

<b>Institution: University of Bradford</b>
<b>Unit of Assessment: A3 Allied Health Professions, Dentistry, Nursing and Pharmacy</b>
<p><b>1. Unit context and structure, research and impact strategy</b></p> <p>The University of Bradford is organised into four Faculties, each subdivided into Schools. Thematic research groupings are either Faculty-based or cross-Faculty. Research within the remit of A3 is carried out in the Faculties of Life Sciences (FoLS) and Health Studies (FoHS) and span a broad range of research interests. These include basic science, drug development, pre-clinical and clinical testing of novel therapeutics and development of innovative interventions to improve health outcomes, with particular strengths in dementia, safe use of medicines and health technologies. Some staff carry out and facilitate interdisciplinary work in University leadership roles [e.g. Breen, Rattray see below]; others mainly collaborate externally [e.g. Goldman, Taylor]. Research groupings have developed and grown or merged into larger units since REF2014. The four current research groupings are:</p> <ul style="list-style-type: none"> <li>• <b>Applied Health Research:</b> [Breen, Cooper, Daly-Smith, Downs, Faisal, Fylan, Gardner, Hardy, Jones D, Lord, Meehan, Mohammed, Morgan, Mountain, Oyebode, Parveen, Quinn, Randell, Rattray, Silcock, Small, Zaman]; previously Healthcare Practice in REF2014 and extends across FoLS and FoHS including the Centre for Applied Dementia Studies and the Medicines Optimisation Research Group.</li> <li>• <b>Non-communicable Diseases:</b> mechanisms, therapeutics and pharmaceutical advances [Afarinkia, Anderson, Elias-Gomez, Falconer, Gopalan, Graham, Grimaldi, Helfer, Isreb, Jones HS, Kantamneni, Loadman, McLean, Moody, Muller, Nasim, Nyathi, Paluch, Paradkar, Pors, Riches-Suman, Sheldrake, Shnyder, Vangala, Waby, Wheelhouse, Williamson, Wilshaw]; previously Cancer Therapeutics and Medicines Development in REF2014. Mainly based in FoLS and includes the Institute for Cancer Therapeutics (ICT) as well as the Centre for Pharmaceutical Engineering Science (CPES).</li> <li>• <b>Skin Sciences:</b> [Ansell, Fessing, Liu, Mardaryev, Poterłowicz, Swaminathan, Thornton] based in FoLS (Centre for Skin Sciences, CSS) and part of REF2014 submission.</li> <li>• <b>Vision Science:</b> [Barrett, Bloj, Denniss, Elliott, Ghorbani- Mojarrad, Heron, Mallen, McKeefry, Rountree] based in FoLS and part of REF2014 submission.</li> </ul> <p><b>Applied Health Research</b></p> <p>Colleagues undertaking applied health research aim to address health inequalities, improve child health outcomes, support healthy ageing and improve patient safety. This research includes both quantitative and qualitative studies into service evaluation, the development and testing of health interventions and the design of both technologies and training to enhance the quality of health service provision. The involvement of end users of this research from the design stage onwards is central to all our work and demands interdisciplinarity and partnership working with all stakeholders including NHS and charity organisations, community-based enterprises, service users, carers and the general public. During this REF period, the partnerships necessary to achieve research co-creation have expanded and strengthened, enabled by University investment alongside Bradford Teaching Hospitals NHS Foundation Trust (BTHFT, including Bradford Institute for Health Research, BIHR), the University of Leeds and the Wolfson Foundation. This has resulted in establishment of the Wolfson Centre for Applied Health Research (CAHR); Bradford academic lead Rattray.</p> <p>Wolfson CAHR aims to develop population-based evidence and interventions, influencing policy and practice and ultimately improving health and wellbeing for all. Sited at BTHFT, the location enables multi-profession teams including clinical professionals such as pharmacists, nurses, physiotherapists, occupational therapists, and optometrists from BTHFT and BIHR to work alongside researchers from the University of Bradford to ensure that research can provide real</p>

world benefit by facilitating translation of applied health research into practice. Partnership with the University of Leeds has also been key for establishing the NIHR Yorkshire and Humber Patient Safety Translational Research Centre (YHPSTR) (section 4).

Our Applied Health researchers lead studies to address health inequalities revealed by the Born in Bradford (BiB) longitudinal cohort study of over 30,000 Bradfordians (section 4) which is tracking individual life courses from birth and is continuing to reveal factors that contribute towards poor health outcomes. Access to extensive health, social care and educational data collected from the cohort enable our academics to develop and test interventions.

The Centre for Applied Dementia Studies continues to revolutionise healthcare for people living with dementia through applied research into ageing and dementia. This research is focussed upon enabling people to live as well as possible with dementia and other conditions of later life through evidence-based interventions and quality service provision. This portfolio of research has been funded by UKRI, NIHR and charitable funders (section 3). The research has been translated into impactful education and training products for the health and social care workforce [ICS A3-5]. The Centre's postgraduate activity includes Alzheimer's Society-funded Bradford Doctoral Training Centre (DTC) (2014-17). This initially supported seven postgraduate researchers (PGR), the majority of whom were from clinical backgrounds. The DTC continues, with students supported from a range of funding sources thereby providing a pipeline of clinical academics and future leaders in health and social care research.

The campus-based Digital Health Enterprise Zone (DHEZ, director Breen) was established in September 2017 as part of a GBP13,000,000 partnership with the City of Bradford Metropolitan District Council with GBP3,500,000 funding from the Department of Business, Energy and Industrial Strategy. Leeds City Region Enterprise Partnership has supported DHEZ from the outset as the regional hub for digital health innovation and its goal of leading digital innovation through collaborative community, business and research engagement for the benefit of healthcare now and for future generations. A growing portfolio of companies is working closely with DHEZ and Bradford academics (section 4).

### **Non-communicable Diseases: mechanisms, therapeutics and pharmaceutical advances**

This group focuses on understanding the mechanisms of non-communicable disease such as cancer, diabetes and dementia. By identifying genetic mutations or protein malfunction in models of disease or patient samples, novel drug targets are revealed. After target characterisation, rational design allows development of novel chemicals which can be tested for therapeutic potential in vitro and in vivo on human tissue and model organisms. Ultimately, the aim is to take new molecules or improved formulations of drugs through pre-clinical testing and into clinical trials to prevent or slow progression of diseases.

The main goals of the ICT are to develop more effective anti-cancer drugs and biomarkers. A key strategy is the generation of novel intellectual property (IP) for small molecules which can progress to advanced preclinical evaluation. Working with globally leading academic and industrial partners, this IP attracts spin-out company investment which will ultimately be licensed to the pharmaceutical industry as novel anti-cancer therapies or diagnostics. The spin-out Incanthera has generated significant impact [ICS A3-1] and enabled the reinvestment of share and IP income to train the next generation of cancer researchers through the establishment of a new DTC within the ICT which recruited three students in 2019, with future cohorts due to start after the COVID-19 pandemic. Regional partnerships with clinical oncology at St James Hospital in Leeds have enabled pharmacokinetic profile analyses of clinical trial patient samples (section 3).

In pharmaceutical advances, the Centre for Pharmaceutical Engineering Science (CPES) uses innovative and greener technologies to develop healthcare innovations for improving wellbeing and alleviating disease supported by industrial and UKRI funding. This is an interdisciplinary centre with collaborators from industry and the Faculty of Engineering and Informatics. Work from CPES has led to reduced environmental impact from manufacturing and improvements in

drug and nutritional product formulations which have already made it to market [ICS A3-4]. Ongoing work is extending their approach and expertise to the development of Type II medical devices such as SelfLift an innovative formulation for polyp lifting.

### Skin Sciences

The Centre for Skin Sciences (CSS) continues to undertake fundamental and applied biological research into understanding relevant skin diseases and hair loss, reducing their negative impact on appearance and improving wound healing. The current director (Thornton) was appointed in 2019 after Tobin left to lead the Charles Institute of Dermatology in Ulster. The CSS recognised expertise into genetic and epigenetic mechanisms of skin and hair ageing/regeneration, and the development of wound healing models for addressing chronic wounds and burns has led to significant income, particularly from industry (section 3). The increasing importance of skin:microbe interactions impacting on skin health and feminine hygiene has been incorporated into the centre portfolio, reflecting market need and taking advantage of interdisciplinary expertise within the Centre. The cosmetics and personal care/devices industry and dermatological healthcare sector have partnered with the Centre for Skin Sciences (Phillips, Aveda, BASF) to develop innovations in skincare which have produced significant impact, delivering scientific credibility to industry [ICS A3-2]. Several products are now on the market such as DN-Age in Europe (BASF), Invati in China (Aveda) and Promasana in the USA (Aveda).

### Vision Science

The strategy of the Vision Science research group is to increase understanding of basic mechanisms of human vision and their development, with the aim of applying this knowledge to identifying disease mechanisms and ameliorating the consequences of visual impairment. For example, research focuses on improving the detection of glaucoma through the development of new ocular imaging approaches (outputs 5-7) and using the Born in Bradford cohort data, for exploring the socioeconomic and genetic contributions to the development of myopia and other refractive errors in childhood (output 173). Other work in the area of refractive error has quantified the impact that compliance with spectacle wear in school children has upon developing literacy and led to the development of the Education Endowment Foundation funded “Glasses for Classes” intervention. The knowledge from underpinning research on how spectacle prescribing can reduce falls in elderly and vulnerable people has directly translated into policy development and changes in optometrist practice in several countries [ICS A3-3].

**Research and impact strategy** for this unit of assessment aligns with the University theme of “Advanced Health Care” and aims to address WHO Sustainable Development Goal 3 “Ensure healthy lives and promote wellbeing for all at all ages”. We remain committed to linking colleagues with overlapping research interests, regardless of their Faculty or School. This approach encourages collaborative working and is supported by targeted investment and organisation of regular themed discussion workshops and several vibrant research seminar programmes which maximise interdisciplinary research.

The broad range of research undertaken has one or more of the following strategic research aims (RA) on the pathway from basic science to successful clinical intervention with the ultimate aim of benefiting patients and public health. Our researchers seek to:

- RA1:** understand mechanisms of disease, particularly diseases prevalent in the ageing population.
- RA2:** identify novel proteins or genes attractive as targets with therapeutic potential.
- RA3:** develop healthcare interventions and healthcare technologies which directly benefit patients.

We continue to support the laboratory-based pipeline to translation with a track-record of bench discovery to impact (**RA1, RA2**). For example, the development and production of the novel

ICT2388 anticancer drug family has required a sustained effort enabled by strategic investment in two scientific Business Development Managers (BDM), supplementing institutional support from the central Research and Innovation Services (RaIS) commercialisation team. This enabled the Incanthera spin out company to attract industrial investment for successful commercialisation, including company flotation on the stock market (2020), creating regional jobs and supporting the local economy.

Collaborations with the White Rose (WR) University consortium and NHS partners via the Applied Research Collaboration Yorkshire and Humber (YHARC) are key to fulfilling **RA3** (section 4). An important driver for **RA3**, reflected in the Institutional Level Environment Statement (ILES), has been poor health outcomes in local areas of socio-economic deprivation. Therefore, our research is designed to improve the health of the local population, narrowing this gap. Our impact strategy engages end users in research co-production. To achieve this, we work in partnership with healthcare, industry, patient groups, carers and community organisations. This model of working in partnership with stakeholders ensures that our research addresses real world problems and results in practical solutions which can easily be implemented by our partners (see section 4).

This strategy has generated successful impact during the current REF period. Researchers working alongside health service professionals, patients, service users and carers have developed a new person-centred approach to healthcare professional training packages based on Dementia Care Mapping™, developed at Bradford. These are now recognised by service commissioners and policy makers as Care Quality Commission gold standard for healthcare professionals treating dementia patients. The online modules approved by Health Education England (HEE) are also available internationally to improve dementia care for health and social care providers [ICS A3-5].

Implementation of the UoA research and impact strategy is supported by regular University Research and Knowledge Transfer (R&KT) subcommittee and forum meetings led by the DVC Research, Innovation and Engagement and Associate Deans for Research and Knowledge Transfer (ADRKTs), with input from the Associate Director of Research and Innovation Services. This group prioritises where institutional investment will bring most benefit. FoLS and FoHS R&KT subcommittees review how five-year research and impact group strategies as well as annual Research Grant Action Plans (RGAP), informed by individual annual researcher Personal Research and Innovation Plans (PRIPs), align with the “Advanced Health Care” theme and support delivery of our research aims (RA 1-3). Research group directors provide leadership with strategic plans underpinned by clear objectives which they regularly revisit to measure progress against key performance indicators such as high-quality publications (see outputs), successful income generation from a mixed portfolio of funders (section 3) and public understanding of research as well as ensuring support for our developing and early-stage researchers. Each research group holds regular team meetings to develop new project ideas, discuss new data, review current projects and through brainstorming, identify mechanisms to develop pathways to impact outside academia as well as sharing good practice in publications and grant writing through peer review. This team-based approach generates a dynamic research environment that is highly supportive of staff at all levels and a critical part of our staff development strategy (section 2).

### Open Research

Colleagues across A3 ensure that all research findings are made widely available not just to the academic and scientific community but also the general public. The importance of open access is emphasised during the mentoring of early career staff and PGRs. Staff and PGRs from A3 actively participate in, and contribute to, central training on how to use the open access publication repository and the annual open access week. We are regular recipients of the institutional “Publication of the Month” award, that includes GBP500 that can be used for accessing media training or developing materials for public dissemination such as videos and infographics for use in social media channels. Colleagues across the UOA have made use of

support provided for publishing for non-academic audiences and often have pieces on their research published by *The Conversation* that are then picked up by media outlets worldwide. A recent example is Breen and her discussions of on the COVID-19 vaccine supply chain developments.

Researchers working with existing large datasets (Born in Bradford, Connected Yorkshire) or generating their own, use effective and established mechanisms to ensure these can be shared for novel analysis (i.e. outputs 93, 96, 150). This opens data up for analysis by the wider research community. We are a leading partner in the ELIXIR-UK consortium <https://elixiruknode.org> that supports the bioscience community by providing training and services to help them discover, distribute, analyse, and store data, exchange expertise and agree on standard approaches. Poterlowicz is a key member of the management and steering committee, being the Training Coordinator (see also section 3).

High levels of patient, public and carer involvement in all aspects of the research cycle are facilitated by the Service Users and Carer Research Group based in FoHS but accessed by colleagues across the UoA. This group helps ensure that patients, public and carers that contribute to research are trained and adequately supported to participate and appropriately remunerated. The Centre for Applied Dementia Studies supports a cohort of people who are living with dementia (Experts by Experience, ICS A3-5) to be involved in research, education and training. The coordinator of Experts by Experience works with the facilitator of the faculty wide group to produce a coordinated response to requests for lay and patient involvement in research across the institution.

An important part of the impact strategy for the UoA includes raising local and regional awareness of our research. Members of the public involvement groups described above directly communicate the findings of research projects more widely in the local community and lead grassroots initiatives; for example, the Bradford Diabetes UK support group is chaired by a member of our Service Users and Carer Research Group. The commitment to increase public awareness led to establishment of Bradford's Café Scientifique, part of a national network, established in 2018 by UoA members. These monthly public science debates across a wide variety of topics are hosted at the National Science and Media Museum and have strengthened this local partnership. Audiences have grown in parallel with Bradford Café's social media presence. Because of recent COVID-19 restrictions, sessions have moved online, attracting up to 100 participants. Event recordings are made available through University YouTube and Bradford Café social media channels. Staff from the UoA regularly join Rattray on his monthly Bradford Community Broadcasting (BCB) radio show to discuss their research as well as topical science and health matters. BCB has 30,000 listeners every week, and the show reaches a diverse audience in the city of Bradford and beyond. Once it is broadcast, it can also be listened to on 'Listen Again' and is shared widely on social media and has a truly international audience.

### **Research Integrity.**

We are committed to delivering open research and innovation that is conducted and delivered with honesty and integrity. The University is a signatory to the Universities UK concordat to support research integrity, and to the San Francisco Declaration on Research Assessment. A working group, chaired by the Associate Dean (R&KT) from FoHS and with a senior member from FoLS, ensures that the responsible use of research metrics is reflected within core University processes.

All UoA research adheres to the University's ethical framework and upholds the Committee on Standards in Public Life's principles of Selflessness, Integrity, Objectivity, Accountability, Openness, Honesty, and Leadership. Best practice in authorship procedures is monitored by FoHS and FoLS Associate Deans (R&KT) who are responsible for dispute resolution. New staff are inducted into the University's ethics policy which commits to maintaining high ethical standards in research. Research involving human participants, their tissue or data (including personal information) must be approved by one of the University Research Ethics Panels (with

membership and chairs drawn from the UoA) before any research activity can commence. All health and social care research is scrutinised by these panels before researchers are allowed to apply for external ethical and governance approvals. All projects involving the use of animals based in the Biological Services Unit pass University scrutiny through the ethics process, as well as obtaining approval from the Home Office under the Animal (Scientific Procedures) Act. Researchers working with patients have accelerated access to obtaining an NHS 'research passport' through the Integrated Research Application Form, written into Wolfson CAHR governance. All undergraduate and postgraduate student projects which involve primary research are required to follow the same process.

Ethical Tissue (ET) biobank staff are responsible for ensuring informed consent of patients and volunteers, co-ordinating ethical approval for clinical studies and the supply of human tissue and cells to researchers. This extends beyond UoA A3, widely across the University and for external researchers regionally, nationally and internationally. In addition to its own website, our biobank is registered on the UKCRC Tissue Directory and Co-ordination Centre, a searchable database which ensures all UK researchers can access ethically sourced and stored human tissue.

## 2. People

### Staffing Strategy

We combine recruitment and investment in the highest quality researchers with nurturing and developing our own talent to develop a pipeline of research leaders, enabled by continued support for local, regional, national and international research network development. We appoint staff either with excellent research track records, or with clear evidence of potential as future research leaders, and with evidence that an individual's research interests align with our research strategy (section 1) and strengthen the relevant research group. Appointments with complementary expertise to maintain or deepen critical mass (at least five FTE per sub-grouping) enables teams led by UoA staff to submit substantial applications to funders e.g. National Institute of Health Research (NIHR) and UKRI. A key part of the staffing strategy during this REF period has been the creation and capitalisation of research potential. We have appointed early career academics (ECRs) and senior research fellows across all research groupings (12 staff). In several areas new senior appointments have also been made: Professor of Digital Innovations in Healthcare (Randell) and Professor in Healthcare Quality and Patient Safety (Gardner), Reader in Physical Activity and Healthy Childhood (Daly-Smith). In October 2020 (after the REF census date) we appointed Professor Siobhan Reilly as the new Director of the Centre for Applied Dementia Studies and Wolfson CAHR Lead for Healthy Aging, in anticipation of the previous director's retirement (Downs) in December 2020.

### Staff Support and Development

Research group leads and mentors work with newly-appointed staff developing their early applications for external funders. New appointments team up with an experienced PGR supervisor to produce peer reviewed and viable PGR projects to recruit sponsored postgraduate researchers, building their research teams. Personal Research and Innovation Plans are formally reviewed annually, initially as part of probation then through continual performance development review process.

We subscribe to, and encourage all researchers to access, the Vitae "Researcher Development Framework Planner" a career development tool supporting all levels of career development and progression. The Bradford Academic career development framework includes a regrade pathway (promotion to associate and full professor) based on evidence of significant research achievements. Access to external research funding dedicated to researchers in their early years at an academic post through, for example, the Academy of Medical Sciences Springboard scheme (Helper) has brought beneficial external research mentoring, including training relevant to impact and communication of research to non-scientific audiences.

The University Research Development Fund (RDF) includes a scheme aimed at ECRs via open competition, with opportunities for applications twice per year to provide funding for pilot studies. This inclusive approach has contributed to the success of follow-on funding bids to NIHR, UKRI and charities. Successful staff development leading to research fellows transitioning to independent academics and succeeding in their first grant applications as Principal Investigators continues (Mardaryev, MRC, GPB 544,992, 2016, 41 months). Institutional, and faculty (FoLS, FoHS) investment has supported training and networking events to engage academic staff across their career journey: VC Interdisciplinary Research Seminars; FoLS Annual Research Open Day and FoHS Scholarship and Research Wednesdays.

To support development, mentoring is in place for newly-appointed staff who in addition to their assigned line manager are given a separate member of staff to act as a research and career mentor. In UoA A3 this system of mentoring has been expanded during the current REF period to all staff that request it or when specific development needs are identified. Staff in all stages of their research career in the UoA have reported benefits of this support, especially where research interests may have developed a new direction or to build confidence and research skills after a practice focused career. Mentoring and other staff training is provided by the University's People & Organisational Development Directorate via, online e-learning resources short courses and year-long development programmes. Staff from the UoA access these as well as external resources, such as the women only Advance HE Aurora mentoring scheme.

Grant writing skills workshops designed to develop proposals are facilitated centrally and have been supplemented in the UoA by engaging the expertise of UKRI and charity grant panel members for specific funders (see section 3) to deliver mini grant panel style workshops, enabling development of grant writing skills. Internal peer review is mandatory before a funding application is submitted, thereby providing timely feedback to researchers on project quality. This is undertaken by two appropriate and experienced colleagues, with the aim of strengthening the proposal and sharing good practice.

An ECR Forum was established across FoLS (2017) and then FoHS (2020) to enhance networking, share information on opportunities and increase peer support for researchers. Membership includes early career academics, research fellows and post-doctoral researchers, with sessions providing tailored advice on developing different types of funding bids (grants/knowledge transfer partnerships/innovate UK/NIHR) and opportunities for exchange funding e.g. Erasmus+ (now Turing) or World Technology Universities Network. The Forum signposts ECRs to institutional support processes and external development opportunities such as those provided by the Yorkshire and Humber Research Design Services. Central funding has supported focused writing sessions ("Shut up & write", 3-day writing retreats to support grant and output development, and Wolfson CAHR workshops) that benefit staff and PGRs across the UoA. Workshops are available for those less experienced or confident in publishing, enabling development of an original article from data already generated or production of a review under guidance of a senior colleague. All opportunities are regularly advertised and made available to staff who submit a strong case for support and have been found to be particularly valuable for those returning from maternity/paternity leave.

External funding has enabled staff to take international sabbaticals including Germany (Bloj), Australia (Elliott) and Canada (Helfer). Agreed periods of teaching relief are more common; either reduced responsibility for a semester or occasionally for longer periods. This is negotiated for staff following completion of a substantive administrative role or when returning from family leave, successfully enabling recipients to reinvigorate their research.

### **Research Students**

For most PGR projects in the UoA, University-trained supervisory teams develop a short proposal and the projects are widely advertised through the University website, FindaPhD and specialist publications (e.g., Optometry Today to attract practising professional applicants. Applicants with their own research ideas approach the admissions team or academics directly,

where dialogue is encouraged. Research proposals submitted by applicants are considered and may be adapted to meet candidate and supervisory team requirements. Interview panels, by video conferencing for international applicants, identify specific training needs at the point of recruitment, expediting any institutional support required. This strategy has also increased transparency as feedback is made available to all applicants where a place cannot be offered.

During REF2021, recruitment of sponsored international PGRs has continued to be successful and several initiatives have been introduced to attract UK/EU PhD students. Notably the UoA has coordinated two EU-funded International Training Networks (ITNs) and joined the White Rose Doctoral Training Partnership (DTP) (sections 3 and 4).

In Vision Sciences, the College of Optometrists has provided competitive scholarships to attract clinically qualified optometrists to research careers, boosting clinical research capacity in a specialty where recruiting research focussed academics is challenging. Faculty-funded competitive scholarships have also been offered with several awarded to supervisory teams in the UoA. One of these was critical to development of the ISCOMAT clinical trial and the achievement of centre status for the Patient Safety Translational Research Centre (section 4). A second graduate was retained as a postdoctoral fellow (BBSRC funded for three years), before successfully taking up an academic post elsewhere, while the third moved to clinical psoriasis research in Leeds, subsequently obtaining a fellowship.

The Dementia DTC within the Centre for Applied Dementia studies focussed on transitions in dementia and was one of only eight DTCs funded by the Alzheimers's Society across England from 2014. Seven PGRs were recruited, and to date four have completed and are continuing careers in clinical research, academia and policy (section 1). A successful model to increase PGR numbers has been developed in applied health research, recruiting clinical staff onto funded scholarships, developing their writing skills to apply for and obtain personal fellowship funding from NIHR. The industrial links of staff in the Centre for Skin Sciences (Thornton, Mardaryev, Fessing) have secured financial support for PGR scholarships, including a CASE award (Aveda, Amway, Merck).

Each PGR is supervised by a team of at least two academics, each of whom has complementary expertise relevant to the project. Expertise from clinicians in BIHR is increasingly incorporated in the team to ensure clinical impact. All candidates are allocated a mentor from outside the supervisory team for informal meetings and discussions to help navigate the PGR journey or provide career advice. Some PGRs undertake industrial placements, facilitating a progression to careers in industry if that is sought.

PhD supervisory training is mandatory, with less experienced supervisors paired with a more experienced colleague and refresher courses for all supervisors every three years. Supervisors further develop their supervisory skills using the UK Council for Graduate Education Good Supervisory Practice Framework toolkit and are encouraged to develop their reflective practice to provide evidence and apply for the national Supervisor recognition programme. Regular "good practice" workshops are embedded in the research calendar to encourage applications. Our excellence in research supervision has been externally acknowledged (see end of section 4).

PGRs across the University benefit from the institutional PGR Framework. UoA Faculty Directors of PGR enable discipline-specific induction and training opportunities to supplement institutional PGR framework training options, ensuring an excellent experience throughout the PGR journey. Good practice in the UoA includes formal submission of a critical review of the literature within six months of registration, and early training needs analysis identifies skills gaps which can be addressed either by attendance at postgraduate taught sessions or through external training provision. Alongside discipline specific training, peer assisted learning schemes offer a support mechanism, helping to avoid potential feelings of isolation, a nationally recognised concern for PGRs.

In the UoA, discipline-level action plans are produced jointly with PGR representatives to respond to feedback obtained and continuously develop and enhance the PGR experience.



Annual PGR scientific conferences, established in 2014, have expanded and now include parallel, discipline-specific sessions, following national and international conference models. The conference is developed by a PGR-led organising committee and has successfully secured external sponsorship, matched by internal funding. Ownership of the PGR conference by these earliest career researchers has produced a format which meets the PGR needs and has enabled the development of transferable skills. Important project management skills include control over utilisation of the funding earned and has enabled prizes to be awarded for the best abstracts and presentations. The conference complements PGRs presenting their work at group level and the mandatory requirement to present in relevant weekly or monthly research seminar programmes to develop key communication and organisational skills. PGRs can access all relevant staff training and undertake training as graduate teaching assistants where that benefits their career development plans.

### **Equality Diversity and Inclusion**

The University celebrates the diversity of its staff and students and in 2020 we were recognised by The Times and Sunday Times as the University of the Year for Social Inclusion. In UoA A3 we endeavour to ensure that protected characteristics have no impact on opportunities for career progression and that openness and transparency means appropriate support is in place to address the diverse set of staff needs at all points in their careers. Commitment to Equality, Diversity and Inclusion (EDI) in research begins with mandatory online training for all staff in the UoA. EDI teams in FoHS and FoLS are working to achieve continuous improvement based on feedback obtained from regular local staff questionnaires. This approach enabled successful achievement of Athena Swan (AS) bronze awards by FoHS and Schools in FoLS containing UoA A3 researchers. Helfer (2016-2020) chaired the committee for the School that received our first AS award in 2018. Recent staff questionnaires provide evidence of progress against Athena Swan action plans. The latest questionnaire (July 2020) included questions to identify how all staff, including researchers, had been impacted by the COVID-19 pandemic and contained a section designed to specifically collect views of ECRs to inform planning for the Researcher Development Concordat action plan.

There are five institutional staff/student networks supporting underrepresented groups (gender, race, LGBT+, disability and neurodivergence). These groups all contain members of UoA A3 staff and contribute to policy and decision making, ensuring we embrace EDI agendas important to all our staff and PGRs. The Equality and Diversity Faculty and University committees have strong membership representation from within UoA A3 research groupings.

Recruitment panels have been trained in unconscious bias, equality and diversity, with panels incorporating male and female representation and including BAME membership whenever possible. Appointments to internal research leadership roles adhere to the same principles as external appointments, including transparent application processes and panel interviews. We are working to address the predominance of male researchers in non-communicable diseases and vision science as well as the lack of male staff in FoHS through our recruitment strategy as part of Athena Swan action plans.

Across the University, recruitment panels have been trained in unconscious bias, equality and diversity, with panels incorporating male and female representation and including BAME membership whenever possible. Appointments to internal research leadership roles adhere to the same principles as external appointments, including transparent application processes and panel interviews. We are working to address the predominance of male researchers in non-communicable diseases and vision science as well as the lack of male staff in FoHS through our recruitment strategy as part of AS action plans.

Flexible working is available to staff. Compressed hours, temporary or more extended reductions in FTE, and opportunities to work from home are regularly considered and approved by line managers, demonstrating commitment to EDI in our workforce. For staff returning from parental

leave, efforts are made to minimise teaching responsibilities in the first semester following return to work, maximising opportunities to re-establish research.

Our regular research seminar programmes offer opportunities for internal researchers to present and enable networking and by inviting external speakers with complementary expertise to our researchers we strengthen collaborations. In response to the predominance of men among senior researchers in some areas of the UoA, an AS programme of research seminars from female role models external to the institution was launched in 2018. These are widely publicised across the institution and have included workshops facilitated by external female professors and experts in gender equality to discuss the progress and development of female staff in science careers. These are open to all staff and ECRs including PGRs.

### **3. Income, infrastructure and facilities**

#### **Income Generating Strategies**

A key objective of all group plans is to obtain external awards from a range of funders to ensure research group sustainability. Industrial partnerships, with support from our dedicated BDMS, have helped secure matched funding from agencies such as Innovate UK or consortia with access to regional development funding (Yorkshire Innovation Funding, Access Innovation, Translate, GrowMedTech). Support from the central IP specialist team in RaIS secures appropriate institutional benefits from these partnerships that can be reinvested in research. UoA research leads, supported by University grants officers with discipline-specific expertise, regularly run sandpit events targeted towards funder priorities or external stakeholder needs (industry, NHS, local government). These are widely advertised using Wolfson CAHR, Faculty and University-wide research briefings to ensure UoA staff across different research groups participate along with researchers from other disciplines, including chemists, engineers, computer scientists, archaeologists and social scientists with complementary research interests relevant to health. This results in the formation of bespoke project-focused teams with the expertise to develop high quality funding bids.

The introduction of annual Personal Research and Innovation Plans as well as Research Grant Action Plans for groups has enhanced personal and group income planning, while institutional investment in, and implementation of, the automated Research Information System tracks development of all external funder applications (contracts, KT and research grants) enabling Associate Deans (R&KT) and research group leads to monitor and support funding bid development.

#### **Future Income Generating Strategies 2021-27**

All UoA staff with significant responsibility for research are expected to develop and submit external grants bids annually, within their university research workload allowance. In UoA A3 we provide additional support for bid development by holding mock peer review panels and are growing our internal directory of grant panel expertise by encouraging staff to nominate themselves for external peer review roles (UKRI, NIHR, charities and intentionally) as appropriate to their expertise and career stage (section 4). This external reviewing experience is increasing the quality of internal peer review. These strategies are anticipated to improve bid quality, enhance effective responses to reviewers' comments, and increase funder success rates.

#### **Development of Income Supporting Research and Impact**

Levels of UKRI income (BBSRC, EPSRC, MRC) are in the same range as income from charity bids across the REF2021 period, with the combined total accounting for somewhat less than half the overall research funding reported (the rest being industrial). Notable successes have been obtained from BBSRC to Vision Science examining mechanisms involved in motion processing in the brain (Bloj GBP313,037; 2017; 36 months) and a project continuing from 2013 investigating contributions vision makes to the potential for elite performance in professional

sport (Barrett). EPSRC funding awarded just prior to this REF period (Paradkar, GBP495,364; 2012; 40 months) has been critical to impact development (ICS A3-4). Skin science obtained MRC funding to investigate skin regenerative mechanisms in the context of wound healing (GBP494,000; 2015; 36 months) and ageing (GBP544,992; 2016; 43 months), research underpinning the impact reflected in ICS A3-2. Transition of fundamental research to early translational science to generating future impact has been supported by MRC Confidence in Concept funding (Mardaryev, GBP56,000; 2018; 12 months). This scheme has developed interdisciplinary collaborations between non-communicable disease, skin and polymer materials scientists enabling feasibility studies and attracting matched industrial funding to expedite future translation (MRC/Bradford Confidence in Concept 2019, GBP149,400, 2020, 36 months).

Several staff in the UoA meet the needs of the market in developing manufacturing solutions and formulation advances for drug or nutrient supplements attracting significant funding from both national (Innovate UK GBP361,718; 2015; 24 months and 2017; 18 months) and regional development funding such as Yorkshire Innovation Funding (YIF) (GBP251,044; awarded in 2013; 24 months). Research undertaken using this funding also delivered impact [ICS A3-4] attracting a Bionow award (section 4). For some groups within the UoA, industrial funding (UK/EU/non-EU industry/commerce and public corporations) has been a steady and significant source of income, bringing in over the REF period almost GBP5,000,000, notably from the Estee Lauder/Aveda corporation (GBP843,873) (ICS A3-2).

UoA applied health researchers have benefitted from steady growth in competitive awards. This reflects the return on strategic investment including that in senior appointments (Sections 1, 2) with awards already generating impact (section 4). NIHR has funded clinical interventions, particularly to reduce avoidable hospital admissions from nursing homes (Downs GBP1,067,474, 2015; 39 months), in safe use of medicines (GBP3,000,000; 2017; 60 months), to prevent falls in a hospital setting (Randell, GBP492,662; 2020; 24 months) and the ongoing, multicentre randomised clinical trial (RCT) ISCOMAT (GBP2,104,057; 2016, 68 months). In dementia, NIHR Health Technology Assessment funded an RCT to investigate clinical and cost effectiveness of intervention to promote independence and self-management in people with mild dementia (Oyebode GBP267,247; 2016; 42 months). We are a key partner in the large Big Lottery-funded Better Start Bradford Innovation hub (Small, GBP309,280, 2015; 60 months) (section 4).

UK charity remains a significant income source and strategically has been used to pilot interventions which then may be scaled-up and become eligible for NIHR funding including collaborations with BIHR (GBP250,000; 2016; 22 months). Yorkshire Cancer Research has supported applied health research (Blenkinsopp co-applicant, GBP202,393 to Bradford, total GBP1,369,806; Rattray GBP191,412; 2017; 16 months) and cancer therapeutics (ICT, GBP1,000,000; 2014; 60 months), the Alzheimer's Society support for the DTC (section 2; GBP515,000; 2015; 36 months) and studies to improve dementia care (Parveen GBP224,838; 2015; 39 months; Lord New Interventions for Independence in Dementia Study (NIDUS) GBP318,180; 2017; 60 months). Over 20 cancer charity awards have been made, notably Breast Cancer Now (GBP322,840)

Skin and Vision Sciences groups obtained EU funding to address global challenges in international cross-sectional teams, the former led a Framework 7 Initial Training Network (CLaSSiC; EUR795,031; 2013; 48 months) and the latter (DyViTo; EUR2,834,980; 2017; 48 months), a Horizon2020 Innovative Training Network (see section 4). This successful trend continues with Poterlowicz securing GBP687,857 (MRC/UKRI, 2021, 24 months) for an ELIXIR-UK FAIR Data Stewardship Training Project designed to address the increasing demand in management of large-scale data (see section 4).

### **Infrastructure Investment & Facilities**

Significant research infrastructure investment has been made throughout the period. The largest of these has built the partnership with the University of Leeds colleagues and BTHFT through the Wolfson CAHR investment. The impacts generated so far from this growing partnership are

expanded on in section 4. Additional central investment which has been provided to the UoA includes GBP120,000 from the UKRI World Class Laboratories Fund to upgrade eye-tracking facilities for Vision Science, and coating and production facilities for drug manufacture.

Further infrastructure investment has refurbished Phoenix South West building to develop DHEZ as the regional hub for digital health innovation and this has increased patient access through new optometry and physiotherapy clinics, both open to the general public, allowing research studies involving patients and more recently supporting delivery of specialised NHS ophthalmology clinics and COVID-19 vaccination trials. Within this environment, vision sciences researchers (including optometrists in training) and their subjects have access to excellent research facilities within key research labs (i.e. electrophysiology, transcranial magnetic stimulation, ocular imaging) which provide the required infrastructure. A fully enabled phlebotomy suite permits blood sampling from consented volunteers and patients and delivers phlebotomy training courses to develop researcher skills. Recently, in partnership with the BTHFT, the site hosted the Novovax phase 3 COVID-19 vaccine trial.

Housing clinical patient facing services in the refurbished DHEZ building has considerably strengthened patient, service users and carer research involvement and is an attractive proposition for industrial partners who observe the benefits of end user involvement in the development and testing of prototype innovative healthcare products. SMEs work with our researchers to expedite development of innovative health care technology enabling improvements in clinician:clinician and clinician:patient research as well as pioneering research supporting patient self-management of chronic illness. The University's commitment to the transformational potential of digital health research has been confirmed by the recent appointment (2020) of Breen as the Director of DHEZ and Randell as Professor of Digital Innovations in Healthcare.

Medicinal chemists and biologists working on non-communicable diseases, including cancer and pharmaceuticals researchers, regularly access the excellent centralised Analytical Centre (AC) facilities, that bring together Bradford's investment in analytical infrastructure for use in laboratory research. Drug repurposing, which significantly speeds up time required before licensing in the clinic, also benefits from access to the following facilities and may have wider applications in a range of diseases, as has been observed recently for COVID-19. The excellent facilities include Nuclear Magnetic Resonance (Bruker 400 and 600 MHz spectrometers equipped with multinuclear and dedicated diffusion probes), vibrational spectroscopy (Renishaw Raman microscopy and Agilent FTIR microscopy), chromatography and mass spectrometry (Waters U/HPLC with single/triple quadrupole mass spectrometry, Agilent GC and GCMS systems and a Thermo Orbitrap LTQ for high resolution/accurate mass work), and X-ray diffraction (Bruker X8 single crystal and D8 powder systems). UoA researchers also make extensive use of the bioimaging facilities including electron, fluorescent and confocal microscopy (FEI Quanta 400 Environmental SEM with Oxford Xplore EDS, Jeol 1200 TEM, Zeiss LSM510 and Nikon TE2000 confocal fluorescence Microscopes) used to monitor development of tumours in pre-clinical models and their response to anti-cancer drugs.

Access is also available to the microscopy infrastructure used by colleagues in Engineering, in particular the FEI Tecnai T20 SEM with EDS. The thermal analysis suite (TA Instruments Q2000/5000 DSC and TGA systems, nanoDSC for solution studies and Zeiss Hot Stage Microscope Particles Characterisation (Sympatec HELOS/ASPIROS and Malvern Zetasizer NanoZS) is used in both cancer therapeutics and pharmaceutical advances research. Importantly there is also access to an onsite proteomics facility (Thermo Orbitrap Fusion with nano-HPLC and Bruker Ultraflex MALDI-TOF), which links to data processing in the High Performance Computing (HPC) facility enabling the production and interrogation of large datasets.

Additional investment in the development of the Good Clinical Laboratory Practice (GCLP) facilities include a top of the range a Xevo TQ-XS Mass Spectrometer combined with UPLC enabling ultra-sensitive site analysis of patient samples from phase I and II clinical trials. This

has expedited our anti-cancer therapeutic drug development pathway by fulfilling the additional regulatory requirements and allowing for in house development of new therapeutic compounds.

The appointment of bioinformatician researchers triggered institutional investment in the HPC facility, which is critical for proteomics research in the UoA. It provides capacity for the analysis of multiple large data sets and is extensively used by skin sciences and staff involved infectious disease epidemiology. Technical support is provided through a combination of institutional investment and external funder project support. The technical manager (appointed 2020) supports the facility and works with colleagues to develop income generating strategies and promote open research (section 1).

### **Operational and Scholarly Infrastructure**

Continued investment in technical support staff enables the operation, maintenance and training in use of specialised equipment described above. In ICT (4FTE) and the Analytical Centre (2.6FTE), technical experts run the high specification apparatus producing key data. One FTE senior scientific officer with expertise in Skin Sciences is supported by 2FTE technical staff to generate data to fulfil industrial contracts. The Ethical Tissue biobank has a dedicated senior technician (1FTE) undertaking sample processing to meet researcher needs and a research nurse (0.5FTE) responsible for volunteer consent, blood sample collection, training and supervision in the phlebotomy suite (part of DHEZ) and providing anonymised clinical information for publication. The biobank team is fully involved in the ethical approval process required to obtain clinical tissue specimens. Ethical review panels (section 2) meet regularly, ensuring that our researchers and those external to the University can apply for ethical approval through the streamlined panel approval process to access tissue or cellular samples from volunteers and consented patients in return for minimal sample recovery and processing charges. Development of *in vitro* cancer cell models from clinical tumour samples, identification of specific pathological histological and molecular signatures within a wide range of cancers for future study and analysis of patient samples from clinical trials have been vital in the progress made in development of anti-cancer drugs developed by the ICT research team.

The Biological Services Unit (BSU) is run and supported by three fulltime specialised technical staff including a senior specialist. The unit houses facilities for rodent models of disease, including genetically modified mice for mechanistic studies and equipment for surgical interventions alongside behavioural analysis. Researchers in the UoA experimentally identify mechanisms important in neurodegeneration, cardiovascular disease, inflammation and metabolic disorders. Therapeutics and skin science researchers share both cell-based and *in vivo* disease models. BSU also supports pre-clinical *in vivo* research, mandatory in development of new drugs, establishing toxicity quotients and investigating potential side effects in a mammalian model prior to clinical trials.

To support staff focused on mechanisms underpinning diseases of increasing prevalence in ageing populations, FoLS invested in a pre-clinical model of healthy ageing, the naked mole rat (NaMoRa), in 2017. These long-lived mammals are highly resistant to disease, providing an excellent model of healthy ageing. This is one of only three UK colonies and BSU technical support investment and training has enabled the successful establishment of two breeding colonies, a source of future income to support sustainability of the facility. Since 2018 an active group of researchers from the non-communicable diseases group meets regularly to develop collaborations and, after Home Office regulatory requirements are met, preliminary data is now being collected for incorporation into external funding bids aimed at understanding how resistance to disease is relevant in humans. FoLS financial support for housing and colony maintenance will continue until at least 2023, by which time external funding will make the colony sustainable. To support development of ECR research or for staff pilot projects with potential to generate impact, in kind usage of the AC, access to ethical tissue samples or the *in vivo* NaMoRa colony without cost recovery is supported on a case-by-case basis.

Public involvement groups supported by FoHS are described in section 1.

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

##### Research Collaborations and partnerships

Wolfson CAHR has developed and expanded strategic partnerships with BIHR, regional NHS Foundation Trusts and the University of Leeds. Continued engagement is assured through staff secondments (Daly-Smith, see below), joint PhD studentships and honorary appointments for NHS staff (i.e. Wright – BIHR and Wolfson CAHR director, founder of Born in Bradford (BiB) – and McEachan, Director of BiB; Twelves, Leeds oncology linked to ICT; Saralaya, director of the Bradford NIHR Patient Recruitment Centre for Clinical Trials). The NIHR YHPSTRC led by the University of Leeds is managed by Fylan who has a joint University of Bradford and BIHR appointment. Fylan's University of Bradford appointment ensures continuity of the momentum developed by Prof Alison Blenkinsopp, OBE, particularly the added value of specialist pharmacists in ensuring safe prescribing and deprescribing at transitions between hospital and community. The recruitment of Gardner provides succession for Blenkinsopp who retired in 2019, strengthening the research team working on safeguarding and enhancing patient safety within applied health research. Impact is being generated through NIHR-funded RCTs including ISCOMAT, the multi-centre clinical trial to improve safety of medicine prescribing at transitions of care for heart failure patients (2016-2021) (section 3).

Suspension of patient recruitment due to COVID-19 enabled ISCOMAT and NIDUS to focus on the impact of changes in NHS services for trial participants using online strategies and online intervention delivery, providing essential information relevant to the future provision of digital healthcare. Current NIHR projects include the use of artificial intelligence to monitor patient safety and care quality across a complex hospital site from a single operations centre and quality dashboards to improve feedback of data from multiple audits for service improvement (Randell). Access through DHEZ to SME business partners such as Serenity Care, Survivors West Yorkshire and Equality for All ensures innovative digital approaches which benefit patient care and improved services can be implemented in multiple NHS settings. Wolfson CAHR has enhanced access for vision scientists and bioinformaticians to major existing projects, such as Born in Bradford (i.e output 173) and Connected Yorkshire, and its collaborative environment facilitates development of interventions to improve population health and advance health policy from evidence-based research.

Daly-Smith was seconded to BTHFT as JU:MP research director to lead the evidence-based development and evaluation of the Sport England funded (GBP2,900,000, 2019, 36 months) whole-systems programme to improve physical activity among children and young people. This programme is a significant component within the Sport England portfolio and is currently supporting 25 localities across the UK to create systems change for physical activity in schools (output 28).

Bioinformatics technology expertise has enabled partnership with industry to produce bespoke artificial intelligence and machine learning packages meeting specific needs for analysis of large datasets. Poterłowicz has been appointed Training Co-ordinator of a European network of bioinformatics professionals (ELIXIR-UK). This organisation delivers training to early career researchers (ECRs) including one event so far in Bradford (2019), upskilling UK ECRs and PGRs.

The Centre for Skin Sciences hosts the Plastic Surgery and Burns Unit, founded by Professor David Sharpe following the fire disaster at the Bradford City football club in 1985. The football club continues to give financial support to post graduate research training of clinical registrars in plastic surgery (MPhil/PhD) developing advances in burns and wound healing. The club supports fundraising activities in the Bradford City region, raising awareness and disseminating the benefits of research in the local community.

Collaborative partnerships across the UoA have been supported by institutional International Development Funding for PGRs to investigate diseases prevalent in low- and middle-income countries. Work with the Institute of Ophthalmology (University College London) and LV Prasad

Eye Institutes, India, capitalises on the fact that enzymes highly expressed in cancer are also important in eye disease, providing an opportunity for to optimise compounds into eye drops to relieve ocular auto-immune disease and diabetic retinopathy (Pors). Graham is working with Surawahardy Medical College, Bangladesh to develop digital solutions which reduce poor pregnancy and foetal outcomes in gestational diabetes. Oyebode is working with China Medical University to investigate Chinese population challenges in caring for elderly relatives.

Through participation in the GrowMedTech consortium (and its predecessor Translate) UoA A3 researchers have secured proof of concept funding and commercialisation support to develop innovative medical devices, establish industrial partnerships and license patents (Cooper, Nasim, Isreb, Kantamneni, Paradkar). These activities are strongly encouraged in the UoA and the central RaIS team provide regular advice and assistance to pair researchers with appropriate industrial partners. Competitive funding made available by the University has enabled interdisciplinary sandpits led by colleagues in the UoA on wound healing, neurodegeneration, and antimicrobial resistance. Industrial investment is often initiated via Knowledge Transfer Partnerships, including skin sciences partnership with InnoVen and Labskin, researching infection control and improvements in chronic wound care (Thornton, Elias-Gomez) and successful partnerships with AstraZeneca, Health Innovations, and Natures Laboratory.

Four Innovate UK ICURe (Innovation to Commercialisation of University Research) awards to Paradkar, are currently at different stages of commercialisation. These projects are led by ECRs demonstrating the skills that are fostered to ensure research sustainability which can be translated into the commercial world for which Paradkar has been nationally recognised (see below). Partnerships have also been formed with global companies keen to research skin ageing mechanisms (Thornton-Walgreens Boots Alliance, Aveda). These partnerships have improved existing products and developed new ones which can legitimately advertise clinically proven benefits to the skin [ICS A3-2].

The EU ITNs mentioned in section 3 train and develop scientists in cross-sectional settings such as industry and museums, providing access to career pathways outside academia. CLaSSiC recruited interdisciplinary EU junior research fellows for 36 months, who split their time equally between industry (Philips, Eindhoven) and academic research. All three fellows obtained PhDs and have continued their careers either in companies or academia. DyVito involves researchers and innovators from nine European universities (Bilkent, Turkey; Delft, Netherlands; Justis Leibig and Ulm, Germany; and Zaragoza, Spain as well as Cambridge, Southampton, Newcastle and Bradford), two museums (National Gallery and National Science & Media Museum) and four companies (Ledmotive, Arup, Schelnk, and Adobe) across Europe that have together developed an innovative research and training plan that will examine visual and haptic perception, neuroimaging, modelling, material rendering and lighting design.

### **Wider impactful contributions to the community and society**

Colleagues in the UoA demonstrate how the research and innovation and the business and community engagement strategies in ILES come together through longitudinal cohort studies of the local population, including continuing analyses of the health of the BiB cohort (see outputs 105, 116, 118, 172, 173). The governance, managed by BIHR and our researchers (Small, Daly-Smith), has enabled the development and launch of focused research studies by researchers from multiple institutions, all of which aim to benefit the local multi-ethnic population. New studies have been derived from original observations using both the comprehensive dataset and the biological samples collected during the study. Recognition that there are increased risk factors for recessive genetic disorders where marriage takes place between blood relatives has enabled targeted education and behavioural interventions to inform the public better on the specifics of risk. Resource implications and patterns of need for additional support within the BiB communities have also been identified which will inform commissioning decisions and healthcare workforce practice. The continued participation of both Caucasian and South Asian families in the study from its inception has fostered an increased sense of community across Bradford. Evidence is starting to emerge of the benefits of research penetrating more widely into close knit

communities which are recognised as underrepresented populations in research studies. Pregnant women and young children in Bradford's areas of socioeconomic deprivation have benefitted from support provided by the National Lottery funded "Better Start Bradford".

The Goal-oriented Rehabilitation in Early Alzheimers Trial (GREAT) has international reach in improving post diagnostic support and in enabling self-management for these patients. The benefits that can result from strategies to enhance dementia self-management both produce improvements in patient care within care homes and in turn improve the experience of people living with dementia (Oyebode, output 68). IDEAL is a longitudinal cohort study that follows a group of people living with dementia and their family carers to explore the group's experiences over time and establish what social and psychological factors support or hinder the ability of people and their families to live well with dementia (Quinn, outputs 39 and 175). The NIDUS project is developing and testing evidence-based training and support programmes to help family (NIDUS-family) and paid home carers (NIDUS-professional) to provide high quality care to people living with dementia while remaining at home (Lord).

### **Engagement with local communities and the general public**

We have developed an increasing focus on the importance of the University in supporting the local community and region and colleagues from UoA A3 are often leading this type of initiative, i.e. Rattray recent appointment as director of research for Bradford's City of Culture 2025 bid.

Researchers in the UoA are carrying out an increasing number of studies where patient benefit defined by the patient voice is the driving force behind the development of the project. The public involvement groups, described in section 1, play a dual role in both ensuring that publicly-funded health research is accountable and transparent to patients and the general public, and providing direct impact on the community. Diabetes research is of particular concern in the local BAME population. Researchers with expertise in this area (e.g. Graham) engage regularly with the local Diabetes UK-sponsored Diabetes Support Group, enabling the development of projects prioritised by individuals living with diabetes and ensuring the patient perspective is highlighted from study inception and development to proposal submission to the funder. Cooper has been instrumental in establishing the Northern Maternity Stream research network with academics, and colleagues working across the NHS, voluntary and local government alongside immigrant groups to improve the outcomes and experience of maternity care for migrant women.

The involvement of people affected by dementia, their families, health care professionals and volunteers is vital in all the work of the Centre for Applied Dementia Studies. Their Experts by Experience group works together with academics in research, education and training projects and hold regular events at the University and in the community. Experts by Experience includes people whose lives have been touched by dementia but whose voices are less often heard, including women, people over 80, members of the black, Asian and Eastern European communities, those who live in care homes, and members of LGBT groups.

Dissemination of research to the public is facilitated by community relationships. One example is the strong relationship with the National Science & Media Museum which has included partner status in bids (DyViTo) and enabled researchers to raise public awareness in Bradford Science Festivals and devise engaging activities for families during half term holidays such as the four day "Operation Owch" medical themed event in 2019 (Graham, Helfer, Rattray, Elias-Gomez). The museum hosts the monthly public engagement forum "Café Scientifique" (see section 1). Researchers from the UoA have led additional public engagement contributions, joining the Pint of Science festival in 2020 (Williamson). All these public engagement events play a dual role: increasing the visibility of our research in the city and local area and contributing to researcher development by providing opportunities to engage with the public.

### **Indicators of wider influence, contribution to the research base**

Several national and international accolades have been awarded which recognise the quality of our researchers. The Queens Anniversary Prize was presented to the Centre for Applied



Dementia Studies in 2015. This is the most prominent national recognition possible for a university, honouring the world class excellence and achievement in developing person-centred dementia care and influencing policy and practice in the UK and internationally. In 2018, Downs was awarded the British Society for Gerontology Outstanding Achievement Award for her work in applied dementia studies over the past 30 years. Mountain received one of only three annual awards of Fellowship from the College of Occupational Therapists for lifetime achievement in research (2016). Elliott was the first UK recipient of the American Academy of Optometry award, the leading international award in optometry (2018), while nationally Mallen progressed from Chair of the research committee of the College of Optometrists to the post of President (2018-2020). Paradkar and his team of ECRs won the prestigious Bionow project of the year award (<https://bionow.co.uk/>, 2019) recognising the team's ability to develop products which have beneficial effects in the pharmaceutical and nutritional industries. Paradkar and colleagues were also finalists in the Best KTP Award 2018 in the Business Impact category. A patented product which reduces sodium level in effervescent products was part of this nomination and is now licensed (Octopoda Innovations). Falconer is a Fellow of the Royal Society of Chemistry (RSC); Waby, Bloj and Graham are Fellows of the Institute of Biomedical Sciences; Oyeboode is Fellow of British Psychological Society and Downs is a Fellow of the Gerontological Society of America.

Recognition of researcher expertise in Europe and internationally is reflected by membership of international research councils (Norway, Randell; Austria, Paradkar; USA-Israel Binational Science Foundation, International Joint Programme Initiative: More Years Better Lives, Oyeboode; EU Horizon 2020, Mountain), and reviewing for the Netherlands Organisation for Scientific Research and American National Science Foundation (Bloj). Randell is Executive Officer of European Federation of Medical Informatics (since March 2019). Graham and Bloj have examined PhDs internationally (National University of Singapore, Norwegian University of Science and Technology and Universidad de Valladolid in Spain).

Several professorial staff have been BBSRC grant panel members during the REF period (Goldman, Graham, Barrett, McKeefry) or are members of EPSRC or ESRC peer review colleges (Mountain, Falconer, Randell, Bloj). Bloj is a member of UKRI Fellowship and Infrastructure award panels serving in 1-2 research council funding meetings and/or interview panels annually as does Mountain. Randell was a member of the College of Experts for the DHSC/UKRI COVID-19 rapid response rolling call for proposals. Several applied health researchers sit on NIHR panels such as the HEE/NIHR integrated clinical doctoral programme (Hardy), NIHR/CNO Clinical Academic Training Programme Expert Review Panel, and NIHR Health Technology Assessment Programme (Mountain), or serve as Associate Members of the NIHR Health Services and Delivery Research Funding Committee (Faisal) of which Randell is Deputy Chair (since December 2018). In 2017 Anderson became UoB's research champion for the Academy of Medical Sciences Springboard competition and since 2016 Pors has been an elected member of the British Council Newton scheme.

Our UoA researchers are also heavily involved in leadership and membership of charity grant panels. During the REF period, Oyeboode was Vice Chair of the Alzheimers' Society grant awarding body for Care & Services Research, and Downs served on the Alzheimer's Society Research Strategy Council. Helfer was recently appointed chair of the British Society of Neuroendocrinology grants committee. Other colleagues are members of other charity panels such as the Heart Research UK Translational Grant panel (Graham) and the Physiological Society Studentship Review Panel (Helfer).

Involvement in government policy developments include Daly-Smith acting as consultant to Sport England and Public Health England, specifically on school-based physical activity expertise. He made significant contributions to the development of the Public Health England Active Mile guidance for schools (2019-2020), while also providing academic expertise to the Association for Physical Education (AfPE) national steering committee. At a regional level, Daly-Smith is on the strategic advisory board for Active Yorkshire and the Yorkshire and Humber

Physical Activity Knowledge Exchange, with a remit to strategically lead evidence-based practice and evaluation across the region.

Current learned society committee positions include the British Society for Neuroendocrinology Steering Committee (Helfer) and the British Pharmacological Society Animal Welfare and *In Vivo* Committee (McLean). Until 2018, Gardner was a member of the British Psychological Society Education and Public Engagement Board. Bloj chairs the interdisciplinary society Colour Group UK (2018-2021) and was an executive committee member of the Applied Vision Association (2015-19) and the British Machine Vision Association (2015-2021).

Researchers in this UoA are active on editorial boards of various journals. Rattray was Deputy Chief Editor of Journal of Neurochemistry (until 2014); Elliott was Editor in Chief of Ophthalmic and Physiological Optics (2010-2020); Randell is Associate Editor of the Health Informatics Journal; Williamson is Associate Editor of Frontiers in Neurodegeneration; Lord is Associate Editor for BMC Health Services Research. Other editorial board memberships include Downs: Ageing and Mental Health; Helfer: Journal of Neuroendocrinology, Chronobiology and Frontiers in Physiology; McLean: Journal of Neuroscience Research and Graham: Journal of Inflammation. Falconer, Pors and Thornton are editorial board members for Scientific Reports. Anderson is Editor in Chief for the "Issues in Toxicology" book series and editorial board member for 10 international journals while Downs is co-editor of the highly commended book "Excellence in dementia care: Research into practice" and is series editor of the Jessica Kingsley Good Practice Guides on Dementia Care. Elliott is the editor of the key optometry textbook "Clinical Procedures in Primary Eye Care", now in its 5th edition.

Most UoA staff regularly review article submissions for specialist journals such as Biochemical Journal, British Journal of Pharmacology, Neuroscience Reports, Journal of Investigative Dermatology, Journal of Proteomics, Journal of Cancer, Vision Research, Journal of Vision, Optics Express as well as interdisciplinary journals such as Scientific Reports and PLoS ONE.

All researchers regularly present their work at national and international conferences. Bloj was keynote speaker at 101<sup>st</sup> meeting of the Argentinian Physicist Association (2016, Argentina). Mountain was keynote speaker at the Alzheimer Europe Annual Conference (Spain, 2018). Downs gave the plenary address at the International Congress on Care for Older People (Italy, 2018). In 2020, Daly-Smith gave the keynote at the Westminster Education Forum on Physical Education and School Sport and was invited by the British Council give a keynote at UK Sport and Education Conference in Qatar.

The UK Council for Graduate Education national PGR supervisor recognition has been achieved by Paluch and Sheldrake (2020). Paradkar and Thornton were shortlisted as outstanding Research Supervisor of the Year in the Times Higher Education Awards (2020 and 2019 respectively). Gardner is a member of the Academic Quality Committee of the ESRC White Rose Doctoral Training Partnership (WRDTP) and Cooper took over the role of Director for Well-being, Health and Communities pathway in the WRDTP in 2020.