

<b>Institution: Brunel University London</b>
<b>Unit of Assessment: 03 – Allied Health Professions, Dentistry, Nursing and Pharmacy</b>
<p><b>1. Unit context and structure, research and impact strategy</b></p> <p><b>Context:</b> Health research at Brunel University London (BUL) has been transformed post 2014. We have benefited from significant investment in 35 new posts, all 78 staff (72.3 FTE) are returned and our research metrics have improved significantly. Since 2014 we have submitted 494 grants (value £122m) with 190 (value £16.4m) awarded to 64 staff members: a 35% increase in applications and 32 % in awards. Research spend increased by 60% from £9.7m to £15.5m and we have graduated 103 PhD students: a 40% increase on REF2014. We have published 2019 outputs (papers, books, chapters and conference presentations) (a 15% increase from 2014) achieving 40876 citations (an 83% increase) giving an average citation per output of 20, average citations per staff member of 524 and an average numbered of outputs per staff member of 26. The 163 papers in our submission have been cited 4075 times (mean citations per paper of 25).</p> <p>Health research is administratively based in the Departments of Clinical and Life Sciences in the College of Health and Life Sciences (CHLS). Our staff group of 78 consists of 15 professors, 11 readers, 19 senior lecturers, 30 lecturers and 3 researchers drawn from 19 different countries (40% from the EU and 13% elsewhere). A third of our staff are clinically qualified. The vision of our culturally diverse and internationally orientated faculty is to be a world-leading health research group focussed on improving health and wellbeing outcomes for individuals and populations.</p> <p><b>Achievement of strategic aims:</b> Following the 2014 major review of University research strategy we realigned our research structures to focus on three interdisciplinary challenge areas where we have critical mass and established research excellence: <i>disease mechanisms and therapeutics (32 staff)</i>, <i>evidence and evaluation (20 staff)</i> and <i>lifelong health and wellbeing (26 staff)</i>. In line with our strategy to enhance interdisciplinarity we integrated social work and the Health Economics Research Group (HERG) into these groups. These developments evidence the maturing of our interdisciplinary research agenda and environment focusing on questions that are (a) significant clinically, empirically or conceptually; (b) show innovation, rigor and originality in topic areas and/or methods and (c) demonstrate potential for societal impact. Our six impact case studies demonstrate the breadth of our activity across our three-challenge area. Pook developed an animal model for Friedrich's Ataxia that has enabled pharmaceutical companies to evaluate potential treatments prior to undertaking clinical trials. Anokye, Coyle and Pokhrel have provided evidence to inform public health policy and investment decisions in physical activity, smoking cessation and breastfeeding to enhance population health and wellbeing and address inequalities. O'Connell and DeSouza's work addressed enhancing quality of life and wellbeing for those with chronic conditions (back pain) or disability (wheelchair users).</p> <p><b>Research structures and plans 2014-20:</b> The 2014 Brunel University Transformational Change Programme created three interdisciplinary research institutes underpinned by challenge led research themes and centres. Our research aligned with the Institute for Environment, Health &amp; Societies (IEHS) and contributed to 5 interdisciplinary cross-university research themes (Ageing, Environment and Health, Health Economics, Systems Biology and Welfare, Health and Wellbeing) and 3 research centres (Genome Engineering and Maintenance, Inflammation Research and Translational Medicine, Health Effects of Radiological and Chemical Agents).</p> <p><b>Research plans and objectives:</b> We achieved our three key research aims for 2014-2020. <i>Increase research income:</i> The number and value of research grants increased by a third (190 grants to the value of £16.4m). <i>Developing agenda setting research published in high quality journals:</i> Examples include: (a) demonstrating recovery benefits from listening to music while in surgery (Meads-Lancet IF 60.3 286 citations, Altmetrics 983); (b) identification of the mechanism underpinning a cancer marker (Vagnarelli e-Life, IF 7.0 citations 79, Altmetrics 106) and (c) long term benefits of increasing physical activity for older people (Victor; Plos Medicine IF 10.5, citations 91, Altmetrics 242). Our publications in the highest quality academic journals have increased</p>

significantly (e.g. 28 papers in Nature Journals, 7 in Lancet Journals, 15 Cochrane reviews). *Enhancing research capacity in quantitative methods:* We appointed 5 staff with big data analysis/quantitative skills across our 3 research areas generating 4 externally funded grants, 3 PhD studentships and a range of publications.

**Research strategy 2021-2026:-** Aligning with the Brunel 2030 Research Vision our strategy is shaped by three intersecting drivers: (a) international global health challenges with economic, social and cultural benefit; (b) developing an open research culture informed by equality, diversity and inclusivity and (c) responding to the post COVID-19 research and recovery agenda. We will achieve this by:

**Consolidating our research strengths:** In line with our college 3 year rolling plan we will continue to grow and build capacity in three research challenge areas by aligning staff recruitment with our areas of established international excellence: neuro and respiratory rehabilitation, ageing and disability across the lifecourse (*lifelong health and wellbeing*), health-related exposures and behaviours (tobacco control, physical activity, radiation exposure and behaviour change) (*evidence and evaluation*) and cell biology, microbiology, immunity and inflammation and cell and gene therapy (*disease mechanisms and therapeutics*) (see section 2 for staffing strategy).

**Developing our staff:** We support the enhancement of our research environment and infrastructure by our staff recruitment and development strategy. A key goal is to develop a staff profile that reflects the diversity of our student population and local community (see section 2 staffing).

**Internationalising our research:** Brunel University is outward facing and strongly international and we are ranked 10th for 'International Outlook' in 2020. Health research has strong international collaborations ranking 11<sup>th</sup> in the UK and 75<sup>th</sup> worldwide and the majority, 86%, of our publications are with international co-authors. Strategic University investment has supported the internationalisation of our research. Brunel is one of 8 institutions funded by the Research England I3 initiative. This supports our Prosperity and Health collaboration with Tampere University with whom we have five joint projects across our three research areas: *lifelong health* (Martin, Victor), *disease mechanisms* (Karteris, McCarthy) and *evidence and evaluation* (Pokhrel). Institutional GCRF support generated new research collaborations in *evidence and evaluation* (physical activity projects in Ghana, Brazil, and Mozambique: Anokye and Norris M) and *lifelong health* (stroke rehabilitation in India: Mohapatra and Norris M). Examples of funded collaborative international research projects include: (a) *disease mechanisms and therapeutics* (Sala's research into adenoid cystic carcinoma and neuroblastoma with colleagues from USA, Sweden, Brazil and Italy and funded by the USA Adenoid Cystic Carcinoma Research Foundation (ACCRF), Oracle Cancer Trust (UK), FAPESP (Brazil) and the Italian Association for the Fight Against Neuroblastoma); (b) *evidence and evaluation* (Coyle's work on health systems in Canada with the University of Alberta) and (c) *lifelong health and wellbeing* (Kramer-Roy's research on supporting families caring for children with disabilities in Pakistan funded by the British Council).

**Enhancing the policy and practice impact of our research.** We have a strong international/national profile for the policy and practice impact of our research. This outcome reflects our strategy of:- (a) focussing upon national/international priority areas; (b) embedded engagement with key stakeholders from both policy and practice communities and local communities; (c) the enduring nature of these relationships and (d) research development activities that foreground impact.

**International:** Exemplars of our contribution to international policy development include:- (a) interdisciplinary clinical practice guidelines for children and adolescents with cerebral palsy (European Academy of Childhood Disability-Green) and (b) training materials/best practice guidelines for addressing sexual/gender violence in universities and for children and young people (outputs from 2 EU projects lead by Alldred).

**National:** We contribute to the development of practice based clinical guidelines for health professionals e.g. splinting post-stroke, stroke, neurorehabilitation and ataxias (Kilbride, Warland,

Royal College of Physicians), occupational therapy in neonatal services (Smyrni) and occupational therapy home programmes for children and young people (Dunford). Our contribution to National Institute for Health and Care Excellence (NICE) guidelines include low back pain (O'Connell); social work interventions for adults with complex needs, including learning disabilities and mental health (Nelson-Becker) and independence and mental wellbeing for older people (Victor).

**COVID-19:** We responded to COVID-19 both internationally and nationally. Anokye, as Chair of the ISPAH (International Society for Physical Activity and Health) LMIC Research Council, contributed to the development of three sets of policy guidelines on physical activity during/post COVID: two for the global south and one with WHO. Corner used her critical care research to develop and evaluate the national rapid education programme in the management of COVID19 patients for non ITU hospital/community staff.

**Engagement with key stakeholders:** This is a core value that underpins our research. We both respond to stakeholders' priorities and are engaged with them in shaping these.

**Engaging with stakeholders:** We have a range of formal structures designed to facilitate the involvement of those who will be end users of our research and in establishing research priorities. CHLS has an advisory board made up of key stakeholders including pharmaceutical and med-tech companies and health care education and provision partners (Health Education England, NHS England, Public Health England). All research centres have external advisory boards. For funded projects, where appropriate, we follow good practice by constituting advisory panels that include all relevant partners and stakeholders (e.g. Kilbride, Innovate UK stroke project; Anderson, Centre for Health Effects of Radiological and Chemical Agents). Engagement and collaboration with our local health economy is facilitated by Brunel Partners Academic Centre for Health Sciences (BPACHS). Successes from this initiative include NHS/jointly funded PhD studentships to increase research capacity within the NHS.

Brunel is the civic university for West London committed to diversity and inclusion. We demonstrate these values by our engagement with our highly diverse local community. Public engagement funding (5 awards-value £10k) supports our established and highly active user engagement groups to contribute to scoping, shaping, implementing, and disseminating our research. Groups supporting our research include the experts by experience group (social work), RAGE our young people with cerebral palsy group and Kidspace (children with disabilities and their parents). The Brunel Older Peoples Reference Group (BORG) is our longest established group. As part of the events marking their 10<sup>th</sup> birthday in 2018, we held a workshop with them to discuss and co-develop our strategy for ageing research in the next decade. Engagement continued during COVID-19 via Zoom which enabled BORG to support our research by providing feedback on proposals under development from PGR students (e.g. Barbour falls and vestibular disease), and colleagues across the University submitting grant applications (e.g. Dong from Design for an ESRC healthy ageing challenge project; Bailey from Sport Sciences which was funded by Abbeyfield).

**Activities to facilitate impact:** Support mechanisms to facilitate impact are embedded in our research development, implementation and dissemination processes and tailored to the needs of specific staff groups (PGR students, early career researchers (ECRs), part-time staff and those returning from maternity/parental leave).

**University wide research impact support infrastructure:** Our Research and Development Support Office (RSDO) provides support for research and business development. We benefit from research support and business development staff aligned to our college and funding stream specialists (Global challenges, EU, Innovate). Our scholarly communications and press teams work proactively with researchers. When papers are accepted for publication/external grants awarded they promote via media releases and publication in outlets such as The Conversation (e.g. Prunty's contributions on touch screens and handwriting). The Royal Society writer and entrepreneur in residence schemes support the activities of individual academics and research groups.

We have competitively won £500k in institutional research support funding since REF2014. All such awards require specification of impact plans. Knowledge transfer funding supports staff to engage with relevant industrial/policy/practice bodies to promote the policy/practice/product outcomes from their research (e.g. working with the Alzheimer's Society to promote the policy/practice outcomes from the IDEAL dementia research programme in which Brunel is a partner). Seminar series and public engagement funding provides opportunities to disseminate our research and discuss potential impact pathways with key stakeholders including our local community. Since 2014 we have won £47k to support 22 seminar series to develop interdisciplinary projects, international/national networks and engage with local stakeholders. We support the development of ECR research networks by using this funding to strategically link them with established researchers (e.g. Dunford and Mohapatra) or support ECRs and research staff to develop applications (Pikhartova, Williams). During COVID-19, we switched our seminar series to on-line webinars and adapted our outputs to reflect the new context. Our ECRs developed a COVID-specific public health series (Cheung, Norris E and Milner) and we contributed to the University life during lockdown series (Thomas, Nelson-Becker).

Dissemination of our research at academic and professional conferences is an important component of our impact strategy. VISA awards, to promote researcher visibility by funding participation in academic conferences, were awarded to 36 different health staff, the vast majority either post-doctoral researchers or staff at lecturer/senior lecturer grade, to attend 50 conferences (value- £79k). All BRIEF award funding for new lecturers includes an allowance for international conference attendance to promote their research and support development of national/international networks (see section 2 for details of BRIEF awards).

*College-level support for impact:* our impact champions provide mentorship and leadership to staff, especially ECRs. For all funded projects, both internal and external, we hold a 'start up' meeting lead by our college research office. Discussions about potential impact are integral to this as well as orientation to standard university processes and procedures (e.g. research ethics and governance). Our research office proactively monitors our current and historic research portfolio for new and continuing impact which enables us to identify projects with significant impact that will mature within the next REF cycle (e.g. handwriting for dyslexic children (Prunty); post-stroke rehabilitation (Kilbride); implementation of OT guidelines for home care of children (Dunford); national guidance for measuring home environment for provision of assistive equipment (Spiliotopoulou) and burn trauma and infection (McCarthy)).

The peer review and support system for both internal and external funding applications introduced in 2014 includes project appropriate evaluation of impact. We also hold termly informal 'pitch to peers' impact sessions. Colleagues' present impact plans for current/proposed projects to a panel including business development, public engagement, and knowledge transfer experts and successful grant holders. We promote the maximisation of impact of published papers by: (a) developing lay summaries or summarising key papers in a form accessible to non-academic audiences (e.g. Centre for Health Effects of Radiological and Chemical Agents) and (b) publications in established professional practice journals to engage with practitioners. In combination these processes enable us to mentor and support staff, especially ECRs, in developing research with impact, ensuring that sustainability is embedded within our research culture.

**Supporting interdisciplinary research:** Our research challenge areas are inherently interdisciplinary contrasting with REF2014 when our research portfolio was strongly discipline/profession led. The majority (65%) of our staff, external grants and outputs (60%) are interdisciplinary across our three research challenge areas. In developing and sustaining our strong interdisciplinary research portfolio we benefit from significant institutional support in terms of staff and internal funding. We benefit from staff support from RSDO to facilitate and maximise interdisciplinary health research. This includes organising events for specific funding calls and

funders (e.g. cross university COVID-19 research response workshop), inviting major funders to visit us (NIHR, Wellcome, Leverhulme) and less formal sandpits and brainstorming sessions.

Institutional investment in the development of interdisciplinary projects has been provided via catalyst funding. This supported pilot studies on ambitious, potentially high risk or disruptive ideas (IDEA awards) and pump-priming novel innovative research projects that crossed the boundaries between traditional disciplines (INTER awards). We won 4 IDEA awards (£48k to Norris M, Ryan and Vagnarelli) resulting in 2 applications (BBSRC, Vagnarelli under review; Norris M, MS Society-funded) and papers (e.g. Vagnarelli- bioRxiv). We won 5 INTER awards (£101k to Bridger, Ryan, Saunders, and Silva). Silva's project facilitated collaboration with engineering colleagues to develop an organ on a chip system resulting in a £45k grant from Breast Cancer UK, collaboration with the Organ on a Chip Technologies network (UKRI funded) and a UKRI grant (under review).

### **Progress towards an open research environment:**

An open research environment maximises the public benefit of research and is characterised by research which is transparent, reproducible and where publications and data sets are freely accessible. We benefit from strong institution support for the achievement of this strategy. This includes relevant institutional policies and international initiatives such as the Declaration of Research assessment (DORA), support for open access publishing and the FIGSHARE data sharing/data repository.

We are part of the UK reproducibility network (Norris E). In June 2020 we created a CHLS wide open science network to champion this activity and support open data practice (Norris E and Pound-Psychology). Open Science is a standing item on our College Research Strategy Group (CSRG) and forms part of our research induction for all new staff run by our college research office. Our scholarly communications team attend CSRG. They provide guidance to health researchers on developing data management plans, data storage, open data and open access publication by attending research group meetings and providing drop-in sessions.

Our open science strategy has 3 elements: publication or pre-registration of research protocols, open access publishing and open data. To promote the accessibility of our research we were early adopters of open access publishing and this is now the norm for health researchers (25% of outputs in 2014 to 100% in 2020) and aim to match this for pre-registration and data sharing by 2028. Colleagues also actively use pre-prints to disseminate their work (e.g. Norris E, Sala, Vagnarelli, Corner). We promote the transparency of our work by the publication or pre-registration of study research protocols in advance of conducting the empirical work on relevant platforms such as PROSPERO (O'Connell, Norris E, Kilbride, Norris M) or publications (Ryan). Making data open promotes reproducibility of results (and reanalysis to answer new questions). Our institutional open data policy is supported by the FIGSHARE data sharing and data depository which is recognised by all major research funders. Where we are the lead researchers or have internally funded the research, we expect data to be made available on FIGSHARE or other appropriate repository either national (e.g. UK Data Archive) or discipline specific (the GWAs Catalog, Gene Expression Omnibus, and PRIDE biosciences repositories). To support open data practices recipients of Institutional funding such as BRIEF/CHLS awards for new lecturers and CHLS/Institutional funded PhD studentships are required to deposit open data.

### **Supporting a culture of research integrity**

We benefit from a strong university-wide infrastructure supporting research integrity. Research at Brunel is governed by our research integrity code which draws together all relevant institutional policies in a single document. Three key principles underpin our code:- (a) nurturing a research environment that supports research of the highest standards of rigour and integrity; (b) ensuring that research conducted conforms with all ethical, legal and professional obligations and (c) transparent, robust and fair processes to handle allegations of misconduct. The code covers

professional standards expected of staff involved in research including leadership, supervision and mentoring of staff, research methods, collaborative working, and conflicts of interest. The code also covers intellectual property, publication and authorship, financial matters, and data management. All higher degree students (and MSc students) are required to complete a compulsory research integrity online module, prior to applying for ethics approval for their research projects. Research integrity is a standing item on the agenda of the CHLS Research Strategy Group (CSRG) and regular updates are received from CHLS Research Ethics Committee (CREC) and good practice is shared. All academic and research staff and PhD students are briefed about the research integrity code at research induction with our college research team and via regular updates.

The University Research Ethics Committee (UREC) approves our animal and human tissue research. The University is a signatory to the Concordat on Openness in Animal Research. Biology at Brunel is an annual event at which demonstrate the openness and transparency of our animal research and demonstrate our commitment to the policy provided by the National Centre for the Replacement, Refinement and Reduction of Animals in Research. The University supports a centralised submission of human participant research approval via the Brunel Ethics Online (BREQ) system and operates a proportionate level of scrutiny depending on the assessed level of risk. Undertaking research with human participants requires formal approval from either the University or College Research Ethics Committee (CREC) depending on the level of assessed risk. As part of our commitment to openness in research our college CREC includes as full members two lay members as well as PhD student reps and members from each division within the college.

## 2. People

**Staffing strategy:** Our staffing strategy prioritises: (a) recruitment of world class researchers to our three research challenge areas and (b) promoting career progression by an active programme of staff development across career grades. The success of this strategy is demonstrated by our recruitment and promotion metrics. Since REF2014 we have recruited 35 new staff (7 professors, 3 readers, 4 senior lecturers and 21 to their first lecturing post) and achieved 46 promotions with 20 staff progressing to senior lecturer and notable examples of career progression where staff have progressed from lecturer to reader (9) and lecturer to professor (3).

**Recruitment:** Underpinning our post REF2014 recruitment strategy has been the appointment of talented staff to our areas of research strength. Strong research leadership is provided by the appointment of 10 readers/professor in our 3 research areas: *lifelong health and wellbeing* (Collier, Conway, Green, Nelson-Becker), *disease mechanisms and therapeutics* (Blakemore, Gavins, Hellewell, Turner) and *evidence and evaluation* (Davare). To ensure the long-term viability of health research, where 40% of current staff are aged 50+, we supported succession planning by recruiting 25 staff at senior lecturer/lecturer level on permanent contracts subject to probation.

**Developing staff:** Our key institutional level mechanism for developing our staff is the annual PDR and includes all staff. Research group leads take a proactive approach to developing their staff and are involved in the PDR process. A key vehicle for research development is the individual 3 year rolling research plan. Developed collaboratively with research leaders, these enable individuals to take a strategic and proactive approach to their research development in terms of key areas of activity: outputs (publications, new data sets), grant capture, impact (including collaboration, engagement and dissemination activities) and engagement with open science practices. Research plans feed into PDR enable staff to strategically align activities with research-based promotion criteria and identify areas for development. For Professor/Readers salary increases and progression is linked to annual targets established at PDR.

Our institutional-level staff development infrastructure provides training around generic core skills such as time management, mentoring and governance requirements some of which are role specific (tier 4 visa training). All staff must complete mandatory training in equality and diversity,

sustainability, health and safety, data protection and financial probity which are refreshed at regular intervals. Research focussed training includes sessions for ethics review and approval and use of the local system (BREQ), chairing PhD vivas, PGR supervisory training and mentoring, developing, and costing research projects, managing research staff etc. For lab-based researchers there is specific health and safety and risk assessment training.

Addressing issues of diversity and equality underpins staff development. Our institutional workload allocation model (WAM) is part of our portfolio of activities to promote equitable and transparent workloads across staff groups alongside established institutional leadership development programmes for women and BAME staff as well as specific promotion workshops. Athena Swan awards are available for those returning from maternity leave. Our age and gender staffing profile suggest that many staff have caring responsibilities. We offer tailored, flexible working to these staff as well as those with other challenging circumstances (e.g. disabilities). We supported remote and flexible working appropriate to specific staff circumstances and this is now embedded in the COVID-19 home-working policy. There are a range of institutional support networks for LGBTQ+ staff, minority groups, working families and carers that enable staff from across the University to meet in a relaxed and confidential setting to collaboratively discuss important equality issues in the workplace.

As a college we hold an annual staff development week when all staff 'red-line' their diaries to focus on their professional development. The development activities are based around staff suggestions and analysis of development needs from PDR/research plans. Activities tailored to the development of research careers include open science, research integrity, impact and dissemination and specific activities such as paper and abstract writing and training in statistical analysis packages (e.g. R). In addition, there are 'drop-in' sessions with RSDO, business development, scholarly communications, media, and communications staff as well as research leaders.

**Supporting staff:** In 2019, the University introduced its new Employee Mental Health & Wellbeing Strategy for staff. This outlines its approach to supporting employees with health problems or disabilities to maintain access to or regain work and raising greater awareness around mental wellbeing and providing opportunities to improve physical and emotional wellbeing more generally. Support for staff is tailored to career grades and circumstances.

*Support for early-career researchers (ECRs)* We hold the 2020 European Commission's 'HR Excellence in Research' award. This recognises our commitment to the Concordat to Support the Career Development of Researchers. A key transition point in a research career is the first academic (lecturing) appointment. Since 2014 Brunel has explicitly supported this transition by implementing a new contract for this staff group termed the 'academic lifecycle'. Staff appointed on these contracts have a 2-year probationary period during which they have a reduced teaching and administrative load to support them to develop their research profile via outputs and grant applications; develop research management skills (e.g. managing staff and budgets) as well as impact and dissemination. Following successful completion of probation there is a two-year development phase after which they are promoted to Senior Lecturer. Eighteen staff have been appointed on these contracts.

CHLS supports new lecturers with a start-up grant of 5k to 'pump-prime' their research including conducting pilot work, building internal/external collaborations and dissemination including funding conference attendance. The University provides competitive funding (BRIEF awards-value £15k), for new lecturers within 3 years of their appointment which are available to fixed-term staff. Since 2014 18 staff have competitively won a BRIEF award (out of 89 funded and valued at £179k) and a further 6 supported by CHLS (value £90k). BRIEF awards are a platform to developing external networks, publications and grant applications. Successful awards from this funding pathway include Rudolf (BBSRC), Vagnarelli (BBSRC and Wellcome Trust); McCarthy (Innovate UK and British Society for Antimicrobial Chemotherapy Research) and Bubici (Bloodwise).

**Established staff:** Institutional support for established staff to develop research proposals and conduct pilot studies is available from the Research Development Fund and sabbatical leave. From 2014-2017 sabbatical leave was organised at institutional level and has been awarded to 10 staff (value of support £95k). Since 2017 this has been devolved to colleges and offers a more tailored and flexible approach in terms of duration and purpose including for the development of outputs, grant applications and impact, attributes especially relevant for our part-time staff and those with caring responsibilities. We facilitate succession planning and staff development by supporting established staff to enhance their experience via research leadership roles (e.g. deputy research centre lead, division and departmental research/PGR directors). Staff Development offer leadership development programmes for emerging leaders (ASPIRE) and those appointed to management roles (Academic Leadership Programme).

**Part-time staff:** We have the highest proportion of part-time staff, 14%, in the university, most of whom are female and combine clinical practice with their university role. These staff are spread across the career grades (5 lecturers/senior lecturers; 4 professors/readers) and their eligibility for institutional/CHLS research support is identical to full-time staff. To meet the needs of part-time staff, research plans reflect the FTE. We have a CHLS wide co-ordinated research activities calendar. This enables us to share activities, facilitates research collaborations, supports dissemination of good practice, and ensures that activities are rotated across times/days week. This enables those with flexible/adapted work patterns and part-time staff to maximise attendance. We record formal research support activities to enable part-time staff/others to access the materials at more convenient times and serve as a resource for new staff. All key research support activities moved on-line during COVID-19 which supports the greater involvement of our part-time staff.

**Postdoctoral research staff:** Since 2014 our 73 research fellows/assistants funded by external grants have made a substantial contribution to the vibrancy and sustainability of our research environment. Our commitment to their development is demonstrated by Brunel's signature to the Concordat to Support the Career Development of Researchers. We have a Concordat Working Group and publicly accessible Action plan. In further recognition of our commitment to the recommendations of the Concordat, and the career development of researchers, Brunel has held the European Commission's 'HR Excellence in Research' award since 2011. We adhere to sector best practice with those employed for a minimum of 4 years on open contracts and all research staff are able to take advantage of the 10 days training per annum set out in the Concordat for career development.

Our Graduate School co-ordinates generic career development activities for postdoctoral research staff which includes a *Researcher Development Programme*, researcher network forums, workshops, and personal and career coaching support which continues for up to 3 years after they have left Brunel. Discipline specific support is provided in research groups. We support the career development of these staff as evidenced by leading on publications (e.g. Noorkoiv- Clin. Anat. 32:319–327, 2019), presenting papers at attending international (e.g. GSA 2016 Van den Heuvel) and national conferences (Kinnear and Williams -BSG) and applying for their own research funding (e.g. £20k to Fortune, Health Education, NW London). Research staff have been successful in obtaining lectureships (Brunel: Cocks, Roberts; other institutions: Williams, Nippissing Canada), research posts nationally (Pikhartova UCL) and internationally (Lavelle and Fortune, Royal College of Surgeons of Ireland) and returned to clinical practice (Stennett).

**Promotion and career progression:** Developing staff is essential for the long-term sustainability of our research environment and career progression via internal leadership roles (see established staff section) and promotion are important mechanisms to achieve this. In 2017 a new institutional criterion-based promotion process was introduced. Support for promotion preparation takes place at the institutional level with briefings for applicants by the Vice Provost as well as sessions for women and BAME applicants. At college level support for promotion is embedded both within PDR/research plans and is a key activity for our research leaders. Examples of successful applications are available for applicants to consult and feedback on draft applications provided. In the 3 years since the introduction of the new process, applications for promotion from health



researchers now broadly match our staffing profile: 55% from women, 3% with declared disability and 13% from part-time staff broadly equal to the profile and 25% from BAME staff (20% of staff). Success rates were 65% for women, 100% for part-time staff and those with a disability. We have achieved 46 different promotions since 2014 and 12 staff have progressed from lecturer to reader/professor during this period.

Inevitably some staff have left since 2014 for retirement (Pook, Gilhooly K and M). Notable career progression moves include Harries (Associate Dean International Student Development and Associate Dean Research and Enterprise Kingston and St Georges), professorial promotions for Allred (Nottingham Trent), McKay (Edinburgh Napier), Sullivan (Nippissing, Canada), Meads (Anglia Ruskin) and readership (Atwell London South Bank).

**Evidence to facilitate exchanges:** We benefit from a range of institutional strategies and mechanisms to promote exchange with business/industry, public/third sector bodies and professional organisations as well as community engagement more broadly. The strategic importance of these activities is recognised by their inclusion in our WAM.

Our CHLS advisory board is a prime mechanism for us to engage with major business, industry and policy/practice audiences in developing our research and innovation strategy. The Business Development team are our primary link with the business community and a member of their staff works exclusively with health researchers. They are a member of our research strategy group, regularly attend research events and group meetings. To facilitate exchanges with SMEs/business they organise individual meetings between researchers and potential partners, showcase events (e.g. July 2020 attended by 55 SMEs) and developed health research business facing publicity materials. We received three Brunel Innovation Vouchers, a mechanism that promotes exchange between staff and SMEs, resulting in three externally funded research projects (£750k Kilbride, McCarthy, Themis).

Links with the NHS at institutional level are facilitated by BPACHS. As part of our strategy to ensure the clinical relevance of our research we recruit staff across the career grades with NHS experience (e.g. Lecturer: Lewis, Mohapatra, MacBean; Professor: Conway). Staff are embedded in the NHS in both clinical (MacRae, Corner) and research roles (Kilbride) thereby facilitating exchanges and offering the opportunity to develop research and research led teaching for our students. Staff from the local health economy hold honorary appointments in our college and work on joint research projects with use including cancer research (Prof Hall, Mount Vernon and Karteris) and physical activity (Stewart, deputy public health director for Enfield, and Pokhrel).

**Recognition and reward for research/impact:** We recognise research, engagement and impact activities of staff in our WAM, probation and promotion activities. Evidenced achievement of both research and impact are important criteria in our promotion system; form part of the salary review process for readers/professors and award of discretionary salary points for lecturers/SLs. University level Impact Awards offer formal recognition for this activity with the work of Van den Heuvel with the Brunel Older Peoples Reference group (BORG) was commended in 2020.

**Supporting and developing PGR students;** Since 2014 we have graduated 104 PGR students and the University Code of Practice for Research Degrees sets out the duties and responsibilities of students, their supervisory teams and the Departments and Colleges of the University. Our programme for PGR students aligns with the Researcher Development Concordat and is led by our Graduate School. Working with supervisory teams, they organise activities to bring PGR students across disciplines together to address the three key elements of the Concordat: environment and culture, employment, and professional and career development and fosters an inclusive and interdisciplinary research culture.

Our research environment for PGR students has radically changed since 2014 and is demonstrated by success in obtaining external studentships. We offer our PGRs a vibrant research environment as demonstrated by our participation ESRC Grand Union Doctoral Training Partnership (DTP) with Oxford and the Open University. The focus of the Brunel partnership is

wellbeing and health. All PGR students benefit from the training and development opportunities that our engagement with the DTP provides. We currently have 5 studentships linked to the DTP. The flexibility of the DTP to provide bespoke training to talented individuals before starting their doctoral studies via the +4 route is invaluable in health research. It offers a route for those in clinical practice to enhance their research skills before embarking on doctoral studies. We have had funded studentships from NIBSCs and from EPSRC and NERC with colleagues in other colleges. We receive substantial support from a wide range of funders including the local health economy (Hillingdon Hospital, Mount Vernon, St Bartholomew's, Oxford), charities (Kidscan) and national (e.g. Public Health England) and international funders (Commonwealth scholarships). Where staff can raise 50% of PGR fees and stipend the college will match and provides other funding support (£163k, 8 awards).

All PGRs are aligned to the research theme/centre of their supervisor and have access to a college research fund of £500 per year to support their studies. Regular research seminars enable students to present at, and receive feedback on, their work from their peers and staff in a supportive environment. Our PGR students have successfully been awarded institutional competitive internal funding to attend conferences to present their work and develop their professional networks. We support a College level PGR student-led research conference annually in which health students both participate as presenters and as organisers. Participation in this is a requirement for year 1 students (present a poster) and year 3 (present an oral paper). PGR students are represented on key college committees including Research Ethics and Student Experience. Their contributions have made positive changes to the 2020 updated code of conduct.

Supervisory teams now consist of two academic supervisors with subject/methods expertise and a Research Development Advisor (RDA) who works with the student identify and address training needs and offer broader support in terms of career planning and wider impact/stakeholder focused activities. Formal progress reviews are held at 4 weeks, 9, 20, and 30 months for full time students overseen by an independent academic panel. Clear milestones for achievement are set for each review in support of successful completion within 3 years. Supervisory sessions are held at least every 6 weeks and recorded on-line. In combination these arrangements support excellence in the academic development of PGR students in terms of successful progression and completion and core academic skills (presentations skills-both oral, poster and on-line), data analysis etc and wider skills such as impact and dissemination, engagement with stakeholders and teaching for those who wish.

Since 2014 we have graduated 104 PGR students. The profile of this group has more UK students than the sector norm (63% v 48%) but a higher proportion of non-white students (68% v 42%) and females (69% v 61%). Award outcomes broadly reflect this distribution. Recruitment routes for PGR students vary across the disciplines underpinning health research. In Biosciences talented undergraduate students can be recruited onto doctoral pathways via master's programmes. Clinical sciences pathways are more complex. We recruit from NHS/social care staff following a period of practice and in health economics via our MSc Public Health programme or similar courses elsewhere.

The excellence of our PGR students is evidenced by internal and external markers of esteem. Five health PGR students have won the VC's award for excellence since 2014. We encourage our students to participate in the University-level PGR conference and 3-Minute thesis competition. Our students regularly publish papers with their supervisors (e.g. Boniface with Norris M and O'Connell) and present at international conferences (e.g. Amin, American Society of Human Genetics with Blakemore and Drenos). On graduation our PGR students follow a variety of different career paths. Illustrative examples include industry/pharma (Corda, Oxford Biomedical; Henry, Catapult; Bikkul, Biopharma), establish their own companies (Badhe, Swalife); lecturing (Cocks, Brunel; Kanya, LSE and Russo Technische Universität Dortmund in Germany), securing prestigious competitive fellowships (Ellmers, ESRC Postdoctoral Fellowship) and postdoctoral research posts (Anjomani-Virmouni Institute of Cancer Research).

**Equality and diversity:**

Brunel, as a research-intensive university, is submitting 100% of eligible academic staff. We followed the processes set out in our Code of Practice for the fair and transparent identification of independent researchers and to ensure that the submitted outputs provided a balanced and unbiased representation of the work of our diverse academic community, their characteristics and contractual positions (age, disability, race, sex, part-time workers and fixed-term employees). Output selection was monitored through regular Equality Impact Assessments. Our Equality Impact Assessment indicates that the outputs submitted for Allied Health are a well-balanced representation of the protected characteristics and contractual positions of our staff. Our submission comprises 55% female staff (58% of outputs), declared disability 3% of staff and outputs and 14% part time staff (12% of outputs) and BAME 17% of staff (19% of outputs). The imbalance in age distribution and outputs for the 40-49 and 50-59 group reflects the distribution of funded grants and research leadership roles respectively.

We aspire to create a research environment that is inclusive and provides support, training and development across career stages and embeds equality, diversity and inclusion across the research lifecycle. At the institutional level we hold the Athena Swan Bronze award as do the two departments (life and clinical sciences) within CHLS, the academic home for health research. We are taking up membership of the Women in Science and Education (WISE) Campaign. In 2020 Brunel was been recognised by the Academy of Medical Sciences as an HEI eligible to host Springboard awards which provide up to £100K over two years and a personalised package of career support to help newly independent biomedical scientists launch their research careers.

We benefit from a range of institutional activities designed to promote equality and diversity. All staff benefit from mandatory equality and diversity training. Our institutional Workload Allocation Model (WAM) assures transparency and equity of workloads across staff grades, FTE and protected characteristics. PDR and WAM intersect to support flexible/remote working tailored to the needs of the individual and their specific circumstances and can be modified to reflect the changing circumstances of individuals. Since COVID-19 the institutional policy on remote working has expanded to encompass all staff. The Aurora Development scheme for women has been attended by 16 health staff (2 part-time), out of 36 delegates overall, of whom 5 have gained promotion and 4 have taken on major leadership roles in CHLS.

To support our equality and diversity strategy, established internal mechanisms are used to alert all staff to internal/external research opportunities (e.g. email notification of key dates for the promotion process), specific email groups for grants (e.g. RSDO yammer lists). We have developed a list of key recurrent research grant deadlines that all staff can use to plan timely applications and use in WAM discussions to plan workloads. This is especially helpful for those on part-time contracts, flexible working or with caring responsibilities. Where institutional internal funds are involved the time schedules for the completion of awards can be adjusted to reflect changes in individual staff circumstances. Recordings/presentations are routinely made of key briefing meetings linked to internal/external funding and posted on the research web pages so that staff not able to attend can take advantages of the opportunities on offer. We maintain a diary of all research events on our intranet site so that we can manage meeting scheduling to maximise the engagement of part-time staff and those with caring responsibilities/complex circumstances (e.g. rotating centre meeting dates etc). This also maximises the opportunities to engage for those with recurrent teaching commitments.

Brunel has a highly diverse academic community: 60% of students and 31% of staff declare themselves as belonging to BAME groups: 40% and 17% in health subjects. This potentially reflects the under-representation of BAME students nationally in non-medical clinical and social care courses which inevitably limits the numbers progressing into the academy. Health staff have actively participated in initiatives to increase the number of disadvantaged and BAME students

across our health courses. This includes hosting Nuffield summer school students, actively engaging in outreach work via the STEM centre and undertaking research to investigate academic achievement and progression in BAME groups in both biomedical and clinical areas (see section 4).

Pre-COVID we recognised that not all staff/PGR students can travel for research purposes/attend conferences because of family responsibilities and other reasons such as disability or flexible working. We support these individuals in discussion with the HoD, research leader and research funder (if appropriate). Where appropriate data collection can be organised via third parties under supervision of the staff member/PGR student and adapted equipment can be provided as necessary to support those with disabilities. Research meetings with colleagues/mentors can be facilitated via meeting software (this predated COVID-19). Research meetings organised by research groups at Brunel, both large conferences and seminars, can be live streamed and/or recorded so that staff with caring responsibilities, part time staff are able to participate or those with teaching/clinical commitments (e.g. the What Works for Wellbeing conference and our Global Health Academy conference).

### 3. Income, infrastructure and facilities

#### Income

Since 2014 we submitted 494 grant applications (value £122m) and were awarded 190 (value £16M) to 64 different PIs (65% female). This represents a 35% increase in applications; 32% in awards and 60% in research spend (£9.7m to £15.5m). We have diversified our funding base and developed a 'mixed economy' including EU/government, research councils, industry and charitable/professional bodies. The proportion of spend from UKRI funding has increased to 30% (from 20% in 2014) and to 10% from industry/Innovate UK. This enhanced research income has supported our 78 staff to publish 2019 articles, conference proceedings and books/book chapters, an increase of 15% in volume, generating an 83% increase in citations.

Our grant income success is built upon 5 key strategic initiatives: (a) the consolidation of our research in challenge areas where we have critical mass (see section 1); (b) alignment of recruitment with research areas (see section 2); (c) development of individual and research group plans (see section 2); (d) a 'model' research funding pathway, linked to career stage and supported by strong mentoring from senior staff and (e) improved quality of our grant submission through enhanced peer-review and support. Our model funding pathway starts with small grants for pilot projects for early career staff (e.g. British Academy), career stage specific grants (e.g. new investigator awards or grants for established researchers) through mid-range grants for those with an established research profile and collaborating or leading large national/international grants for those with an established track record. Grant preparation and submission is supported by institutional Research Development Funding/BRIEF awards (depending on career stage), linked to individual and group research plans to promote a timely and proactive approach to grant submission. We publish the deadlines for recurrent grants so that staff are aware of these and embed grant development plans within their portfolio of activities.

Research grant support activities operate at three levels: research group, college and university. Key to the successful award of a research grant is the quality of the submission and the primary drivers of this are our research groups whose meetings provide informal opportunities for colleagues to get feedback on draft project proposals at an early stage. Since 2014 all external grants where Brunel staff are the PI are required to be peer reviewed by 2 experienced colleagues. For those submitted by health staff this process may take the form of a traditional paper-based review mirroring funding agency processes but also includes more innovative and interactive activities such as seminar presentations and idea pitches. Peer reviewers consider the scientific merit of proposals, but also impact generation and dissemination plans. Where interviews and presentations are part of the grant awarding decision-making process, we provide applicant(s) with mock interviews and opportunities to hone their presentations.

At College level our Research Strategy Group (CSRG) drives strategy and support. CSRG includes all research leaders facilitating the exchange of good practice across groups. Since 2014 we have run an Annual Research Day which provides a forum for colleagues across the college to meet and tap into expert advice around topics such as open science, data management and hear personal 'grant getting' success stories presented by colleagues. Institutional support is provided by our Research Support and Development Office (RSDO) where we are linked with a dedicated college-specific support team who cover the health portfolio. RSDO organise a range of activities including visits/presentations from major funders such as Leverhulme, Wellcome, NIHR. They provide support to specific career grades such as the January 2020 grant development workshop for ECRs attended by 50+ delegates. For funding schemes with regular submission dates or specific calls and a broad reach of subjects (e.g. BA/Leverhulme and ESRC) we operate a university wide review and support of applications. RSDO maintain a library of successful grants that potential applicants can consult. Our business development team manage brokering and links with business/SMEs via infrastructure such as Innovation Vouchers and bringing SMEs and researchers together (the July 2020 health research showcase event) and creating customised publicity materials highlighting the strengths of health research at Brunel and support the filing of patents (Themis, MacBean and Hernandez).

#### **Applications and awards:**

*First grants:* A vibrant and sustainable research environment must support and develop staff to successfully capture their first external grants. Since REF2014 18 staff, of whom 10 were women and 2 part-time were awarded their first externally funded research grants. Illustrative examples include Hernandez (SPARKS/Great Ormond Street Charity, £220k) and Prunty (Royal College of Occupational Therapy Priority Award, £80k).

*Fellowship awards:* We have secured prestigious fellowship awards that recognise the international research excellence of staff. Three notable examples of such awards are Gavins (Royal Society Fellowship, £250k), Pazoki (Rutherford Fellowship, £300k) and Vagnarelli (Wellcome Trust Investigator Award, £900k).

*Major and prestigious grants:* Illustrative of our high prestige awards include Dunford's receipt of the Royal College of Occupational Therapy Elizabeth Casson Trust award (£99k). Themis, in collaboration with UCL, KCL, and other colleagues won the highly competitive SBRI InMutaGene CRACK-IT Challenge (£99k). Major high value grants from UKRI include MRC (£306k Sala; £290k Themis), BBSRC/BIBS (£771k Rudolf), ESRC (£1.7m Victor) and Innovate UK (£750k 3 awards to Themis, McCarthy, and Kilbride). Significant support, awards of £100k+, have been won from a wide range of charitable funders including the MS Society and Action Research Children (£420k Ryan), Royal Society (£245k Blakemore) and Friedrichs Ataxia Alliance (£209k Anjomani-Virmouni).

*Consortia grants:* Our research excellence is evidenced by both our leadership and collaboration in large research consortia. International consortia leadership is illustrated by Pokhrel's leadership of the 2m Euros, 7 country EU FP7 funded EQUIPT study quantifying the benefits of investing in smoking cessation (Return on Investment). Alldred led 2 EU grants on gender violence, value £350k, involving 10 different countries. Anderson leads the £1m interdisciplinary Centre for Health Effects of Radiological and Chemical Agents (CHRC) funded by the Nuclear Community Charity Fund which involves Leicester and the London School of Hygiene and Tropical Medicine. Victor led the £1.25m ESRC funded What Works for Well-being collaboration involving colleagues at Brunel (Mansfield and Kay in Sport, Health & Exercise Sciences) and Anglia Ruskin, Brighton, Tampere University and LSE. Our expertise is recognised by our collaboration in large consortia EU projects. Examples include McCarthy and Houlden (17 country EU BBI / Horizon 2020 Recover project (£480k to Brunel)); Anokye and Victor (Brunel led EU STAMINA project) and Saunders (Valor-Plus project (£485k)).

**Links between funding and high-quality research output and impact:** The EU funded work of Pokhrel in tobacco control has generated high quality research outputs with impact. This study generated 19 high quality papers and informs a well-respected book on the Return on Investment model in Public Health Policy published by Springer with approximately 3000 downloads. The initial paper in *Addiction* (2017) has 11 citations and an Altmetric score of 85 (top 5% of scores) of which 62% is accounted for by engagement of the general public suggestive of broader societal impact. This work has made a major policy impact by contributing significantly to the development of the NICE Public Health Return on Investment tool and forms the basis of our case study on tobacco control.

Our work with adults/children with cerebral palsy (lead Ryan) funded by a grant from Acton Medical Research (£250k), 1 from the Irish Health Research Board (E204k) and pump priming from Brunel (£35k BRIEF, IDEA and INTER awards) has generated 10+ peer review papers. This also generated broader societal impact by underpinning the creation in 2016 of the Adult Cerebral Palsy (CP) Hub. This campaigns for the 110,000 adults living with CP and developed from the adult CP research advisory group linked to our research projects.

**Organisational infrastructure supporting research and impact:**

Infrastructure investment is linked to our three research areas and supports our staffing strategy. Our substantial investment of £1.75m in a new state-of-the-art animal facility enhanced our capabilities in this area supporting the appointment of new staff (e.g. Hernandez, Gavins) and the grants they secured. We invested £250k in a high-performance computer cluster which facilitates brain imaging (fMRI & EEG), genomics, and epidemiological data processing activities supporting our recruitment of staff with quantitative expertise (e.g. Drenos, Pazoki and Sisu) and our work in the use of large datasets (e.g. UK Biobank). During COVID-19 these computing resources were used to model service recovery in Hillingdon and the clinical implications of backlogs, delays and new service configurations (in an environment with varying COVID transmission levels) (lead Taylor in computing with health research colleagues and one of our PGR students). To support our work on falls in older adults (Young and Kal and PGR students Cocks and Ellmers) we invested £25k in a new gait laboratory opened in 2016 managed by a university funded post-doctoral staff member (Kal). This supports interdisciplinary research and funded projects with our colleagues in Sport, Health and Exercise Sciences (Bailey and Shaheen). We have infrastructure to support on-line research with human participants. We subscribe to the Bristol On-Line Surveys Platform and our institutional subscription to ZOOM supports the conduct of online interviews and focus groups. This infrastructure has assumed greater prominence in the post-COVID research world and enabled us to continue with our research portfolio. Technical support for our activities is provided by 7 technicians in biosciences and 3.4 fte college IT team.

**Operational and scholarly infrastructure supporting research and impact:**

There is significant support for research and impact from central university infrastructure including the library and scholarly communications office. These colleagues underpin our open science activities by open access publishing and open data (supporting and promoting FIGSHARE data repository). We track the academic impact of our work by citations-which have increased by 80% compared with REF2014. Our subscription to Altmetrics enables us to track the wider societal impact of our work. For example, a paper on loneliness across the world, funded by Wellcome and supported by the BBC published in June 2020, has an altmetric score of 596, which included 42 news outlets, and was 90% generated by general public users.

We have benefited from significant institutional infrastructure support for impact. The University invested £78k in 45 VISA awards to support 36 different staff members, mostly lecturers and postdoctoral research staff, to attend national/international conferences. This supports the development of research networks and disseminate their work. The Brunel Policy Unit, led by Fisher (Politics) and links with the Cabinet Office Open Innovation team, partnership of 4 universities – Brunel, Essex, Lancaster and York afford us access to policy makers at national level

and provides internship opportunities for PGR students (Kumar-biosciences). These links also enable staff to engage with policy makers to better understand how to present our research in a format that is accessible to them. Our press office proactively promotes the impact of our research by monitoring BRAD our paper repository, for new deposits and work with authors to promote their work in the media. Examples of this are the paper from Harvey on the potential of plants in breast cancer treatment where the press release generated coverage in The Telegraph, Daily Mail and 42 other press outlets as recorded by Altmetrics. Our events and public engagement teams support the delivery of the research seminars and public engagements (see section 2).

**Monitoring diversity and equality in access to institutional research support:** As part of our commitment to equality and diversity we audit our research activity and support against our staffing profile. It is a standing item on our research strategy group agenda which is attended by our associate dean for equality and diversity. Our research leadership reflects the broad gender profile: 7/10 professors, 6/10 readers and 4/6 research group leads are female. as does internal research support (7/10 staff awarded study leave were females as were 13/19 BRIEF awards). Part-time staff received 2/10 study leave awards and 2/19 BRIEF awards. Of the 22 seminar series awards 16 were to teams led by women as were 4 of our 5 public engagement awards. Two thirds (65%) of research grants awarded since 2014 were led by a female PI and 25% of part time staff are current grant holders.

We actively support diversity by the research questions that we explore. Diversity was an underpinning theme of our contributions to the inaugural 2020 Brunel Research Festival (deferred because of COVID-19 to 2021). We have established a cross-college social justice research group, led by Thomas (Health) and Spurling (Arts) to champion this agenda and have led specific symposia on the health and wellbeing of a diverse range of groups including LGBTQ+ populations (Thomas), gender violence (Alldred), ageing and minority ethnic groups (Collier, Nelson-Becker, Norris M, Van den Heuvel, Victor) and children and disability (Dunford, Green, Prunty, Ryan).

**Collaborative research infrastructure:** As a member of the cross-HEI Combined Universities Brain Imaging Centre (CUBIC), Brunel jointly owns and operates a 3T Siemens MAGNETOM TIM Trio MRI scanner (with Royal Holloway, Surrey & Roehampton) in a purpose-built lab suite and run with the support of a specialist MRI technician (1 FTE). This facility supports the work of Nowicky and Davare and provides the opportunity for interdisciplinary research projects with our psychology colleagues in the Centre for Cognitive Neuroscience. Staff make collaborative use of major research infrastructure in the UK and internationally. Illustrative examples are: (a) computer infrastructure nationally (UCL, Queen Mary, Imperial, Earlham Institute used by Drenos, Pazoki, Rudolf) and internationally (Yale-Sisu); (b) mouse facilities nationally at Imperial, Great Ormond Street, Cambridge, Leeds (Anjoumani-Virmouni, Themis, Hernandez, Pina, Bubici) and internationally Chieti-Pescara University, Italy (Sala).

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

##### Supporting research collaborations and networks

Our post-2014 research structures focus upon three research challenge areas. This strategic realignment has underpinned our staffing strategy, enhanced our research collaborations, networks and partnerships and generated increased grant income, higher quality outputs and impact. The foundation for our research is engagement with our key stakeholder groups: our local community, practitioners and professional bodies and policymakers and we have a range of mechanisms to support these links. Engagement with our local communities is supported by institutional funding for knowledge exchange and public engagement. It is a requirement for internal research funding such as BRIEF awards to include engagement and impact. Key committees include local community members as appropriate (e.g. CHLS Ethics committee). We support a range of user/ expert by experience groups to underpin our research.

The creation of BPACHS has strengthened our research links and networks with our local health and social care economy and provides a supportive mechanism for establishing research partnerships and engaging with practitioners (e.g. Death Cafes run by Nelson-Becker and our local palliative care team). The embedding of our staff in clinical work locally and the role of placements for our UG and PGT courses in occupational therapy, physiotherapy, nursing, social work and physician associate courses serve to enhance our relationships with practitioners. Colleagues are active within professional bodies (e.g. Chartered Society of Physiotherapists, Royal College of Occupational Therapy) by shaping research priorities and contributing to the development of clinical guidelines. Institutional engagement with policy makers is supported by the Brunel Policy Unit and Cabinet Office link as well as project specific links (e.g. the What Works for Wellbeing project involved extensive engagement with Department of Culture Media and Sport). The specific expertise of staff involves them in contributing to policy/practice via involvement with NICE and professional bodies guideline development (see section 1). These activities are valued by the institution and credit for these included in our WAM and the promotion and career development criteria.

Nationally we collaborate with at least 30 different universities across our research portfolio. In lifelong health we have strong links with Exeter via our funded projects in dementia, stroke and Parkinson's disease. Staff have formalised research links via visiting posts at a range of institutions including Oxford (Lewis), Cambridge (Pina), UCL (Drenos and Tomita), Imperial (Themis, Bubici Gavins, Blakemore). Internationally the institutional strategic relationships with Bahrain, Tampere and Brazil are key to health researchers (section 3). Staff have formal links with Perpignan (Bridger), University of Pavia, Italy (Vagnarelli), Universitat de les Illes Balears (Anjoumani-Virmouni), LSUHSC-S, USA (Gavins). We also participate in formal research networks both national and international. Examples include the UK Organ on a Chip technology network and internationally the Canadian Social Sciences funded Ageing+Communication+Technologies(ACT) network led by Trent University (Martin) and the International Loneliness and Isolation Research Network (I-LINK, Victor).

### **Interacting and engaging with research users and beneficiaries**

Our research environment is enriched and enlivened by our strong links with a wide range of research users, beneficiaries and audiences as referenced in sections 1,2 and 3. We facilitate this by:-the use of advisory boards and involvement of research users in the development and dissemination of research. Exemplars of our approach are the MS, CP and stroke projects Ryan, Norris M, Kilbride). All had advisory boards consisting of key stakeholders to maximisation project the relevance and impact. These projects included experts by experience, clinicians and policy makers in the development, design, and dissemination of research.

Outreach activities extend beyond specific research projects but reflect wider commitment to engaging with research users and beneficiaries. We have developed a number of health-related local community initiatives including promoting and developing wheelchair basketball, running community based cardiac rehabilitation programmes and cycling and handwriting clinics for children with disabilities. Two PGR students ran 'Dementia Friends' courses on campus for staff and a number of local schools. These activities bring together researchers, students and members of our local community and greatly enhance our research culture and engagement with our local community. The start of a new initiative to develop a campus Boccia club with Disablement Association Hillington (DASH) was delayed because of COVID19. We also have robust links with national with the Friedrich's Ataxia charity (Anjoumani-Virmouni) and international third sector groups (UK and European Progeria Family Circles (Bridger).

### **Wider contribution to society**

Staff actively engage in activities and relationships which directly inform policy, support research excellence and quality improvement in the clinical/professional communities. We share and promote the knowledge gained from our research as part of our goal to improve societal health and wellbeing and reduce inequalities. In addition to our 6 impact case studies, further examples



of our research that demonstrates our wider contribution to society include Prunty, with funding from RCOT, has developed evaluation and management tools for children with handwriting difficulties which are used in clinical and school settings in the UK and Republic of Ireland, informing how handwriting is both taught and assessed. The splinting guidelines developed by Kilbride for post stroke upper limb rehabilitation fed into the RCP Clinical Stroke and Spasticity Guidelines and attracted approximately 4000 downloads a year from the RCOT website. In a 2018 National survey of therapists, 80% reported using the guidelines in practice and 45% had incorporated them into departmental standards. Spiliotopoulou developed guidance to help older people and professionals select appropriate assistive devices for their homes. Other examples of our contribution include Green's role as an expert advisor to the parliamentary health ombudsman for issues of developmental disabilities. Our work on loneliness was included in the UUK list of the Nation's Lifesavers: the top 100 individuals or groups based in universities across the country whose work is saving lives and enhancing health and wellbeing.

### **Engagement with diverse communities and publics:**

Public lectures, seminars linked to specific topics including carers week, brain awareness, dementia and celebration of key events such as older people's day, world social work day, are a regular part of our engagement and outreach portfolio. During COVID-19, health researchers have been actively engaged in university level public engagement webinars (Norris E, Milner, Cheung, Nelson-Becker, Thomas and Victor) as well as providing expert insights into aspects of the COVID-19 pandemic (Norris E, Victor, Cheung) and resultant inequalities (Milner). We run seminars/workshops in collaboration with BPACHS on a range of clinical/practice issues as well as providing speakers for a wide and diverse range of community organisations.

### **Sustaining health research and the underpinning professional and academic disciplines.**

Thriving disciplinary research is the foundation upon which interdisciplinarity is built. We actively support staff across career stages to engage with professional bodies (RCOT, CSP) and learned societies as appropriate to their career stage. Illustrative of our activities at Professor/reader level are Green (Chair Nominations Committee Chair for European Academy of Childhood Disability) and Gavins (Member Accreditation Assessment Panel Royal Society of Biology). At SL/L Dunford (Chair National Executive Committee of the Children, Young People and Families Specialist Section of the Royal College of Occupational Therapists), Stenbeck (Board member International Federation of Musculoskeletal Research) and Sisu (Member Early Career Lecturer Forum, advisory group to HUBS, Royal Society of Biology).

### **Supporting the next generation of researchers**

Supporting the next generation of researchers is key to the sustainability of our disciplines and we support activities internally and externally towards this goal. Internally our academic lifecycle employment contracts ensure that research development is embedded across the probation and development phases and via internal research 'start-up' grants. We facilitate attendance at conferences for PGR and early career staff via college funds/VISA awards so that our staff can develop their professional profile and networks. We link early career with established colleagues attending the same conferences/meetings so they can benefit from their networks. Seven researchers in ageing, three senior staff (2 profs, 1 reader) and 4 early career researchers (2 lecturers and 2 postdocs), attended the interdisciplinary international conference-of the Gerontological Society of America in New Orleans in 2016. Colleagues are actively engaged in ECR activities involved with learned societies/professional bodies as organisers, delegates or senior colleagues. Research staff in ageing have attended sessions of the Emerging Researchers in Ageing (ERA) group of the British Society of Gerontology as delegates (Rippon), organisers (Williams) and senior colleagues (Gilhooly M, Victor).

### **Institutional support for interdisciplinary research**

During this REF period support for interdisciplinary has been co-ordinated by 3 cross-university research institutes. Health researchers have benefited from the support of the Institute of

Environment, Health and Societies and we received £149k to support 9 pilot interdisciplinary projects resulting in the publication 35 papers and 5 grant application (3 funded, 1 pending). Interdisciplinary is assessment criteria for internal research support (see section 3).

**Examples of larger scale interdisciplinary work, and how we support the development of these activities.**

Anderson's £1m project working with nuclear test veterans is an exemplar of our support for and successful implementation of an interdisciplinary research project with a strong element of knowledge translation and impact. The academic development and co-ordination of this successful project was supported by IEHS and RSDO using an established institutional grant development model used for other successful awards (e.g. ESRC What Works for Wellbeing award). A planned programme of activities focussed on bid development took place co-ordinated by IEHS involving matching internal and external collaborators and supporting meeting/activities to shape the grant. Colleagues not involved in the application provided peer review and support. The research funders visited Brunel who made a significant institutional commitment to support the bid. Once funded the project established an advisory board and project steering group to oversee the progress and established regular engagement events support key beneficiaries.

**Responsiveness to national/international priorities:** Strategically our key areas of research align with key national/international priorities which enables us to respond to specific calls. Internationally Smith's work with Uganda and Mexico focuses upon TB, a major health challenge in LMIC countries enabled submissions to British Council calls. Our excellence in ageing research was recognised by participation in two large ESRC/NIHR funded dementia projects that formed part of the Prime Minister's Dementia challenge (UCL consortia including Gilhooly and Sullivan, Exeter consortia including Victor).

Health staff responded to COVID-19 both as professionals, returning to support the NHS, and researchers. We have responded to COVID-19 as a research priority at both local and national level. Locally we focused on life under lockdown for vulnerable groups such as older adults, those with disabilities, funded by Health Education England (£20k), as well as a collaboration with computer science modelling the impact of COVID-19 upon the local NHS (Anokye and PGR student). Van den Heuval and Victor participated in the Exeter IDEAL dementia programme projects focused on the impact of COVID-19 upon people with dementia and their carers (ESRC funded) and those from black and minority ethnic groups (funded by DHSC).

*Shaping research priorities:* We actively shape international/national and local research priorities via our involvement with international (French Research Council, Vagnarelli; French National Research Agency, Davare) and national funding bodies (ESRC, Victor and Nelson-Becker; NIHR, DeSouza, Pokhrel, N3Cr-Gavins) as well as international/national charities (Telethon-Spain-Sal, Nuclear Test Veterans, Fredrich's Ataxia, Progeria, Cilia Society, Breast Cancer Now, Kidscan).

**Indicators of wider influence:** Health research staff across the career grades hold active leadership roles to sustain and support our academic and professional disciplines. Key activities include leadership roles in scientific publishing and within professional and disciplinary organisations, active engagement with external funders through grant panel membership and a sustained contribution to scientific peer review. These activities are supported at institutional level, included within our WAM, and form a key section (external impact and markers of esteem) of our internal promotions criteria.

All staff are engaged in journal and grant peer review activities at national and international levels appropriate to carer grade. We support development in peer reviewing for both papers and grant applications for new lecturers, research staff and senior PGR students by formal activities, workshops including 'mock' reviews within our research groups and at our College Research/Staff development days. Staff hold prestigious journal editorships (e.g. O'Connell, Co-Ordinating Editor of the Cochrane Pain, Palliative and Supportive care group; Victor, Editor in Chief Ageing and Society; Green, Editor Physical and Occupational Therapy in Paediatrics). Editorial roles across a

range of high profile international journals including, Journal of Ethnic Diversity in Social Work (Nelson-Becker), Human Neuroscience (Davare), BMC Health Services Research (Pokhrel), BMC Public Health (Cheung, Norris M), Developmental Medicine and Child Neurology (Green), Frontiers Oncology (Sala), Oncotarget (Vagnarelli), PLoS One (Pina). Examples of grant review roles are: EU (Conway, Green; Victor), international funders (e.g. NIH (USA), Gavins; Sweden, Green) and UK based funders government, UKRI, charities and professional bodies across all carer grades.

#### **Esteem indicators.**

The esteem of our staff is demonstrated by a broad range of indicators appropriate to career stage. Research excellence is demonstrated by Corner (Intensive Care Society Researcher of the Year, 2020), Victor (Lifetime Achievement Award of the British Society of Gerontology, 2017) and Nelson-Becker (Ralph & Eve Seelye Charitable Trust Award Fellowship, University of Auckland, NZ, 2019). Ankoye chairs the International Society for Physical and Health LMIC Research Council. Fellowships were awarded to Bridger, Gavins and Rudolf (Royal Society of Biology) and Victor (Gerontological Society of America). Anderson was Awarded Honorary Membership of the Royal College of Radiologists (2017) and is Past-Chair of UK Association for Radiation Research (ARR) (2014-2016) (Chair 2012-2014). Nobus was Chair of the Freud Museum in London (2015-2018) and is now an Academic Associate of the Museum.

The esteem of our research is demonstrated by the award of Outstanding European Health Research Award to the EQUIPT project led by Pokhrel at the European Network for Smoking and Tobacco Prevention Conference (2016). Thomas and colleagues won the Quality in Ageing journal 2016 best paper award. Keynote plenary lectures have been given by Kishore (Indian Immunology Congress 2019 and European Academy of Allergy and Clinical Immunology Congress, 2020), Nobus (International Neuropsychanalytic Congress 2019 and the Freud Memorial Lecture 2015), Anderson (International Symposium on Chromosome Aberrations, 2019), Victor (Manchester Interdisciplinary Collaborative on Ageing, 2018), Green (Italian Scientific Society of OT Congress, 2016).

Illustrative of our collaborative arrangements for PGR students include co-supervision of studentships from EPSRC within Brunel (Davare/Roberts) and our strong record of successful participation in the ESRC Grand Union Doctoral Training Partnership (DTP) (Kilbride, Norris M, Martin) with Oxford and the Open University (see section 2).

**Developing a diverse health research community:** We are contributing to the development of a diverse health research community that is essential to the conduct of research post COVID-19. This starts with the recruitment of undergraduate students in health-related disciplines, supporting their attainment, facilitating entry into doctoral training and subsequently academia. Our academic community at Brunel is highly diverse but some health-related subjects (notably physiotherapy and occupational therapy) are less diverse. In collaboration with St George's we were awarded £28k from Health Education England to investigate academic achievement by BAME students in physiotherapy courses across the south east which confirmed their attainment gap. We are working collaboratively to address this attainment gap as an initial step to achieve our aim of a developing a truly diverse academic health research community at Brunel.