental health needs of children and young people in Blackpool (Lottery Community Fund £2m, with Blackpool Council 2018-22)
- Professor **Patel** and mid-career **Yeoman**'s EPSRC project for sensors to evaluate bowel dysfunction (£531k 2021-24).

Optimising our use of infrastructure, facilities, and expertise to deliver user-led research with impact. Partnerships and co-production of research with patients and public have been core values, and central to enabling us to deliver impactful research across A3. The following demonstrate how we maximised successes to support user-led activities guided by our targeted impact strategy outlined in Section 1.2:

- clinical and nursing research embedded within NHS, national and international organisations to work directly with patients. This has enabled research to impact the lives of disadvantaged populations through a direct improvement of services [ICS_Hepatitis-C], the expansion of non-invasive liver scanning to marginalised populations in the community (Dunhill Trust £134k), shaping new services and frailty models informed by what matters to older people (Burdett Trust for Nursing £150k) and service-based improvements in compassionate care (Burdett Trust for Nursing £150k).
- enhanced community engagement with vending machine technology to improve uptake of HIV testing and amongst adolescents in Zambia (Viiv Healthcare £13k), optimised HIV monitoring through health records (£299k, Royal Academy of Engineering),
- NHS integration to support sustainability and clinical relevance of research in neuroimaging. The Clinical Imaging Sciences Centre provides NHS PET-CT scanning to BSUH NHS Trust, MRI and CT scanning to NHS services for early memory loss, and pre-neurosurgical MRI assessment and musculoskeletal scanning. Revenue generated contributes to CISC investment in neuroscience research enhancing sustainability.
- impact activities from SHORE-C cancer survivorship research supporting patient experience during cancer treatments and beyond, [ICS_PrefHER], including a Breast

Cancer Campaign funded app development for self-management of exercise to enhance recovery**.**
- using the ESRC Impact Acceleration Account (£43k) to support public engagement in scabies outbreaks in care homes, involving textiles expertise and resulting in free public exhibitions in Brighton and Canterbury.

Investment in new organisational infrastructure that now underpins our thriving research environment includes:
- **NIHR RDS (South East)** supporting health and social care researchers across England on all aspects of grant applications, from appropriate research design, identifying funding sources to involving patients and public. With follow-on funding (£1.6m) in 2018 under the leadership of **Huber**, with five research advisers and a public and patient involvement co-ordinator enabling enhanced A3 integration and expansion of capacity to support strategic priorities for NIHR across Sussex, Kent and Surrey. Over 70 competitive grant applications supported per year, 77 have attracted funding over the REF period.
- **BSCTU** supports clinical research applications, with 12 staff, a Director from a partner NHS Trust, and in collaboration with the Institute of Cancer Research, ensures NHS-led patient facing research reflects highest quality standards in accordance with specifications of the UK Clinical Research Collaboration. Two medical statisticians, based within the Department of Primary Care and Public Health, provide links with methodologists. Prior to establishment in 2014, researchers relied on CTUs outside our region, BSCTU increasingly supports a range of multi-centre, randomised controlled trials, including Clinical Trials of Investigational Medicinal Products (CTIMPs) with overall income of £1.8m, currently 13 trials (collaboratively £5.5m).
- **JCRO**, (3.6 FTE, £487k 2019-2022) developed and funded initially by BSMS combines expertise from UoB, UoS, BSUH NHS Foundation Trust and Sussex Partnership NHS Foundation Trust (SP NHS), with 50% SP NHS funding for its Head. It provides practical assistance, advice in clinical research management and NHS research governance; coordinates strategic development of research to ensure cross-institution benefits of NIHR landscape is enabled, such as generation of Research Capacity Funding and support for CRN, RDS applications and ARC. Since its inception in 2019, the total award value of grants supported by JCRO reached >£15m with >£6m to UoS.
- **SRECs** identify research priorities, co-ordinate staff development and career progression support, deliver the Research Concordat and monitor progress against KPIs. Significant investment is targeted (Section 2.1.2) at both School and University level, purposively supporting ECRs to lead research as they move toward independence, gain experience as named co-applicants with development towards PI roles. This includes support by central Research, Enterprise and Social Partnerships teams in both Universities; matched funding and supportive costing models, often leading to prestigious funding. Three designated Research Development Officers/Knowledge Exchange Managers support health and biomedical research, alongside Research Quality and Impact teams facilitating productive external relationships. A school funded Research Governance Officer (1.0FTE) supports BSMS Research Governance and Ethics Committee, within the UoS research governance framework, providing ethical scrutiny.

3.2. Research funding success

Our approach and arrangements enabled substantial growth in NIHR grant successes, have grown capacity and reach at every stage from postgraduate to large scale programme work, and enabled engagement with international consortia. The overwhelming majority of our research awards can be mapped to the strategic priorities of NIHR and the EU (eg healthcare technologies, ageing and well-being) and to the third sector (particularly diverse chronic diseases and improvements in care access for marginalised groups).

A notable feature of our award portfolio is the trajectory of ***EU government*** funding and the increased number of our nursing, medical, bioscience and preclinical researchers who lead or partner EC networks including projects on:

- initiatives to reduce risk from noncommunicable diseases in Uganda (**Van Marwijk**, lead, EU SPICES Research and Innovation Action Grant €5.9m).
- generation of new patient driven outcome measures for terminally ill children (**Farsides**, Co-I, C-POS ERC Consolidator Grant €1.8m).
- pioneering treatments and technological innovation in the field of biomaterials for medical implants and tissue engineering (**Santin**, PI, H2020-ICT MADIA €531k, H2020-NMBP REFINE €215k, FP7-NMP OPHIS €468k, FP7-HEALTH NEXT €670k), in wound healing (**Allan**, PI, Interreg 2 Seas DERMA €2.7m), and in novel nanoporous carbon applications to fatty liver disease and cirrhosis (**Sandeman**, PI, FP7-IAPP ACROBAT €1.5m, H2020-PHC CARBALIVE €9.6m). Together these represent over €15m of funding for international networks with our staff as leads, that address the use of new biomaterials in healthcare.
- delivering new knowledge for dignified care (**Galvin**, lead, H2020 MSCA ITN INNOVATEDIGNITY €4.3m, involving 15 interlinked research studies) and care delivery (with **Huber**, INTEREGG 2Seas EMPOWERCARE €4m). Both projects generate new insights for 'living well' in care systems and cumulatively involve 20 non-academic partners in care services and older person advocacy organisations in 11 countries.
- developing the first ever European online survey assessing the knowledge, attitudes, practices, and training of Community Health Workers supporting Men who have Sex with Men (MSM) (**Sherriff,** lead, with **Huber** the nine partner ESTICOM consortium - European Surveys and Training to Improve MSM Community Health). The research led to the development of the first European-wide training programme for MSM-focused CHWs adaptable for all EU countries (€1.9m).

In this REF period we have targeted and substantially increased our ***NIHR*** portfolio, one of our most notable strategic successes and have simultaneously sustained ***UKRI*** funding including:

- the NIHR Global Health Unit for Neglected Tropical Diseases (£5.7m) was established by **Newport** and increased its reach with a new NIHR 5S's grant (£3.4m) for stigmatised skin diseases.
- cross-disciplinary neuroscience collaborations with **Lukashkin** and **Russell** are producing new genetic insights about the auditory system with novel applications for understanding mammalian hearing and contributions to advances that address hearing loss (MRC £1.14m). These advances also supported **Levic**'s work on changes in inner ear signalling associated with deafness which offer new insights for restoring hearing or slowing hearing loss.
- through the STRiDE project (UKRI GCRF £7m; Lead LSE, Sussex Lead Banerjee A1), **Farina's** research seeks to better understand the prevalence, cost, impact and stigma of dementia across seven middle-income countries.
- a multicentre randomised control trial, **Llewellyn**, aims to understand the psychological interventions that would reduce risk behaviour amongst men who have sex with men (NIHR Research for Patients Benefit Programme £250k).
- research by **Staines** to understand if adolescent growth predisposes individuals to osteoarthritis, and the mechanisms involved, is leading to the development of ground-breaking imaging technologies to understand joint biomechanics in real time (MRC £200k).

Our continued engagement with major ***health charities*** with notable increase in funding reflects our commitment to global challenges, new services, evaluation and research impact in partnership and with the public, often leading to further competitive funding to build on consolidated work. Notable examples include:

- our work in global health with global mapping of podoconiosis is underpinned by ECR **Deribe**'s Wellcome Trust Fellowship (£660k).
- a prestigious Wellcome Trust Humanities and Social Science Collaborative Award (£1.2m) **Farsides**'s (Co-PI) exploration of ethical preparedness of NHS for genomic medicine to mainstream genomic medicine in the NHS, extends her earlier LABTEC Strategic Award (£96k).

- Wellcome Trust support for **Harrison**'s work on neuroimmunology and mood in Alzheimer's disease (£628k) and **Berni**'s Sir Henry Dale Fellowship to study the genetics of diversification in neuronal circuits (£325k).
- underpinned by support from charities (Breast Cancer Research Trust, Team Verrico and Age Concern) and EPSRC (cumulative £737k), **Flint** has generated evidence that stress hormones can reduce the efficacy of cancer treatments and demonstrated the effects of stress hormones on cell signalling, drug resistance and immunity in breast, ovarian and prostate cancers. Through collaborations with **Patel,** and funding from CRUK (£79k), and Rosetrees Trust (£17k), now extended to investigate the role of stress in the progress of prostate cancer and cancer treatment, bringing chemical and biological science together using microneedles to detect biomarkers in age related conditions (Wellcome Trust £118k).
- **Rajkumar**'s work on hypertension outcomes in the very elderly, supported by the Dunhill Trust (£236k), contributing to better understanding of the factors influencing blood pressure measurement in this group.

Commercial sponsors. We have demonstrated further success in our approach to partnership for transfer of scientific knowledge for health benefit, for example:

- SHORE-C researchers, **Shilling, Jenkins** and **Catt,** have a portfolio of industry-funded studies focused on patient-centred outcomes and support for self-management in cancer patients (£471k Bristol-Myers, £113k Roche Product Ltd, £216k Aventis Pharma).
- research on marginalised groups with HIV by **Iwuji** (ECR) and **Vera** has been sponsored by industry, including a clinical trial of a drug regime switching protocol (Gilead Sciences £443k) and a medicines review toolkit for people living with HIV (£76k Merck Sharp and Dohme).
- optimising engagement to achieve hepatitis C elimination in the most marginalised groups, researched by **Verma**, is funded by Gilead Sciences (£245k).
- support by William Scholl Great Foundations (£731k) enabled **Morrison** to investigate health and industry professionals in shoe manufacturing knowledge about children's feet, with influence on health visitor practice guidance.
- funding from the US Army Research Office ($37k) and DSTL (£40k) allows **Cragg** to model nerve agent behaviour and create chemical warfare agent sensors.

3.3. The nature, quality, provision and operation of specialist research infrastructure and facilities

At the UoB campus, research infrastructure has received £1m of capital investment since REF2014 where its £23m Huxley research building provides access to advanced tissue culture, an image analysis suite, chemical analysis (mass spectrometry, infrared, ultraviolet/visible, fluorescence and NMR spectroscopy) alongside state-of-the-art laboratories for chemistry, microbiology, molecular ecology and biosciences. During the REF cycle, facilities have been upgraded to include a Quadrupole-Orbitrap mass spectrometer, DXA scanner, 3D scaffold printer, flow cytometer and confocal microscope.

A distinctive feature is our multidisciplinary environment and major investment in specialised equipment to facilitate cross-disciplinary collaborations. The custom-designed Brighton Genomics laboratory funded by a £233k Research Council Capital grant (**Smith**) and £369k UoB/HEFCE investment, underpins a Professorial appointment and 2.0 FTE Experimental Officers providing sequencing and library preparations. For example, our internally funded mass spectrometer (£320k) led to collaboration with Durham and São Paulo to determine the gender of archaeological human remains from tooth enamel peptides. Instruments such as a 3D scaffold printer, used to prepare platforms for tissue regeneration, and an X-ray photoelectron spectrometer, to analyse fabric impregnated with antimicrobial nanoparticles, demonstrate our innovative use of equipment.

Our researchers access the Clinical Imaging Sciences Centre (CISC) for PET-CT and MRI, for which £3.64m (including £568k from the Wellcome Trust) was invested for a 3T MRI scanner in 2017 and building reconfiguration to provide testing facilities and seminar rooms. Through CISC, new quantitative imaging techniques enable the study of brain inflammation, abnormal ageing, eye

oxygenation and neurodegeneration. Additional capital expenditure (£235k) has funded a new dataset for dementia patients to study patterns of dementia onset, a collaborative project drawing on expertise in the Science and Technology Facilities Council doctoral consortium at UoS.

Our international Wellcome Trust and NIHR funded international programmes (**Newport**) leveraged investments which we now jointly benefit from in collaboration with international partners in low- and middle-income settings. These include: joint informatics capacity building at the Institute for Endemic Diseases, Sudan; provision of UK training for staff scientist, and enhanced computing capacity at the Regional Centre for Bioinformatics at Armauer Hansen Research Institute, Addis Ababa, Ethiopia. We equipped a laboratory at the Ethiopian Public Health Institute with refrigerated centrifuge, a multichannel pipette and a Greiner LeucoSep-tube; developed a biobank at the Mycetoma Research Centre in Khartoum, Sudan, and a cell culture lab at CDT-Africa, Addis Ababa, Ethiopia.

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

4.1. Responding to national and international research priorities

A collaborative, interdisciplinary ethos is embedded across our A3 work supported through:

- internationalising research with new partnerships in our fields, supporting relationships at all researcher levels, including exchanges, sabbaticals, secondments, joint supervision of PGRs.
- maximising opportunities created by our investments to build partnerships at scale, facilitating our response to international priorities, including technological innovation and its translation into practical change, working with and for the marginalised, engaging in the Global South, sustaining an underpinning commitment to meaningful public engagement and open access research.
- formalising infrastructures to incentivise effective research engagement with NHS and local government partners (Joint Clinical Research Office, NIHR Applied Research Collaboration KSS).
- Sustaining multi-institutional doctoral training consortia, within regional and international partnerships (Section 2.1).

4.1.2. Illustrative successful international health research partnerships

Ageing and Dementia. **Farina** and **Daley** with the International Longevity Centre, Universities of Southampton and Newcastle, modelled outcome and cost impacts for interventions in dementia, generating evidence about stigma and family burden in low- and middle-income countries (LMIC), cited in 2019 NHS Long Term Plan. **Faragher** forged research partnerships between the UK and Japan to address premature ageing (BBSRC JPA partnership award). **Vera** delivered a one-stop clinical memory service, in Japan and Zambia with a multisectoral team of community representatives, clinicians, product designers, engineers and social researchers. Building on this collaboration, **Vera, Levett** and **Wright** increased research capacity in ageing and HIV in Zambia, through International Development Challenge Fund (IDCF) investment and the Sussex Sustainability Research Programme (SSRP), effectively collaborating for prevention and management of frailty in older people with HIV, contributing a new model of screening for frailty through effective international partnership.

New Technology and Devices in Healthcare. **Santin** and **Allan** forged international collaboration in biomaterials for contributions to treatment of chronic dermal wounds. Drawing on a multi- sector consortium comprised Portsmouth, Ghent and Eurasante, a business facilitator based in Lille, they further progressed infection detecting wound dressing innovation, which consolidated new commercial partnerships. **Sandeman**'s ACROBAT project with industrial and academic partners from the UK, Germany and Ukraine, both examples forged cross national conference papers, publications, enriching translational potential in our environment.

Disease and chronic conditions across the lifespan. **Ferns,** with UNESCO Center for Health-Related Basic Sciences and Human Nutrition (hosted by Mashhad University of Medical Science,

Iran), is contributing an influential cohort study developing new population sensitive cardiovascular risk assessments. **Russell** and **Lukashkin** have advanced new insights to cochlear supporting cells and cochlear sensitivity collaborating with Creighton University, USA and support **Forrest**'s work on cochlear proteins with the National Institutes of Health, USA. CRMD developed strong translational research capacity through providing solutions to pitfalls of current methodologies for pancreatic islet transplantation in partnership with three companies, AvantiCell (UK), Explora (Italy), Cellon (Luxembourg) and a centre for organ transplantation, ISMETT (Italy).

Public Health, Policy and Ethics. Our research drives growing international partnerships as demonstrated by **Zaman**'s 5S NIHR Global Health work on Stigmatised Skin Diseases spanning Sudan, Ethiopia and Rwanda and **Newport**'s NIHR Global Health Unit in Neglected Tropical Diseases which has expanded beyond Ethiopia and Sudan to the continent of Africa. This has led to joint appointments and secondments including **Fekadu**, and **Deribe.** A global partnership in Kenya and Uganda delivered novel research design for antimalarial drug development on malaria transmission-blocking, as opposed to standard drug efficacy trial design. Implemented in LMIC by ECR **Eziefula**, the work is contributing to global targets for malaria control which resulted in changed WHO guidelines. In European work, **Sherriff** [ICS_HealthInequalities] and **Zeeman** collaborated with six partner countries to develop new critical perspectives on policy, practices and service delivery that support understandings of context and lived experience of LGBTI citizens and (health) service-users; leading to impact on national and international public policy agendas. This led to a Visiting Professorial appointment, joint publications, PhD funding and further team funding applications. In collaboration with 17 countries, **Sawyer, Sherriff,** and **Huber** contribute to a global WHO project (ProSPeRo) on sexually transmitted infection point-of-care testing which generated the largest ever data set for validating HIV/Syphilis Duo point of care tests and additionally created new opportunities for ECRs to engage in multinational research. International collaborations also link local NHS partners to international consortia such as **Newport'**s contribution to the *Brighton-Lusaka Health Link*, a partnership between UoS/BSUHT and the University Teaching Hospital in Lusaka, improving HIV infection care access, with new clinics with the University of Zambia, Zambian Medical Association, and the Centre for Infectious Diseases Research (CIDRZ).

Cumulatively, the effectiveness of these collaborations is demonstrated by successes of international teams in influencing policy and practice but also in the volume of publications co-authored with colleagues in other institutions. A KPI monitoring international co-authorship as proxy indicator of our international influence was introduced in 2017, In the last year, 154 articles with international authors were published by A3 staff in highly regarded applied health research journals such as *Lancet Infectious Diseases, 2014; Clinical Cancer Research, 2014* and *Nature Communications, 2016* to enhance international reach.

Of 300 outputs in this submission, 50.7% are co-authored with international academic partners, and 39% with national collaborators. The quality of our research outputs and the resulting research impact is evidenced by strong research metrics (SciVal): 30.7% of our outputs are in the top 10% most cited publications worldwide and 61% are published in the top 10% journals (CiteScore).

All submitted staff have led or been members of collaborative projects, and we actively support ECRs to participate in networks or partnerships locally, nationally, and/or internationally (Section 4.4). Our contributions led by experienced researchers enrich our environment and extend partnership opportunities for ECRs and international team building in focused research areas. For example, CRMD researchers **Macfarlane** and **Santin**, through the RESTORE network (H2020 Large Scale Research Initiatives), built the infrastructure to develop advanced therapies resulting in a pan-European, 338 partner network coordinated by ten partners from translational medicine centres, biotech and not-for-profit organisations. **Galvin** contributed to quality assessment research to enhance doctoral research through the International Network for Doctoral Education in Nursing (INDEN), with the Universities of Ulster, Michigan, Illinois and Florida, facilitating global perspectives and drawing European partners into this agenda through the network.

We enhanced our environment through hosting international visiting research fellows from early career to professorial levels in targeted topics complementing research theme strengths. For

example, in non-infectious diseases, Guimaraes (Universidade de Brasilia); in sensors, Islam (Bangladesh Agricultural University); in biomaterials, Lokteva (Moscow Lomonosov University) and Kryazev (Academy of Sciences, Omsk, Russia); in public health, Mirandola (University of Verona, Italy), Jackson (University of Toronto, Canada), and Kayes (Auckland University of Technology, New Zealand). Since appointment in 2019, Mirandola's collaboration has led to the generation of nine internationally co-authored research outputs, and a new funded global collaboration with WHO to conduct a Health systems analysis of sexual and reproductive health services in Covid-19 affected areas.

Three Marie Sklodowska Curie Action Individual Fellowships generated 11 outputs and high-profile conference presentations for example: a) Raveendran, (visiting **Savina**, 2017-2019) at the 10th Singapore International Chemistry conference (SICC10, 2018); and European Advanced Materials Congress (2018); b) Azizova (visiting **Sandeman**, 2017-2019) at the 4th International Society for Biomedical Polymers and Polymeric Biomaterials (ISBPPB), Poland (2018) and the 29th Annual Meeting of the European Society for Biomaterials, Netherlands (2018). Exchange activity has enriched the environment by stimulating new research directions such as Berillo's (visiting **Savina**, 2016-2018) development of a cryogel-based bioreactor for environmental and wetland water treatment.

4.2. Relationships with research users and integration with health and social care providers

Our strategic health research partnerships. We established further local collaborations (Section 3.1) in 2018/19, as the JCRO moved from supporting 12% to 65% of all projects spanning NHS and HEI partners, and in its first year saw an increase in the value of competitive funding awards across partners of 60%, with a 33% success rate. JCRO facilitated stakeholder meetings for all awarded projects, ensuring continued engagement and embedding user needs. Joint work with NIHR RDS, higher tier local authorities (Brighton and Hove, East Sussex, West Sussex, Kent and Medway), NHS Trusts and HEIs and the Academic Health Sciences Centre in Kent, Surrey and Sussex, led to award of the NIHR Applied Research Collaboration, with NHS matched funding. The associated Doctoral Programme, together with training secondments for health and social care professionals will enhance the interface between communities of practice and our applied health researchers.

NHS partnerships underpin strong professional links enabling impact, innovation and evaluation including joint and honorary contracts, NIHR funded early career medical training posts, and Academic Health Sciences Centre funded Implementation Leads in primary care and dementia as part of NIHR ARC KSS. NIHR academic trainees are matched to our four thematic groups and undertake research training supported within A3 teams. For example **Eccles** has been awarded a MQ Arthritis Research UK Fellows Award (2018 – 2021, £225k) to conduct a clinical trial of new targeted treatment for anxiety in hypermobility. The NIHR ARC structures have enabled ECRs to take a leading role in projects to hone project management skills and forge partnerships. **Middleton** has extended work to Papua New Guinea (PNG) with colleagues at Sussex (Stewart, UoS REF 2021 A5 case study). The PNG Institute of Medical Research and Binatang Research Center established a new primary care facility in the remote protected Wanang conservation area which clan leaders identified as a key priority for their community.

Engaging with social and community care partners. We have responded to the UK's ageing society Grand Challenge through: leadership of the £1.2m *Time for Dementia* (TfD) healthcare programme by **Daley** and **Wright** contributing to the Alzheimer's Society's target to train 4m Dementia Friends by 2022; **Cameron** co-designing the *Building Resilience for Wellness and Recovery* intervention with the Sussex Recovery College and Occupational Therapists, Sussex Partnership Mental Health Trust; **Haines**' delivering meaningful activity interventions for people with learning difficulties with improved quality of life impacts; a collaborative model of care trialled by **Verma** which has been commended by both Public Health England and NHS England and cited as Good Practice by HCV Action UK.

Local authority collaborations, and community outreach. Contributions through public engagement and media initiatives include:

- **Witchel**'s engagement with Brighton and Hove City Council and the Noise Abatement Society led to a local initiative for Brighton city centre to control noise and make urban environments desirable from an acoustic perspective.
- **Huber, Sawyer** and **Sherriff** sustained evaluations with East Sussex County Council (ESCC) and local Clinical Commissioning Groups (Hastings and Rother, Brighton and Hove, Eastbourne and Hailsham, North West Surrey) to act on fuel poverty, diabetes and Covid-19.
- **Vera,** as Trustee, steered Martin Fisher Foundation's goal of zero HIV infections and HIV-associated stigma.
- **Farina**, with a NIHR communications officer, developed a public-facing online dementia research portal, 'Join Dementia Research', for Kent, Surrey and Sussex.
- **Zaman**'s work enabled sustainable public health approaches in palliative care using community theatre funded by AHRC.
- **Smith** appeared in the BBC Children's TV series *Operation Ouch* and on the BBC World Service.
- **Ford**'s ESRC and STFC Impact Acceleration Accounts award shaped patient and public engagement strategy for both Universities and the local community through collaboration with the ARC KSS PPI strategy group to develop the ARC KSS Public and Community Involvement and Engagement strategy.

Intellectual contributions to the external policy environment. Staff holding influential senior roles on policy forming groups include:

- **Dean'**s participation in Research England's REF2021 Equality and Diversity Advisory Panel, Chair of UUKi International Research and Development Network (2020-2022) and National Director of Doctoral Training Alliance, University Alliance (2017-present).
- **Patel** advising the All-Party-Political Group for Diversity and Inclusion in STEM to support increased participation of BAME researchers**.**
- **Santin'**s contribution to the European Technology Platform for Nanomedicine through his leadership role on Regulatory Science for Assessment of Nanomedicine and Biomaterials and as Council Officer of the European Society for Biomaterials.
- **Llewellyn** providing written and oral evidence to the Women and Equalities (Select) Committee, House of Commons Health and social care and LGBT communities enquiry, 2019.
- **Farsides** chairing Nuffield Council on Bioethics working group on Clinical Research with Children, and Genomics England Ethics Advisory Committee (leading work on information provision for children and young people in 100,000 Genomes project) and co-lead of Medical Ethics group Infected Blood Inquiry.
- **Memon,** as member of Cancer Research UK Round Table, contributing to implementation of NICE cancer guidelines, **Rajkumar** advising on NICE clinical guidelines on atrial fibrillation and **Farsides** to Children End of Life Care NICE guidelines.
- **Ostler, Faragher** and **Yeoman** advising the British Society for Research into Ageing and **Faragher** advising policy on older age as Chairman of the British Society for Research on Ageing, President of International Association of Biomedical Gerontology.
- **Kersten** advising New Zealand Accident Compensation Corporation and NZ Ministry of Social Development on use of outcome measures, and methodologies to assess government work capability assessments.
- **Mukopadhyay** and **Galvin**'s participation as appointed governors for Western Sussex Hospitals NHS Foundation Trust (2017 – 2020).

4.3. Contributions to the sustainability of our disciplines: Influence, advisory positions, intellectual contributions to initiatives

Researchers hold Visiting Professorships, for example, the Universities of Keele, Surrey, Hull, Memorial University (Canada), Auckland University (New Zealand), Boras (Sweden) and

Pittsburgh (USA). Early and mid-career researchers are encouraged to undertake national and international visits and achieve fellowship positions supported by internal mobility funding schemes (see REF5a(s)). As examples, ECRs **Sawyer** and **Shahvisi** initiated research partnerships with Universities of Zambia and Oxford respectively.

Institutional research quality review. **Kersten** advised on international research quality and impact as external panel member for national level Performance Based Research Funding Quality Evaluation, New Zealand Universities, (2018) and **Cragg** was international evaluator for Czech Academy of Sciences' 2015 – 2019 institutional research review.

Chaired major grants committees. **Flint** chairs the National Cancer Research Institute Symptoms Management Committee, **Llewellyn** chairs the South East and Central Regional Funding Committee (NIHR) Research for Patient Benefit Programme (RfPB) (2019 – 2023) and **Dean** chaired the Food Allergy working group of the European Food Safety Authority (2015 – 2018), and served on the Swedish Research Council 2019 (Register Based Research Programme).

Acted as expert evaluators supporting awarding bodies response to research priorities. Staff provided expert interdisciplinary evaluation for over 30 bodies including: **Haines** for NIHR Health Technology Assessment and **Aranda** for NIHR Public Health – health inequalities group; **Sandeman** for NHIR i4i; **Smith** for US NIH. **Cragg, Sarker** and **Savina** served on specialist international bodies (US Petroleum Research Fund; Russian International Affairs Council; Bulgarian National Science Fund; Polish National Science Centre; Chilean National Fund for Scientific and Technological Development; PAZY Foundation). **Dean** panel member for NordForsk 2016 (Health and Welfare Research Programme], Swedish Research Council 2020 (World Leading Researchers' programme) and Finnish Academy of Science 2020 (Research Network Programme). **Ostler** has evaluated L'Oréal Fellowships for Women in Science awards since 2015. **Inacio Silva, Ostler** and **Savina** are panel members EU Marie Skłodowska-Curie Individual Fellowships; **Cragg** and **Sandeman** advised the British Council Newton Fund panel and **Newbury** served as Panel Member for the UKRI Future Leaders Fellowship (SIFT and Interview Panels; November 2019 and January 2020).

Provided intellectual contributions through serving scientific bodies. **Harrison** serves the Clinical Interview Committee, Wellcome Trust; and is President Elect for the PsychoNeuroImmunology Research Society, the leading international society for research into bidirectional interactions between the immune system and brain. Our biologists provided advice to a broad range of bodies with **West-Oram** on the Scientific Advisory Board, International Working Group *Public Health Ethics/Covid-19* of the German Akademie für Ethik in der Medizin (AEM); **Macfarlane** on the UK Islet Transplant Consortium, **Haines** co-opted as member of National Executive Committee of the Royal College of Occupational Therapists Specialist Section People with Learning Disabilities; and **Okorie** is Royal College of Physicians Regional Specialty Adviser, Clinical Pharmacology & Therapeutics. **Faragher** advised on health research strategy of the BBSRC, **Ferns** to the Medical, Scientific and Research Committee of HEART UK. **Ostler** is a member of the Royal Society of Chemistry Education Council and standing committee member of the UK Heads of Chemistry and **Pitt** sits on the Virology Scientific Advisory Panel.

4.4. Wider influence and contributions to and recognition by the research base

Leadership of Journals. **Cooper, Ferns, Gard, Kersten, Newport, Sandeman, Santin** and **Sigala** have been Editors of nine international journals, **Cragg** and **Ferns** are founding Editors and **Otter, Gard, Inacio Silva, Rajkumar, Sarker** and **Smith** hold Associate Editorships. Staff have been Editorial Board members for a further 40 journals that span our remit including: *PLoS One; Global Qualitative Nursing Research*; *Frontiers in Immunology*; *Supramolecular Chemistry; Materials in Medicin*e; *International Journal of STD & AIDS; Advances in Epidemiology; SM Vaccines and Vaccination*

International research leadership, contributions to conference keynotes. **Dean** for the Aurora Programme (LFHE Leadership programme for women) in Dublin and Edinburgh influencing gender in research careers; **Ostler** contributed to work on ageing cells (American Ageing Association, 2016, 2017); **Otter** influenced specialised podiatry applications (British Society Rheumatology, 2016), New Zealand; **Sarker** worked with the Vietnamese Science and Technology Academy on its Nano Curcumin project; **Macfarlane** shaped new diabetes management strategies to improve lives (Society for Endocrinology, Metabolism and Diabetes); **Yeoman** contributed to the strategic direction of ageing research (British Society for Research into Ageing); **Sandeman** contributed advances in biotechnologies at European Society for artificial organs; for nanoengineered materials (ESAO symposium 2015 on the future of haemodialysis; MXene at the Frontier of the 2D Materials World, 2019; MXene, Ten Years Later, 2020 USA; **Smith** promoted genomics advances (Wellcome Genome Campus); **Newport** awarded Galton Institute competitive funding to host the African Society of Human Genetics Conference. ECRs have been invited to present papers including: **Jones,** on detection of reactive oxygen/nitrogen species in *ex vivo*-cultured cancer tissue using electrochemical techniques, at the UK Interdisciplinary Breast Cancer Symposium (2020) and nominated for the Forrest Prize and **Zeeman** (then ECR) on Health4LGBTI reducing health inequalities experienced by LGBTI people to the European Commission for policy change.

Prizes and awards as indicators of recognition for contributions to the research base. **Smith** was made a Fellow of the Royal Society (2019), and **Morris** received the Distinguished Service Award of the Chartered Society of Physiotherapy (2019); **Deribe** (ECR) was awarded Bill & Melinda Gates Foundation Grand Challenges Rising Star award (2019) for contributions to understanding the global epidemiology of neglected tropical diseases in Cameroon, Burundi, Ethiopia, Kenya, Rwanda and India. As a former PhD student was awarded Young Scientist, 3rd World Laureates Forum, (2020), and was inducted as Fellow of Ethiopian Academy of Sciences (2018); **Patel** recipient of the Royal Pharmaceutical Society Award (2015) and Fellowship of the Academy of Pharmaceutical Sciences of Great Britain (2018); **Faragher** first UK recipient of the Glenn Foundation Award for services to biomedical gerontology and is an Ageing Analytics Agency top 50 longevity influencer. In 2016 he was awarded the UKs highest honour in the biology of ageing, the Lord Cohen of Birkenhead Medal.

4.5. Cooperation and collaborative arrangements for PGR training

PGRs benefit from global network activities within multidisciplinary, academic, industrial and clinical supervisory teams. Recognised networks, enrich our training environment through bespoke network events, seminars, Summer Schools and specialist research training and secondments including:

As partners in AngioMat MSCA ITN, early-stage researchers in biomaterials are seconded at biotech partner laboratories, for example in Ireland (Vivasure Medical Ltd). INNOVATEDIGNITY MSCA ITN delivers trans-national network training in gender, dignity and digital innovations in care, with two UK, and five European Universities; provides secondments with 7 European non-academic partners spanning older person advocacy organisations, professional policy influencing bodies, older person service providers and digital businesses. Two NIHR global health programmes on Neglected Tropical Diseases (NTDs) with partners in Ethiopia, Sudan and Rwanda train 12 PGRs. Eight of these PGRs receive specialised training in NTDs from biomedical and social sciences perspectives via the NIHR Global Health Research Unit (**Newport,** >£5.7m). Four PGRS directly benefit from activities of NIHR-RIGHT Social Sciences for Severe Stigmatising Skin Diseases (5S Foundation; Co-Is **Ivashikina, Nahar** and **Zaman** >£3.4m) training in stigmatising skin conditions through social science perspectives. Two University Alliance DTP funded PGRs, supervised by **Patel** and **Inacio Silva,** accessed seven training events and two Summer Schools.