

<b>Institution: Abertay University</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>1.1 Unit Context and Structure</b></p> <p>Abertay is a focussed and compact University that in recent years has grown its reputation, including being named the top modern university in Scotland (<i>Guardian Good University Guide 2019; Times/Sunday Times Good University Guide 2017</i>). Although we are one of the smallest Scottish universities, we produce high-quality research and knowledge exchange (RKE) aligned with international, national and local priorities, which delivers real impact for society (REF5a). The Allied Health Professions Unit has contributed significantly to these achievements.</p> <p>This UoA3 submission (<b>10 FTE</b>) is largely focussed within the Division of Health Sciences (DHS) in the School of Applied Sciences (SAS), which was formed in 2019 by merging previously separate Biomedical &amp; Life Sciences and Nursing &amp; Counselling departments to <b>consolidate Allied Health activity</b>. The Unit benefits from a <b>£4M strategic investment</b> in research facilities (Section 3.3) and has been formed from a mix of new (4 FTE) staff appointments in Allied Health, existing staff (3 FTE), and (3 FTE) academics previously submitted to REF2014 (UoAs 4&amp;5). New appointments include a Professorial position to provide leadership in mental health and an academic with extensive experience of professional practice. A combination of funding success, mentoring and support, have resulted in 7 promotions since 2014, thus supporting staff retention and Unit development.</p> <p>As a new Unit operating within a newly formed Division we have laid the foundations to purposefully build progress in terms of research quality, research income and external impact within UoA3 and, in line with Abertay's interdisciplinary research strategy (below), UoA3 has developed strong collaborative links and accessed external funding with researchers across the University (e.g., UoAs 4, 6, 12, 24 and 32) and with external practitioners and stakeholders (e.g. NHS and Macmillan).</p> <p>UoA3 comprises three interacting research groups:</p> <p>i) <b>Biology of Health and Disease:</b> We focus on cancer systems biology, with the Universities of St Andrews and Edinburgh, and reproductive health, with the University of Dundee and the Assisted Conception Unit, Ninewells Hospital, Dundee. Our cancer systems biology combines experimental data streams and theoretical modelling (UoA12) to characterise cell signalling network responses to therapeutic interventions and oxidative stress and have developed a statistical model of patient survival based on the spatial distribution of cells in patient tissue. Drawing on our expertise in electrophysiology, we have extended our focus to reproductive health and IVF failure in particular. We have elucidated one of the causes of IVF failure, which has resulted in a spin-out company (Fertility Genomics) developing routine standardised screening tests that can inform clinical decisions, fast track patients to alternative treatments and reduce IVF treatment failure. We collaborate with our UoA6 colleagues focussed on molecular and comparative physiology and nutritional health, and on antibiotic resistance gene spread in wild animal populations, including links to environmental and public health. The Research Group makes a substantial contribution to income (Section 3), and partners with stakeholders for impact pathways.</p> <p>ii) <b>Mental Health:</b> Our research in mental health focuses on the development and delivery of effective interventions and support for people experiencing challenge, and the interplay between physical and mental health. Our research is community- and practice-based, undertaken via our on-site Tayside Centre for Counselling (TCC) that provides a venue for large-scale data collection. The TCC provides counselling to the local community and accepts referrals from NHS GP services, from the local Diabetes clinic, and from the Ophthalmology department at</p>

Ninewells Hospital. The TCC hosts projects examining the role of emotional and psychological support for long-term health conditions, and the evaluation of Pluralistic Counselling. The clinic is part of a UK-wide BACP-supported Research and Training Consortium (RTCC), which promotes collaborative working between clinics at York St John University, Newman University and the University of Salford (going forward also the University of East London and the University of Roehampton). This work involves strong alliances with external partners, including NHS Health Boards, further enabling development of research into interventions used in mental health support.

- iii) **Practice Engagement:** Our unifying focus is to inform the development and refinement of practice engagement through the allied health research we conduct. As well as the health and disease focus described in (i) and (ii), we explore the engagement with, and experiences of, healthcare practice. We recognise the value of person-centred care, where we have shown that contextualising care in a person's situation is of particular importance, and interpersonal and complex trauma, relational and person-centred approaches are key. Our approach is typically based on detailed assessment of individual experiences (e.g., in-patient treatment for anorexia; how students with vision impairment experience inclusion and support in schools, experiences of harmful therapy). In population-based research on healthcare communication, we have assessed patient communication with practitioners in relation to symptoms indicative of cancer as a pathway to improve healthcare messaging and devised a taxonomy of explanations to aid healthcare practitioners in their care of patients with persistent physical symptoms. We have also explored broader perspectives in practice engagement, including the profiling of patient demand on the healthcare system and ethical aspects of healthcare, e.g., genetic modification of the human germline to improve health. We have extended our collaborative approach (with UoA4), combining our expertise in communication-based interventions and behavioural analyses, to examine the role of quantitative methods to characterise behaviour and enhance the quality of practitioner interventions (Section 3.4).

### 1.2 Research and Impact Strategy

Our overall Unit strategy is to deliver research with impact, combining academic excellence with stakeholder collaboration. The Unit operates within the context of **Abertay's RKE Strategy** (2014-19 & 2020-25), R-LINCS: Research-Led Innovation Nodes for Contemporary Society (REF5a). R-LINCS integrates our research into a single Abertay-wide initiative designed to capitalise on our compact, focused and collaborative nature. R-LINCS bridges conventional boundaries among research disciplines to devise innovative cross- and inter-disciplinary approaches that deliver research with impact. Essential for a small University, our strategy guides and supports our Unit research activity directly and brings together School and Divisional planning, staff management, research studentships, and central funding in five-year plans.

R-LINCS (2014-19) was organised into 4 cross-cutting contemporary themes and was centrally led and managed. It provided:

- (i) A single, pan-University research leadership to drive our discipline strengths and interdisciplinary research agenda and foster external collaborations, including with external organisations (Sections 1, 3 and 4);
- (ii) A cross-University **Graduate School**, which offers us a coherent, Abertay-wide integrated training programme for staff and Postgraduate Research Students (PGRS) (Section 2);
- (iii) Intra- and inter-theme support for RKE including funded and co-funded doctoral studentships and Pump Priming awards (Section 1, 3);
- (iv) Facilitation of public engagement (Section 4).

We have refreshed our strategy (R-LINCS2, 2020-25) to use our expertise to target specific Challenge Spaces presented by modern society, through research leadership in our Pools of Excellence, i.e. distinct ways of working that cross-cut Challenge Space areas and discipline strengths encapsulated in our academic Divisions (see Figure 1). Of particular note for UoA3 is one of four research Challenge Spaces, 'Health and Care across the lifespan', where UoA3 will play a leading role going forwards (see Section 1.3).

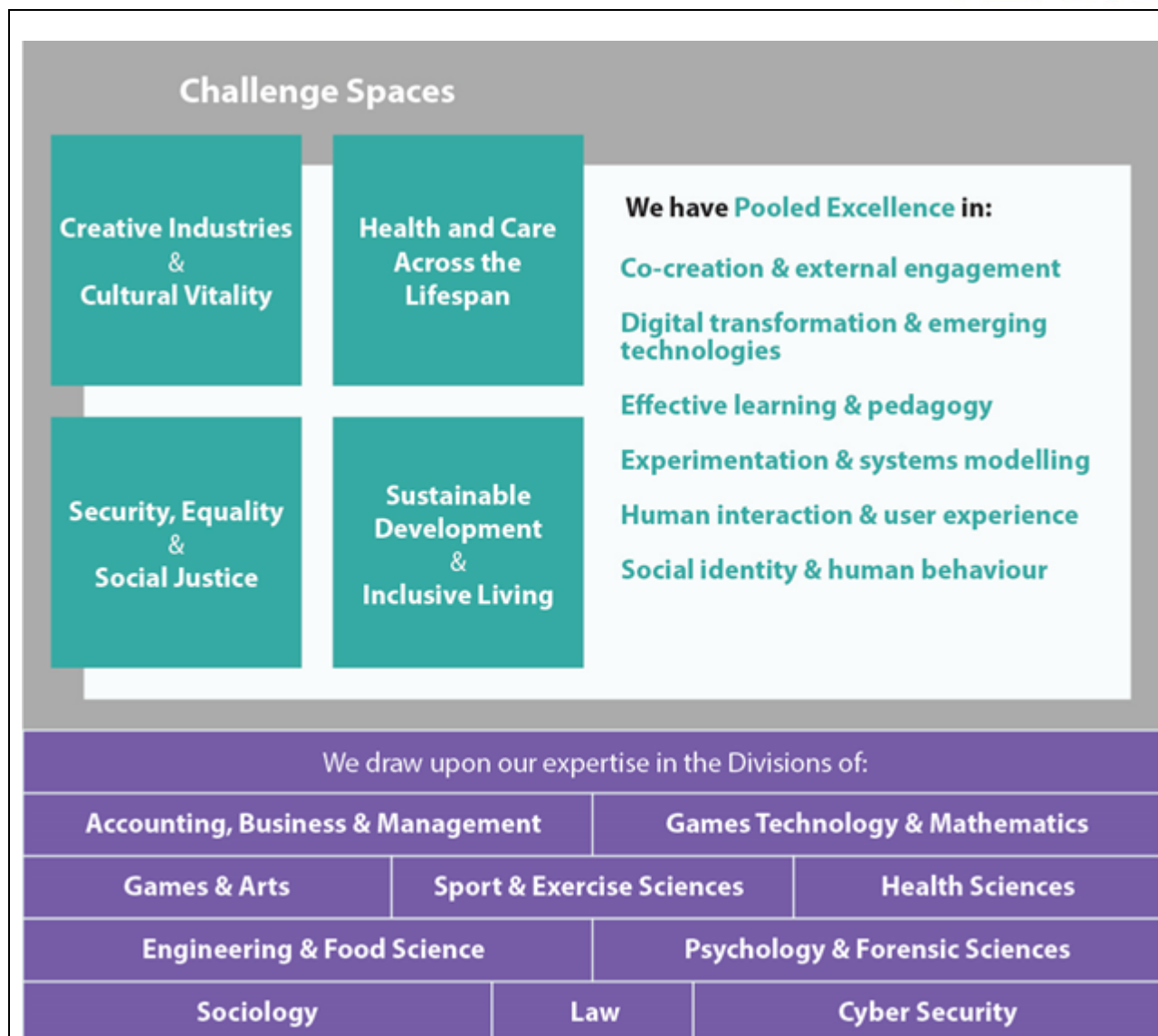


Figure 1: R-LINCS2 2020-25

The UoA3 approach to **research integrity** and progress towards an **open research** environment wholly aligns with the institution via centralised R-LINCS strategy and research management. Abertay fully engages with (and is a signatory to CSCDR and KEC):

- (i) the principles of the Concordat to Support Research Integrity (CSRI)
- (ii) the Concordat to Support the Career Development of Researchers (CSCDR)
- (iii) the Knowledge Exchange Concordat (KEC)
- (iv) the Concordat on Open Research Data (CORD)
- (v) the Concordat for Engaging the Public with Research (CEPR), which we use to guide development of supportive RKE policies, practices and structures (Section 2).

We are compliant with our CSRI commitments: all staff and students and visiting researchers are required to adhere to the highest standards of **integrity** in the conduct of their research as set out in the Abertay Research Code of Conduct (ARCoC) and engage in mandatory research integrity training (including Research Ethics and GDPR for Researchers).

The University has taken important strides to develop an **open research** environment. Published outputs are open-access compliant and we are working towards open access compliance with our research data by 12/2021. Our Open Access and Research Data Management Policies, researcher development training and individual support is provided by our dedicated Research Support Manager, increasing staff engagement with open research, pre-registration, and open-access data repositories. We are committed to the responsible use of

metrics in research evaluation and are a signatory of the San Francisco Declaration on Research Assessment (DORA). Our policy and practice on research metrics for research assessment is included within our ARCoC and informs our Recruitment and Promotions policies and procedures and our REF Code of Practice.

**Our strategy** as a small nascent Unit, has focused on specific research areas and on interoperation with other disciplines (e.g., psychology, systems modelling, food & nutrition, art & design), as well as stakeholder engagement. We have used strategic investment of R-LINCS studentships to open up new areas of collaborative and interdisciplinary research, which has afforded us access to important consortia and high-quality funding sources, including UKRI (MRC), NHS, Chief Scientist Office (Scottish Government), Ministry of Defence, UK Charity and Trust funding.

We have achieved the following strategic goals during the REF2021 period:

**(i) Produced high-quality research impacting physical and mental health and well-being:**

We have supported development of high-quality research through leadership, mentoring, investment in research facilities (Section 3), engagement with the Graduate School researcher development programme and one-to-one support (Section 2). We have prioritised high-quality research with impact in a targeted way through the use of personal appraisals, workload planning, resource allocation, appointments, and accessing institutional support. Unit growth was supported by 6 fully-funded R-LINCS PhD studentships (including one co-funded by the Northwood Trust) during the REF2021 period, and our 'Future Scholarships' scheme (fee waivers for strategic development) has provided a further 3 Research Degree fee-waivers since 2018. Development of the postgraduate student base and associated research output has contributed to a research environment that has continuously improved during REF2021.

**(ii) Diversify income sources:**

UoA3 has secured income (individual and collaborative) for RKE, thus contributing to the generation of £718k during REF2021 (see Section 3 for cross-Unit project income). Early income was dominated by a single income stream (the Northwood Trust) and we have used this funding and strategic internal investment to diversify our sources of external funding and extend our consortia (see Section 3). We have supported the development of high-quality research funding submissions through provision of research leadership, mentoring, engagement with the Graduate School researcher development programme and one-to-one support (Section 2), and a revised peer-review process for grant applications that has improved grant success rates and scale across Abertay (e.g., in 2020 30% success rate (average award £335k) with peer review vs 10% success rate (average award £53k) without).

**(iii) Increase collaboration and impact:**

Our consistent and competitively won internal funding has allowed us to develop research projects and gain experience which has led to the growth of collaborations, grant applications and impact. We have used creative approaches and internal R-LINCS studentship and Pump Priming funding to deliver interdisciplinary research (Food & Nutrition; Forensic & Analytical Science; Systems Modelling; Sport & Exercise Sciences; Psychology; Art & Design). Since 2014, we have had 15 completed PhDs, and 2 Pump-Priming awards (£10k) which have enabled us to develop our research and impact with a focused range of stakeholders (NHS, health charities).

Our two REF2021 **Impact Cases Studies**, '*Counselling for Sight Loss: Increasing the quality and availability of specialist counselling for people with sight loss in UK and Ireland*', and '*More than one pathway to change: Innovating psychotherapeutic practice via Abertay's pluralistic counselling model*', have emerged directly from our strategy of supporting effective KE and creation of partnerships. These case studies directly impact the delivery of counselling support practices for different patient/client groups in the UK and internationally, primarily through influencing the training of practitioners and more broadly in the delivery of therapy by adoption of



the practice. Our Impact Case Studies do not exhaust the range of impact we achieve (Sections 3 & 4), some of which will be realised substantially in the next assessment period.

### **1.3 Future Strategic Aim and Objectives (2020-25)**

Our strategic research aim aligns with Abertay's RKE Strategy (2020-25). UoA3 fundamental and translational research will **lead the 'Health and Care across the Lifespan' Challenge Space**. We will contribute to Pooled Excellence in 'Experimentation and Systems Modelling' through basic research, 'Co-creation and External Engagement' through translational research, and 'Human interaction and user experience' and 'Social identity and human behaviour' through practice engagement RKE.

**Mental Health** will maintain our national lead in counselling RKE and extend beyond therapeutic support to grow our mental health nursing care research, which aligns with our existing professional practice taught portfolio. **Biology of Health and Disease** will continue to undertake interdisciplinary RKE, particularly with our systems modelling researchers and through collaboration with stakeholders for impact. Our unifying **Practice Engagement** group will drive impact by enhancing health and wellbeing policy and practice, through collaboration with practitioners, stakeholders and across disciplines.

Our **strategic objectives** going forward are to:

- (i) Produce high-quality research that impact physical and mental health and well-being;
- (ii) Develop sustainable research groups through leadership appointments and researcher development support.
- (iii) Increase funding success and income.
- (iv) Increase research impact, recognition and collaboration.

The delivery of objectives will require continued investment in staff and facilities, R-LINCS/ Future Scholar studentships, and networking support to stimulate new collaborations and grant applications. For R-LINCS2, Abertay has committed to c.15 fully funded PhD studentships, funded PhD studentships for newly appointed academic staff (dependent on R-LINCS2 objectives alignment), and Pump Priming and Open Access funds.

Key areas of focus for development are research Group leadership, mentoring (ECR and staff with practitioner background) and research-focused management. Central to leadership and mentoring will be strengthening the role of our Health Research Forum. This Forum will be key to maintaining and coordinating research focus, enhancing best practice in research (e.g., Open Science, research design), consolidating existing, and stimulating new, stakeholder links and landscaping funding opportunities. Having diversified our income sources (Section 1.2) we will drive up income through one-to-one grant application support from the Graduate School (including our grant application peer-review processes) and the availability of an exemplar applications repository. Research-focused management is a University-wide development agenda (Section 2) and will be effected via e.g. block teaching and sabbaticals.

We have clear, sustainable plans to continue developing the vitality of our research environment as our Unit emerges from a recent period of transition and consolidation. We will continue to build on our existing strengths, providing a sustainable base of expertise.

## **2. People**

### **2.1 Staffing Strategy and Development**

This is a new UoA of 10 FTE, 3 of whom did not have significant responsibility for research in REF2014. Their REF2021 return reflects investment in research leadership with a new professorial appointment (2015). This appointment enabled an increased research focus within the Unit, and a growing ability to attract, develop and retain high quality researchers (4 FTE are new appointments) and secure funding. Appointments include 2 ECRs (interplay between physical and mental health) and 1 established researcher (experiences of healthcare service users and delivery).

The UoA3 team comprises a good balance of experience: 1 Professor, 2 Heads of Division (HoDs), 4 Senior Lecturers (or equivalent) and 3 Lecturers; all are Category A eligible and on

permanent contracts. During the REF2021 period, 7 were internally promoted at least once, reflecting Abertay's commitment to developing staff careers. The University's commitment to investing in staff is further evidenced by a Gold award from Healthy Working Lives. New staff benefit from a comprehensive Induction Programme covering PGR degrees and regulations, Abertay's RKE Strategy, ARCoC, CSRI, CORD and CSCDR.

## 2.2 Staff Development

Consistent with the CSCDR, line managers are committed to staff well-being and all UoA3 staff have twice-yearly *Developmental Discussions* with their line manager to appraise both short-term research objectives and long-term plans, discuss training and development needs, and review any well-being or workload issues.

Training and development needs are met through the Graduate School and HoDs. The Graduate School has three Researcher Development Staff who, together with senior Abertay staff, provide **>100 development opportunities annually**. Training includes advanced statistics, GDPR, impact, enterprise, PGR supervision, public engagement, paper and grant writing. Where necessary, staff development needs were met by external organisations, (e.g., Fast Track Impact; Transparent and Reproducible Science training; national Aurora leadership programme).

Divisions provide internal support for national and international travel, conference attendance, dissemination (e.g., Refocus on Recovery conference in Nottingham; the BACP Conference Belfast) and international conferences in Europe (e.g., the European Conference on Mental Health in Split; Integrating Diversity into Psychotherapy Research, Amsterdam).

R-LINCS provides leadership in Academic Enterprise (two academics with excellent track record in KE) and in 2019, Abertay initiated Bell Street Ventures, an enterprise hub situated on campus to develop enterprise and entrepreneurship skills and is supported by a charitable donation and Santander Universities Network. Successes in the allied health area to date include a local games company using games to improve healthcare and in UoA3 in supporting the spin-out company Fertility Genomics (Section 3.3).

ECRs and other new appointments are given additional support in the form of a reduced teaching load in their first year to establish their research. There is a 2-year probation period to ensure regular objective setting and discussion with line managers. Depending on experience and qualifications, ECRs may also be required to complete Abertay's Postgraduate Certificate in Academic Practice (PGCAP). This qualification has a research focus as well as developing teaching skills, including modules such as 'Developing Academic Practice' and 'The Effective Research Academic', covering the supervision of postgraduate students, the research funding landscape, project management, developing a research niche, and internal research procedures (e.g., ethics, data management). For established staff, additional research time can be provided through a formal Sabbatical scheme (Section 2.4).

Within UoA3, all new staff are offered mentoring by a more experienced colleague. In addition, and given our small size, we joined a Cross-Institutional Academic Mentoring Scheme TRAM (from 2016) with 6 Universities including St Andrews, Dundee and Trinity College Dublin. Originally aimed at ECRs it has since been extended to senior academics/researchers and to three more HEIs. Five UoA3 staff have benefitted from being matched with mentors/mentees at external institutions to provide objective support for career development.

An important environmental improvement during the current assessment period is that staff research has been supported by consistent internal funding. The R-LINCS scheme that provides PhD studentships (below) also awards Pump Priming research funding to support new projects and help ECRs develop a track record of independent research. Pump Priming funds have supported the initial production of data which supported larger project applications (e.g., £7k awarded for the purchase of microfluidics equipment enabled a larger collaborative project on reactive oxidative species and synaptic activity to secure RSE funding).

Two UoA3 staff are members of the University Research Knowledge and Exchange Committee, and one Chairs the University Ethics Committee. Thus, we make a significant contribution to development of policy and practice that supports the University RKE environment and engagements with UK Concordats (Section 1.1).

### **2.3 Training and Supervision of PGR Students**

Our postgraduate research students (PGRS) are essential to the vitality of our research community: they work alongside experts to pose new questions and find creative solutions to problems facing society. During REF2021, we awarded 15 PhD degrees (REF4a), 1 MPhil, and 10.5 Masters by Research (MbR) degrees. Eight of these MbR awards were funded by the NMAHP unit of NHS Education for Scotland to increase the number of research active staff within the Allied Health workforce. Viva voce success rates have increased to 100% from 2016/17 due to improved Research Degrees training, monitoring and support. We have a further 7 continuing PhD students and 2 continuing MPhil/MbR students. This constitutes a healthy and sustainable PGR community for a Unit of 10 FTE.

PGRS funding has been secured from external organisations (NHS Education for Scotland; Northwood Trust) as well as R-LINCS studentships, co-funded studentships and the Abertay Future Scholars programme. We have co-supervised students at several external institutions including Edinburgh Napier University, University of Nottingham, and University of Dundee.

PGRS are named authors on >20 published papers in the current assessment period and have presented or co-authored more than 30 conference presentations and posters. Our PGRS have achieved excellent success after graduation, going on to lectureships (e.g., University of Dundee), research positions (National Phenotypic Screening Centre, Royal College of Psychiatrists, UCL Institute of Health), and clinical posts (Virology at Ninewells Hospital).

All PGRS are based in Abertay's Graduate School, allowing access to training and a large peer group from other disciplines. As well as providing physical resources (allocated desk in an open-plan office, social area, IT equipment), the Graduate School provides:

- **Progress panels:** Students complete an annual progress report and presentation to a Review Panel to assure student progress, supervision quality and provide an opportunity to address any issues.
- **Personal development planning:** Students track meetings, achievements, goals and training needs into a Vitae Researcher Development Framework system, which must be submitted for approval one month before the PhD thesis. This ensures that students are systematically focused on progress, and are able to articulate research, experience and wider achievements attained throughout their PG training.
- **Annual Graduate School conference:** All PGRS are required to present their research to peers, supervisors and academic staff from across Abertay, helping students develop presentation skills and confidence in a professional context.
- **Training:** Weekly skills-based seminars are held to meet training needs, including research methods, statistics, qualitative analysis, public engagement and outreach training, academic writing, funding applications and business development.
- **Access to Researcher Development Staff:** providing tailored statistical support, and academic advice e.g., funding applications.
- **Funding opportunities:** students can apply to a dedicated fund for conference attendance and researcher training support.

To further support PGRS, staff inexperienced in postgraduate supervision are required to complete an online Epigeum course on **Supervising Doctoral Studies** and our in-house training before being mentored through a first PGRS supervision. Those new to Research Degrees examination must engage with our **Novice Internal Examiners Process** which involves in-house training and observation of *viva voce*.

Recruitment is centrally managed, and our procedures adhere to the UK Quality Code for Higher Education requiring that selection is undertaken by at least three suitably trained staff and is compliant with our Equality & Diversity Policy. The University's Admissions Policy states that, subject to availability, admission is open to all those that have the ability to benefit from the opportunity to study for a given degree. Abertay will only admit students to programmes of research degree study that are properly resourced and supported.

#### 2.4 Equality Diversity and Inclusion

To maintain consistency, inclusion, and fairness, all REF2021 Units have followed a centralised approach to EDI. Abertay's ethos embeds inclusion, diversity and equality in all our policies, operations and strategic thinking. We recognise and value colleagues and students with different backgrounds, experiences and attitudes who bring fresh ideas and perspectives to the University. Since REF2014, the University has been awarded the **Athena SWAN** Bronze award (2015, 2018). Led by the Graduate School, the self-assessment team helped drive development of fair and equitable policies and practices to support researchers, staff and students across Abertay. In 2016, we were the first Scottish university to achieve the Race Equality Charter Mark.

Our Academic Recruitment and Promotion Policies are applied to ensure a fair, equitable, transparent and consistent process for appointing and reviewing the grade of academic staff, which is integrated with the University's grading, Role Profiles and underpinned by the principle of 'equal pay for work of equal value'. As a signatory of DORA, when considering appointments and promotions, we evaluate research on its own merit rather than on the journal Impact Factor.

For UoA3, 16 new appointments were made from a pool of 49 applicants during this part of the REF period (Table 1). A total of 13 applications for promotion were submitted from 12 members of staff, with 9 successfully promoted (some on more than one occasion) (67% female).

Characteristic	Applicants	Appointments
Sex	65% Female	88% Female
Age	Average age =45	Average age = 42
Race	17% BAME	31% BAME
Sexual Orientation	12% LGBT+	6% LGBT+
Disability	12% declared disability	6% declared disability

Table 1. UoA3 Recruitment EDI Data (since introduction of a new HR system in 2017).

Consistent with CSCDR, all staff have undergone mandatory Diversity in the Workplace and Unconscious Bias training, and Recruitment and Selection training is required for all involved in recruitment and promotion decisions. Our **EDI Action Plan** requires an **Equality Impact Assessment** (EIA) for policy, statements and procedures and makes accessible relevant software systems and supporting information. UoA3 staff are represented on committees that ensure EDI is promoted. UoA3 staff are representatives on the School Staff Engagement Advisory Team which has ensured that staff with caring or health responsibilities are supported during COVID restrictions.

Our **Sabbatical Policy** encourages staff to apply for sabbatical leave for research (6-12 months). The policy provides for particular consideration of leave following maternity/adoption/shared parental leave to help re-establish an employee's career and allows for sabbatical leave to be explored as positive action to promote career development for under-represented groups. During REF2021 we have supported 6 Allied Health sabbaticals.

The University's suite of **Work Life Balance Policies (Flexible Working, Maternity Leave, Parental Leave, Shared Paternal Leave, Adoption Leave, Carer's Leave)** are designed to support staff to balance work and home-life and deal with personal responsibilities. Well established policies are in place which both comply with current legislation and aim to establish a "best practice" culture. Abertay supports all periods of maternity leave regardless of provision by external research funders.



Support is also given for training in gender awareness, and opportunity for gender-equal work flexibility. Two female UoA3 staff have been funded to attend Equate Scotland workshops, and 4 have been supported by the university to attend the Aurora programme. There is also support for flexible working, maternity and paternity leave. Staff who have taken maternity leave are given reduced teaching loads upon return to work to support resumption of research activities. Flexible (home) working is fully supported, with a new Digital Strategy launched in 2019 empowering staff to deliver in a way that works best for them.

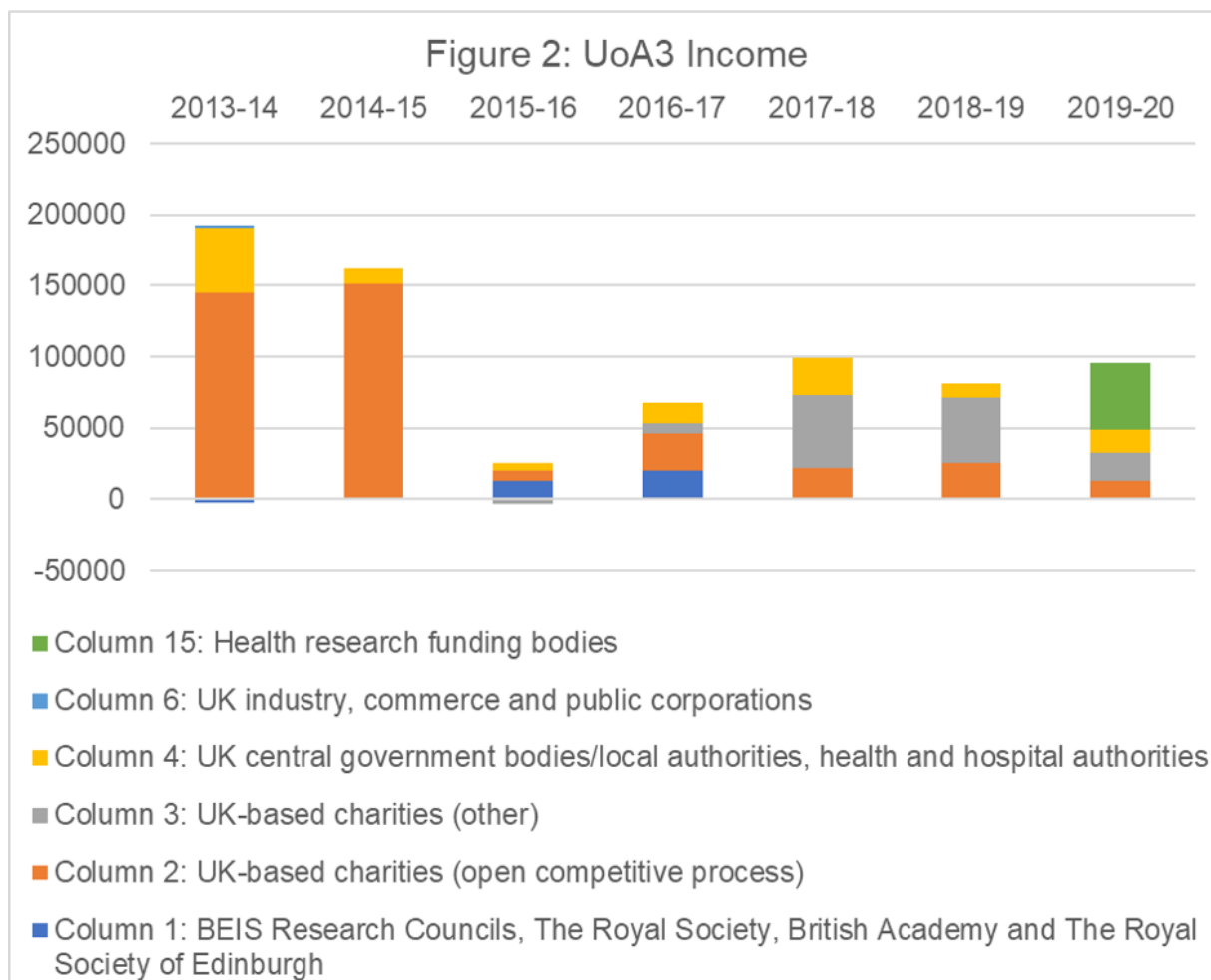
**2.5 REF2021**

To facilitate the development of fair and equitable processes, the REF2021 Steering Group and particularly the REF2021 Code of Practice (CoP) Working Group represents a diverse membership. EIAs have been carried out by an independent panel during CoP development. Unit composition adhered to the CoP and the REF Unit Champion group for selecting outputs comprised 4 staff (3 female). Promoting research opportunity across all staff has been a focus of UoA3 during REF2021: the submission is 70% female, including one Professor and two Heads of Division; 54% of outputs are attributed to female staff.

**3: Income, infrastructure and facilities**

**3.1 Overview**

Our income generation strategy is in line with R-LINCS, where we combine academic excellence with stakeholder engagement to deliver research with impact. Our research partners include the Universities of Dundee, St Andrews and Edinburgh, and our research stakeholder partners include NHS Tayside, NHS Lothian and Macmillan Cancer Support. The following figure profiles income over REF2021 (£718K total).



Income in 2013-14 and 2014-15 is dominated by Northwood Trust funding (Column 2, UK-based charities (open competitive process)) for cancer biology research and subsequent systems modelling based on experimental data streams (this research was returned in REF2014 UoA5 and as such represents a long-standing research agenda). Funding from Northwood Trust in later years is co-returned with UoAs 12 and 32, reflecting the transition from experimental to theoretical modelling (Section 3.2) and computer games (Section 4).

From 2015-16, funding streams diversified to include UKRI (MRC) and Chief Scientist Office (CSO, Scottish Government) funding for our reproductive health research (Section 3.3), funding in mental health from the Burdett Trust for Nursing (Section 3.4) and Ministry of Defence funding in behaviour and communication (Section 3.5 co-returned with UoA4).

Our research is underpinned by facilities in the School of Applied Sciences. Our investments, in line with R-LINCS, impact multiple units. Abertay invested in a fully equipped suite of Science Laboratories (analytical chemistry, molecular biology, microbiology, tissue culture, forensic science), Sensory & Consumer Science, Food Innovation and a Food Processing Plant (**£4M, 2016-19**). **Biology of health and disease facilities** include cell culturing, molecular biology (qPCR, nanodrop, imaging), AFM and fluorescent microscopy, mass spectrometry and HPLC. We provide incubators, ultracold storage and dedicated biowaste disposal required for cloning and microbiological methods supporting cancer research, sperm physiology and imaging capability, alongside the NHS facilities (reproductive health), and associated work in antimicrobial resistance, pollutant effects on animal health and food science (UoA6).

Central to our **Mental health infrastructure** is the Tayside Centre for Counselling (TCC). The TCC is a six-room facility (five counselling rooms, one meeting room) that provides an environment for community-based mental health research. The TCC hosts projects examining the role of emotional and psychological support for long-term health conditions, and the evaluation of Pluralistic Counselling. The TCC also hosts ongoing service delivery with clients experiencing sight-loss and people living with Diabetes, both of which receive NHS referrals from local services. In the case of clients experiencing sight loss, the TCC provides a forum for participant recruitment from a marginalised group. The clinic space provides a space for research interviews, focus group activities and supervision when not in use for teaching and counselling. Data collection on the process and outcome of the counselling provided, including a unique corpus of over 1000 hours of audio recordings (with consent for future research) of therapy interactions, has been instrumental in obtaining DASA funding to examine non-verbal communication (Section 3.4). The TCC provides a venue for large-scale data collection on the process and outcome of counselling and underpinned research for both the impact case-studies for this submission.

Below, we highlight major projects contributing to UoA3 income. Note that while REF4b requires data reporting on spend, our narrative reports on a research/applied research project basis to provide a clearer sense of the nature of funding received and to represent both cross-unit and cross-REF period income generation. These projects highlight working within and across disciplines, and we note both links to REF2021-returned output and follow-on funding.

### **3.2 Cancer systems biology**

Within the REF period Abertay secured £0.6M (Northwood Trust co-returned with UoA12 and UoA32) in cancer systems biology. We developed a statistical model of cancer tissue structures (developed with the University of St Andrews) using spatial statistics to characterise the distributions of cancer and stroma cells, accounting for any voids in tissue. The model is able to predict patient survival based on no other information than the arrangement of cells in cancer tissue (UoA3 output 24144705).

Our systems biology models of cancer cells combine proteomic time-series data from cell cultures with computational models of intracellular signalling in response to therapeutic insult. Working with the Universities of Edinburgh and St Andrews, we focused on cellular responses to reactive oxygen species (ROS) which can damage DNA and impact cell fate by modulating cell

signalling pathways. We used a mix of experimental and theoretical models to identify the role of the protein NRF2 in regulating cellular responses (including proliferation) to ROS (UoA3 output 15636084). We went on to demonstrate the role of NRF2 in mediating cancer cell responses to combinations of a range of anti-cancer drugs and reinforced the importance of NRF2 in drug resistance and as a key anticancer target (UoA3 output 15636070, 15577784 and 15577803).

In research on computational methods aligned to our experimental cancer biology work (returned in UoA12, output reference 17495132), we developed a computer games-based playable simulation of the intracellular signalling network that animates dynamics using an interactive interface. The tool allows clinicians and biologists to directly interact with the cancer cell model, introducing drugs and cancer-causing mutations through a menu interface. This visualisation toolkit was a catalyst for a £0.4M partnership (co-returned with UoA12) with Macmillan Cancer Support and the Scottish Funding Council supported Innovation Centre Digital Health and Social Care Institute (DHI) (2017-). We are combining our interactive network visualisation with machine learning to develop a service provisioning framework to allow Macmillan to profile current and future service demand for different age groups, cancer types etc. and the partnership will be rolling out an AI-backed service recommender engine **to support persons affected by cancer across the UK.**

### **3.3 Reproductive Health**

Within REF2021 Abertay secured funding from MRC (£500K (2015-17), £35K to Abertay with NHS and Universities of Dundee and Birmingham) and from CSO (£300K (2018-21), £64K to Abertay with NHS (Ninewells Hospital) and Dundee University. Abertay conducted the electrophysiology investigations (MRC) and all assay development (CSO).

Drug development for the treatment of male infertility has been a neglected area. We initiated research with strategic internal funding (sabbatical for Brown 2013-14, 2 studentships (one School-funded (2011-14), one R-LINCS (2016-19) for Brown's team) to identify a number of compounds with novel pharmacology in human sperm with the capacity to evoke clinically relevant changes in function in patient sperm (UoA3 Output 17495649). We were the first to demonstrate that sperm with a loss of CatSper current failed to respond to progesterone and there was fertilization failure at IVF. **This study was the first evidence** that loss of CatSper function does not impair human spermatogenesis, is a possible cause of "unexplained" male infertility and would make a suitable novel male contraceptive target (UoA3 Output 17489560).

Based on the above findings we secured MRC funding to characterise the nature and prevalence of patient sperm calcium signalling dysfunction and the consequence for IVF outcome. We demonstrated that defects are complex and common, and signalling can be uniquely manipulated by components of the female tract (UoA3 outputs 17489567, 17489538). We used pharma drug discovery approaches to transform investigations into novel therapeutics for male infertility by demonstrating that high-throughput screening (HTS) is a viable approach to much-needed drug discovery for male factor infertility (UoA3 output 17489546).

We subsequently proposed that development and validation of assays that can detect ion channel dysfunction and sperm phenotypical failure prior to assisted conception treatment could inform and improve patient treatment pathways (now CSO supported).

Determination of novel causes of infertility is critical to address the deficit of knowledge in 30% of unexplained fertility cases. In a funded studentship (Northwood Trust and R-LINCS) we are using next-generation sequencing (NGS) to determine genetic causes of infertility in a cohort of men with sperm that fail IVF. Our studies of patients who fail assisted conception treatment have demonstrated that if knowledge of genetic defects was available before assisted conception treatment then this knowledge could be used to inform treatment pathways.

This observation was the founding idea for Fertility Genomics which was launched with the practical assistance of Abertay's enterprise centre, Bell Street Ventures. **Fertility Genomics is the first and only company** to provide an NGS service direct to consumers and IVF clinics to

screen for causes of infertility and failed assisted conception. The company aims to accelerate fertilisation success to reduce the emotional, medical, and financial impact of infertility treatment.

### **3.4 Transitions between services in people with Intellectual Difficulties: Development of a nurse-led person-centred education development programme**

This project funded by the Burdett Trust for Nursing (£195K total, £17K to Abertay from 2018) with Napier University and NHS Lothian was brought to Abertay by the Co-PI (at Abertay from September 2018). The project combined a review of the literature on transitions for people with intellectual disabilities (Abertay co-authored) with qualitative research exploring the experiences of young adults with intellectual disabilities and their families at the point of transition from child to adult health services.

Service users and their carers were interviewed and took part in focus groups to identify key themes. The project determined that transitions for this service-user group were a highly emotional and testing period. Practice recommendations included: early and coordinated planning; effective information sharing and communication; and clear transition processes and guidelines. Registered nurses were found to have a key role in providing information and support, along with coordinating care at the time of transition from child to adult health services for young adults with complex intellectual disabilities. It was identified that it is vital that nurses' input is person-centred and responds effectively to the expert knowledge of family carers, while at the same time ensuring the family's need for information and support is also addressed.

This project articulated skill-sets for person-centred care that enabled additional funding (£8K (2021), Burdett Trust for Nursing) to undertake a research project with nurse practitioners in children's mental health services to explore the role of letters and cards given to staff by service users as 'gratitudes' for their care. It was proposed that these documents served to enhance feedback processes for care delivery, but additionally provided a sense of positive recognition and identity to staff in a particularly challenging work environment.

### **3.5 Behaviour and communication**

The DASA-funded project 'Validating non-verbal indicators of interaction partners' emotion and rapport to predict communicative behaviour in a defence and security context' (£100K, 2019, co-returned with UoA4) was a collaboration between counselling and psychology colleagues with the aim of developing methods for the fast appraisal of communicative success in emotionally charged situations such as counselling, therapy and high-stakes negotiation.

Using a novel analytical approach based on Recurrence Quantification Analysis, the research team identified how aspects of communication on different levels – communication strategy, content, speech sounds or prosody – manifest themselves in dynamic patterns of change in basic speech parameters such as speech rate or pitch contour. Establishing such a link could support the development of automated technological solutions for real-time appraisal of communicative success in emotionally charged situations while preserving full interlocutor anonymity.

Quantitative results were subsequently verified combining counselling practitioner expertise and expertise from experimental psychology, to ascertain whether interlocutor communication strategies and affective states are reflected in quantifiable patterns of recurrence of non-verbal speech parameters. The results found indications for a 'non-verbal quantitative footprint' of communicative success and produced several suggestions for the continuation of this research including (a) employing stronger and more ecologically valid affect and communication strategy manipulations in experimental research, (b) introducing Machine Learning techniques into the analysis of Recurrence Quantification parameters, (c) augmenting the range of non-verbal speech and communication parameters to test the generalisability of this analytical approach, and (d) conducting cross-linguistic and cross-cultural comparisons of how recurrence patterns relate to interlocutors' affective states and communication strategies in different languages and cultural contexts to test the universal applicability of this approach.



These lines of research are now ongoing, and the inter-disciplinary team is seeking further funding for this promising new approach. The implications of this project for Mental Health research lie in a potential extension of quantitative methods that can aid practitioners in rapid and objective appraisal of success of communication-based interventions.

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

Abertay is fully engaged with and a signatory of the KEC and the CEPR, which are used to guide our development of supportive RKE policies, practices and structures.

##### **4.1 Collaborations and networks**

UoA3 has productive collaborations across disciplines within Abertay, as well as with other institutions, the public and private sectors. Leadership from R-LINCS, research groups, and cross-institutional initiatives help foster these collaborations. For example, the School of Design and Informatics is a world leader in digital technologies and gaming and from this a number of interdisciplinary projects have emerged including the use of games narratives and design to support people with cancer (in partnership with Macmillan Cancer Support and part of the £0.6M Northwood Trust portfolio of projects). Another project which features intra-institutional collaboration uses statistical expertise within UoA3 coupled with biological modelling expertise within the School of Design and Informatics to predict the effects of anti-cancer drugs in 3D spheroids of cancer cells using data from 2D cell culture (UoA12), and whether pharmaceutical and illicit diazepam tablets could be differentiated and identified to manufacturer source with forensic science colleagues (UoA12) and Robert Gordon's University. UoA3 has created synergies among research groupings, for example with UoA6 staff developing models for physiology and microbial resistance for use in human medicine; and with UoA4 staff on big-data streams provided by the TCC to create predictive models of human interactions. A number of co-supervised studentships exist across Units which feed into the sustainability of groups by drawing on collaborations among researchers.

We have collaborated with over 100 academic institutions and stakeholders in over 21 countries. These external collaborations have enhanced the work of the Unit and the work of others through shared learning, access to facilities, joint grant applications and publications. Of note are the collaborations with healthcare services including:

- Work with colleagues at the Assisted Conception Unit at Ninewells Hospital on fertility and IVF failure (Section 3.3).
- The RTCC described in Section 1.
- Engagement in the external academic community through *Social Pedagogy and Practice Research and Development International (SPPREAD)*, a multi-institution international academic/research collaboration with academics from Denmark, Brazil, Scotland, and England. This research informed curriculum development and publications in mental health.

##### **4.2 Wider activities and contributions to the research base, economy, and society**

The unit has engaged in partnership working with the public sector in particular with NHS colleagues in Tayside, Lothian, and Fife. We are undertaking work within NHS Lothian on the transitions between services for people with learning disabilities (Burdett, £17,000) a project which will likely directly impact on NHS practices (published in the Journal of Advanced Nursing).

A cross-disciplinary group exploring children and young people (CYP) created in 2018, which brings together researchers and stakeholders (including from the Dudhope Young Peoples Inpatient Unit, covering NHS Scotland North, and local NHS funded youth organisation 'The Corner') are collaborating on, i) a Burdett Trust funded project examining letters of gratitude from patients to nurses, and ii) a collaboration with Tayside Education aiding the establishment and evaluation of Schools Counselling in Scotland. The CYP group has fed directly into the British

Psychological Society's Expert Reference Group on Children and Young People, helping to shape Ofsted policy recommendations for supporting wellbeing in education.

Beyond the NHS, the spin-out company *Fertility Genomics*, founded by UoA3 researchers in 2018 (company number SC604796), is starting to produce impact as a direct-to-consumer and direct-to-business (assisted conception clinics) genetic testing company that provides whole exome sequencing for causes of infertility and failed assisted conception treatment. We are currently in discussion with partner clinics in the UK and India to generate additional income streams and validate our findings using clinical outcomes (Williams et al., 2015 (doi 10.1093/humrep/dev243), Brown et al., 2018 (doi 10.1093/humrep/dey278)). At the time of writing, we have an agreement in principle with one clinic.

Our work within the counselling and sight-loss community is evidenced in our Impact Case Studies: We have collaborated with the Royal National Institute of Blind People (RNIB) to create the award-winning (highly commended for 'excellence in service, support and care', 2019) practitioner training course *Counselling for Sight Loss*, accredited by Vision UK. Work with RNIB on *My Blind Pen-pal* has resulted in a series of 12 podcasts for a closed Face Book group (n=8000 members globally) about the emotional impact of sight-loss, and we have compiled a global directory of counselling and support agencies for people with sight-loss. The TCC hub for practitioners working with pluralism, impacts the local community by providing pro bono counselling and psychotherapy to local clients (n>180 over REF2021), and those referred from NHS services in Tayside and Fife.

UoA3 researchers have influenced healthcare policy: Nielson et al., 2015 *BMJ Open* cited in NICE Guidelines on 'Emergency and acute medical care in over 16s: Service delivery and organisation'; Elliott et al., 2015 *BMJ Open* cited in Scottish Government 'Main Report of the National Review of Primary Care Out of Hours Services'; and O'Shea et al., 2015 *Journal of Intellectual Disability Research* cited in NIHCE 'Mental health problems in people with learning disabilities: prevention, assessment, and management'.

We have raised our societal profile during the current assessment period via dissemination of our published work. Publications from staff submitted to UoA3 have attracted media attention with 145 articles in international news outlets (Altmetric), including *Nursing Standard*, *American Journal of Managed Care*, *BBC*, *The Guardian*, *Daily Mail*, *The Independent*, *Business Standard* (India), *Nursing Times*, and other outlets such as *The Conversation* and *Reason*. Some of these outputs have attracted high media attention for the journal in which they are published. For example, UoA3 Output 17489524 is the all-time #1 output for the journal *Bioethics* (also in the top 5% of all outputs on Altmetric (score of 894)). The paper "*Time to start intervening in the human germline? A utilitarian perspective*" concerns the ethics of creating 'designer babies', and generated a significant media interest, including national and international radio & TV interviews, discussions and debates with the author (totalling 110 news outlets).

UoA3 researchers have been elected as members of professional bodies, associations of influence or invited onto advisory groups, during the assessment period: For example, as Governor and Trustee of the British Association of Counselling and Psychotherapy (BACP); Chair of BACP research committee; Chair of Vision 2020UK Counselling and Emotional Support Services Group; Member of Cross- Party Advisory Group on Vision Impairment, Scottish Executive; Chair of the Pluralistic Practice Steering Group (disseminating the research impact of ICS 2); Governor of RNIB Scotland and Member of the BPS UK advisory group on Children and Young People. Advisory group membership includes: the 'Need to Talk' Partnership Board overseeing a European funded project in collaboration with RNIB; Fighting Blindness and Vision UK; Member of Sight Loss and Mental Health Committee - Vision UK/RNIB; Scottish Vision Strategy Advisory Group; Invited member of Project Board overseeing the Early Intervention and Rehabilitation in Eye Care Services project (EIRECS), funded by Innovation, Excellence and Strategic Development Fund (Department of Health).

Awards received by staff include the Highly Commended Award - Vision UK John Thompson award for excellence in services, support and care (2019); and the BIGSPD Innovation Prize 2019.

Staff have been invited as keynote speakers, for example, *Creating opportunities to talk about mental health in sight loss* at the Rehabilitation Workers Professional Network Conference Scotland (2019), and at professional and public conferences including: RETINA International Conference 2018; Scottish Vision Strategy Conference (2014 and 2016); Vision UK 2015 Conference ; Need to Talk (2018 and 2020); Children and Young People's mental health and wellbeing: Communities, families, resilience and resistance Conference (2019). We have also been invited to deliver workshops on Sight Loss and Mental Health; Scottish War Blind Training Day (2019); Embedding counselling for sight loss in rehabilitation pathways (2019).

UoA3 staff have raised the profile of our Unit by chairing their own successful conferences for example:

- *1st International Conference on Pluralistic Counselling and Psychotherapy* 2018 with 200 academic and practitioner delegates from 8 different countries, and co-chairing the event in 2019 (London), 2020 (Dublin/online).
- 11th Scottish Mathematics Support Network (SMSN) annual meeting (2019);
- Scottish Mental Health Nursing Research Conference (2016).

We made successful bids for CETL-MSOR (Continuing Excellence in Teaching and Learning in Mathematics Statistics and Operations Research) meeting (2022) and are bringing the BACP research conference to Dundee in 2022.

UoA3 colleagues have published one book and 8 book chapters during the REF2021 period.

We have editorial board membership for journals including *International Journal of Disability and Development; Disability and Society*. Staff are regularly involved in peer-review for publications including *Person-centred and Experiential Psychotherapies; Counselling and Psychotherapy Research; International Journal of Educational Research; Bereavement Care Journal, International Journal of Disability, Development, and Education, Mental Health Review Journal, and Human Reproduction, Contraceptive and Reproductive Healthcare*. In addition, staff have been invited reviewers for funding agencies including Foundation Maladies Rare; Czech Health Research Council, and serve as PGR examiners, including external examinations at UK universities.