Institution: University of Dundee
Unit of Assessment: UoA4 Psychology, Psychiatry and Neuroscience
1. Unit context and structure, research and impact strategy

UoA4 at the University of Dundee (UoD) undertakes ground-breaking and impactful research in two thematic clusters, *Social Inclusion and Health* and *Human Communication and Learning,* which organise the wide range of complementary expertise in this Unit of Assessment. Within these broad areas, we address key theoretical questions and real-world issues affecting people's lives in rigorously controlled research, using state-of-the-art methods. Our goal is to foster an academic community locally, that delivers real-world impact globally, through the advancement of theory and practical outcomes, and to train the next generation of clinical and non-clinical researchers in an interdisciplinary environment. The University's mission to **transform lives locally and globally** is at the heart of this strategy and much of our research contributes to the University's interdisciplinary themes of **Health and Wellbeing** and **Social Justice**. In line with the University's **strategy to 2022**, our research is supported by modern laboratory facilities, effective infrastructure support, and strong new staff appointments to complement and build on our research strengths. We work collaboratively as part of national and international networks, whilst actively involving stakeholders in setting research priorities, building on robust community out-reach activities to ensure our world-leading theoretical research has real-world impact.

Leadership and Management: The Unit has broad ranging expertise, bringing together psychologists (School of Social Sciences (SoSS)), clinical academics, neuroscientists and psychiatrists (School of Medicine (SMED)). Our collaborative approach ensures that the Unit works together to build on and extend key research areas. Dr Alissa Melinger (Head of Psychology) represents the Unit in discussions with Deans and Associate Deans of Research in the respective Schools and on University panels and provides strategic research direction. The University Dean's group feeds directly into the University Executive Group and thus directly influences University strategy and resource allocation. The Schools manage research funds, research postgraduate training and progression monitoring, and annual assessment of research progress, ensuring efficiency, consistency, and cohesiveness.

The establishment of two thematic clusters enables us to generate critical mass through focus and sharing resources around key areas of excellence (see below). SMED has strong research streams spanning UoA4 and UoA1. SMED staff members **Matthews**, **Colvin**, **Hales** and **Smith** and their research groups are submitted to UoA4 because their research on pain, addiction, problematic opioid use and mood disorders makes an important contribution to the *Social Inclusion and Health* theme. Our focussed approach on the two themes has attracted outstanding new recruits, with **Acar**, **Benwell**, **Bliuc**, **Bradford**, **Colvin**, **Keitel**, **Koomen** and **Saunders** all appointed into the Unit since REF2014.

Review of strategic research plans described in REF2014
A primary strategic aim in 2014 was *to grow our research capacity in our key areas of strength, namely Language and Cognition, Human Development, Social Identity and Pain and Addiction.* To achieve these aims, our research activities were re-organised into our new thematic clusters, which provide an overarching structure to our research strengths. Within *Human Communication and Learning*, **Keitel, Benwell** and **Saunders** have strengthened our research expertise in cognitive neuroscience and **Bradford** and **Koomen** have boosted our expertise in developmental processes, adding lifespan, cross-cultural, and cross-species perspectives. In *Social Inclusion and*

Health, **Acar** and **Bliuc** contribute expertise in social processes as they relate to human functioning. Expansion of our Pain and Addiction research which was achieved through the recruitment of **Colvin**, who brought complementary clinical and research expertise from her post as a Consultant in Pain Medicine (NHS Lothian).

We also identified the goals of *developing strong, sustainable cross-Unit collaborations between Neuroscience and Psychology* and *strengthening the clinical profile of the Unit*. To these ends, **Matthews**, Professor of Psychiatry, was seconded to Psychology at 0.4 FTE, where he served two years as Head of Discipline, bringing clinical experience to Psychology and ties with the NHS, bolstered by **Colvin, Hales** and **Smith** within the Unit. **Matthews'** clinical expertise and leadership enabled the desired gains in interdisciplinary programme funding on topics in *Social Inclusion and Health*, such as reducing risk of overdose (**Sani**), understanding analgesic prescribing practices (opioids, gabapentinoids) and risks (**Colvin/ Smith**), ameliorating the perceived loss of self in dementia (**Ross**), and smoking cessation (**Saunders**).

Our ambitions to *build behavioural research capacity* and further *establish links between Psychology and Neuroscience* were advanced by recruiting 4 new colleagues into Psychology who bring extensive cognitive neuroscience expertise (**Benwell**, **Bradford**, **Keitel** and **Saunders**) and straddle our two research themes. Their expertise with neuroscientific approaches strengthens links across the Unit and has supported the establishment of a new MSc in Applied Neuroscience (from 2020) that brings together research-led teaching expertise from Psychology and Neuroscience. Many students' research projects are co-supervised by psychologists and neuroscientists, thereby building further collaborative opportunities. In addition, **Benwell**, **Bradford** and **Keitel** have contributed methodological expertise to Master's level training in neuroscience and neurodevelopment.

Research Strategy

Our principal research aims are to advance understanding of human behaviour, improve health and well-being, and positively address real-world problems in our society by engaging with the global and local community. To this end, we have assembled researchers with theoretical, methodological, and clinical expertise to create a vibrant and enriching community in which colleagues thrive, underpinned by a supportive and collegial environment, extensive research facilities, and effective administrative support. The success of our strategy is demonstrated by our outputs and our funding successes (see Section 3). We benefit from research infrastructures in SoSS and SMED, which support research, impact, and dissemination activities. We encourage colleagues to engage with key external roles by taking account of them in workload allocation, promotions and annual research reviews. These include roles with Scottish Government, professional bodies and international professional organizations, as described under Section 4. Unit cohesion and solidarity, combined with effective School support-structures, has been crucial to the maintenance of morale and productivity during the COVID-19 crisis.

Our two research themes maximise the effectiveness of our research breadth by pooling together expertise and resources. Themes consist of projects, rather than individual researchers and several staff contribute to both themes. This organizational decision was taken to encourage novel collaborations and fosters a cohesive, inclusive environment that is critical for a small Unit such as ours. Indeed, many projects bridge the two themes, such as **Keitel's** work on neural entrainment in deaf individuals with cochlear implants, **Benwell's** work on the neurophysiological predictors of symptom severity in Alzheimer's and other diseases, and **Duncan**'s use of cognitive methods to identify children at risk of language and literacy disorders due to social inequality.

Social Inclusion and Health

Research within this theme investigates mental and physical health, from social to biological perspectives, with a clinical emphasis on depression, pain and drug dependence. The theme drills down into the identity-behaviour relationship, examining protective health benefits of social group membership (**Acar, Bliuc, Hopkins, Sani**) and the relationships between socioeconomic deprivation and chronic pain (**Colvin, Hales, Matthews, Sani, Smith**). Recent appointments have expanded this theme to include research on activism and social exclusion, such as understanding the mobilisation of prejudice against minorities (**Bliuc**) and minority group members' contestation of their marginalisation (**Acar**). Research from the behavioural strand of this theme has demonstrated that the sense of belonging that arises from participation in collective events (e.g., the Magh Mela festival in India) has positive impacts on health and well-being (**Hopkins**) and revealed wide-ranging protective and therapeutic effects of feeling connected to multiple social groups (**Sani**). Within the clinical strand of this theme, **Colvin, Hales** and **Smith** form a key Chronic Pain Research Group within the UK. They are involved with critical projects in the field (e.g. Dolorisk, Advanced Pain Discovery Platform) and have developed the Scottish Pain Research Community. Their research has been fundamental to documenting and countering the worrying increase in opioid prescription, and they are developing non-pharmaceutical behavioural approaches to pain management, as described in their impact case study. At the intersection between the behavioural and clinical research, **Saunders** recently established a collaboration with a 3rd sector charity (Action on Smoking and Health Scotland) exploring the social factors that support smoking cessation. Research in this theme has been funded by the ESRC, MRC, CSO, Wellcome, Volkswagenstiftung, among others.

Human Communication and Learning

This research theme investigates the cognitive processes that underlie our everyday interactions, our decisions and self-control processes, across the lifespan and across diverse populations. The theme builds on Dundee's long tradition of conducting exceptional research in language processing. **Melinger, Kamide** and **Van Gompel** investigate the processes underlying language comprehension and production in healthy adults, with a focus on processes at the lexical, syntactic and discourse levels, while **Duncan** conducts work on language and literacy development, which underpins her impact case study. The recent appointment of **Keitel** has further expanded our language research with her work investigating the neurological mechanisms underlying language comprehension. Other appointments have grown critical mass around self-regulation, decision making, and behaviour change (**Benwell**, **Koomen, Saunders, Vincent**). For example, **Koomen** has shown that a cooperative context can aid children's delay of gratification and **Saunder's** research indicates that self-regulation comprises a wide array of strategies that are used flexibly depending on a range of individual and contextual factors. Developmental research within this theme extends across the lifespan, from foetus into older age, with a focus on social cognition and social relationships. **Nagy** investigates the mechanisms that underly imitation in newborns, highlighting the infant's innate social nature, **Ross** has explored the role of children's developing sense of self in the offset of infantile amnesia and **Bradford's** research explores the lifespan trajectory of our understanding of other minds and how this relates to our cognitive and social wellbeing. Research within this theme has been supported by the ESRC, Leverhulme Trust, British Academy and Wellcome, among others.

Research plans over the next five years: Over the next five years, colleagues within UoA4 will continue to prioritise ground-breaking and impactful research. In *Social Inclusion and Health*, we plan to expand the global reach and relevance of our research by extending our investigations to include culturally diverse, non-western populations (e.g., **Acar, Koomen**) and focus on highly topical issues such as collective action in oppressive regimes (**Acar**), online extremism (**Bliuc**),

and the unequal impacts of COVID-19 across minority groups (**Hopkins**). This will involve extending our connections with Scottish universities to develop a research group in these areas. Our health-related research will examine the role of adverse childhood experiences and unhealthy behaviours on the development (and prevention) of chronic pain and addiction, and *vice versa*, particularly in marginalised groups, and the team will continue to develop a case identification algorithm for primary healthcare to ensure detection and inclusion of people with chronic pain for future pluripotential research. Aligning with the University's Health and Wellbeing priority, UoA4 will work to engage more closely with colleagues in the School of Health Sciences (UoA3), to help expand our links with professional networks to support and enrich research within this theme. In *Human Communication and Learning*, we intend to integrate different research methodologies such as ERP recording (**Benwell, Keitel**), peripheral psychophysiology (**Saunders**) and eye tracking (**Kamide, Van Gompel**), and to make them more mobile so they can be used in the community. Based on our strengths studying cognition across the life span (e.g., **Nagy** focuses on infants, **Koomen** and **Ross** on pre-school children, **Kamide** and **Bradford** research older people, complementing our wide-ranging investigations of young adults), an important goal will also be to integrate research findings from different life stages to achieve more continuous models of cognitive changes from infancy to old age. Our research will also allow us to develop explicit quantitative models of human behaviour (**Vincent, Van Gompel**).

We will intensify impact locally and globally through widening public engagement, e.g., by developing the Scottish Chronic Pain Patient Reference Group (**Colvin, Smith, Hales**), growing the Art from the Start initiative (**Ross**, see below), and expanding our links with the educational sector (**Duncan**). We will continue to work with policy makers through established links (e.g., National Advisory Committee for Chronic Pain, Fife Education, Scottish Government COVID-19 Advisory Group) to implement our research, and to ensure that policy and practice are informed by the best available evidence. To secure our continued financial sustainability, another important aim is to expand and strengthen our research networks to attract larger grants and to develop global collaboration, by organising sand pit events, grant-writing retreats, and hosting workshops that attract a global audience, capitalizing on the growth of virtual meetings.

Supporting interdisciplinary research
Interdisciplinarity is at the heart of this cross-school Unit, promoting a vibrant research culture. Several research areas within the Unit are inherently interdisciplinary, illustrated by work on chronic pain (**Colvin, Hales,** and **Smith**), which involves collaborations with other healthcare professionals, statisticians, basic scientists, and data scientists; research on neurological diseases (**Benwell, Keitel, Ross**), which involves neurologists, clinical neurophysiologists and statisticians; and work on early literacy (**Duncan**), which involves the education sector, pedagogists, language pathologists, and neuroscientists. Interdisciplinary research is supported under the aegis of the Institute for Social Science Research (ISSR), a research hub that brings together staff from across four Schools in the University (Social Sciences, Business, Education and Social Work, Health Sciences). Internal seed funding for interdisciplinary projects, workshops, and seminar series is available through the SoSS Incubator Grant fund and the SoSS Research Innovation fund. ISSR organises research seminars, workshops, and an annual forum to showcase interdisciplinary research, which stimulates interactions with researchers from other disciplines. This has resulted in successful collaborations, including interdisciplinary bids for PhD funding from the Scottish Graduate School for Social Science (SGSSS), e.g., with Human Geography, Law, and Education.

Open science activities
Advancement of empirical disciplines such as psychology and neuroscience depends critically on ensuring the reproducibility of research findings and open access to data.

Open Access requirements and funding are managed by the University's Library and Learning Centre (LLC), as described in the Institutional-level Environment Statement (ILES). LLC organises an annual Open Access events week, provides training in data management, and supports Open Access compliance, research metrics, and researcher profiles. In addition to the University online repository (Discovery), colleagues also use PsyArXiv and the Springer Read and Publish Agreement to make their research Open Access, increasing its visibility and accessibility.

The University and Unit's focus on reproducibility and open science has encouraged staff to participate in international open science initiatives, including the Psychological Science Accelerator (**Saunders** is a founding member), Reproducibility Project; Psychology Replication, ManyBabies, EEGManyLabs (**Benwell** is a founding member). Indeed, our colleagues are leading the way in advocating for open science - **Saunders** has delivered headline talks on Open Science practices at international conferences; **Benwell** co-edited 2 special issues encouraging preregistration and the submission of null results; **Vincent** shares analysis toolboxes via GitHub and OSF. We have raised awareness of Open Science practices and embedded them in our teaching across all levels of our programmes, increasing engagement with study pre-registration, pre-print publications, and sharing of documentation, data, and analysis code on OSF or other open-source repositories**.**

Research Integrity

The Unit's culture of research integrity entails strict adherence to professional and legal regulations for research involving human participants. All research projects are reviewed by a School Research Ethics Committees (SRECs). SRECs report directly to the University Research Ethics Committee (UREC), which provides oversight, monitoring and guidance to the School Research Ethics Committees. The School of Social Sciences, Humanities and Business SREC (chaired by **Ross**) spans eight disciplines, each with at least two trained reviewers, to allow double review for high-risk projects. For clinical projects, Tayside Medical Sciences Centre (TASC) provides comprehensive support for researchers, including access to required Good Clinical Practice training, and established policies and procedures around research governance for projects. The Tayside Clinical Trials Unit works with NHS Tayside Research & Development to assist with obtaining the necessary permissions and approvals for clinical research (through the Integrated Research Application System; IRAS).

We follow the Concordat to Support Research Integrity. Both SoSS and SMED have Research Integrity Leads who are members of the University-level Research Integrity Group (RIG). Research Integrity leads are responsible for promoting a culture of research integrity, providing education, training and impartial advice on the responsible conduct of research. They also ensure that all research staff and postgraduate students undertake training modules which inform them about ethical conduct of research, plagiarism, collaborative research, personal data security, amongst others.

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2. People

Category A Staff. Following recent recruitment, we have achieved a diverse demographic that facilitates staff mentoring at all levels and ensures long-term Unit sustainability. With two exceptions, all Category A staff are on full-time permanent contracts. The current composition comprises six professors (**Colvin, Hales, Hopkins, Matthews** (0.5), **Sani, Smith** (0.65)), four Readers (**Duncan, Melinger, Nagy, Van Gompel**), three Senior Lecturers (**Bliuc, Kamide, Ross**), and seven Lecturers (**Acar, Benwell, Bradford, Keitel, Koomen, Saunders, Vincent**). Of the lecturers, five are Early Career Researchers (ECRs, **Benwell, Bradford, Keitel, Koomen, Saunders**) and five are within their probation period (**Acar, Benwell, Bradford, Keitel, Koomen**).

Colleagues are distributed across age brackets, with 25% under 40, 25% between 40-49, 45% between 50-59, and 5% over 60. This group includes approximately 55% females, 40% non-native speakers of English, 50% non-UK born, and two BAME colleagues, illustrating our commitment to promoting diversity and investing for the future.

Recruitment. Our recruitment strategy has been to add critical mass within our two research themes by appointing ambitious researchers who complement and extend our existing strengths, as well as expanding the research expertise within the University, ensuring a truly interdisciplinary research environment. New appointments have been based on a proven research track-record, interdisciplinary working, and a demonstrated commitment to societal impact. As mentioned, staff are also recruited to strengthen the links between Psychology and SMED. Over the assessment period we recruited eight colleagues, six at the level of Lecturer (**Acar, Benwell, Bradford, Keitel, Koomen, Saunders**), one at Senior Lecturer level (**Bliuc**) and one at Chair level (**Colvin**).

Start-up Packages and Mentoring. To enable our colleagues to flourish, we ensure that all new recruits join the Unit with the equipment, laboratory space, and support funds they require, as well as access to the Clinical Trials Unit, if needed. The size and nature of start-up packages are bespoke to each individual based on their specific needs. During their 3-year probation, new staff have reduced teaching and administrative duties. New hires are paired with a mentor and they receive support from colleagues in their paper and grant writing. New starts also participate in the cross-institutional Teaching, Research & Academic Mentoring Scheme (TRAMS), which runs in partnership with other institutions. Completion of a Postgraduate Certificate in Academic Practice is mandatory. Grant proposals from all staff are peer reviewed internally, consistent with UKRI's strategy of demand management. UoD's Organisational and Professional Development team provide workshops on writing, research funding and enterprise and offer career advice. Effectiveness of these support structures is evidenced by recent high-profile publications (*Nature, Lancet, Cortex, Cognition)* as well as prestigious funding awards from, e.g., the **Chief Scientist Office**, Research Councils (**ESRC**) and Charities (**Leverhulme**). These support structures have also assisted new starts in securing their first research grants within 2 years of starting in post.

Appraisals and Tenure Reviews. The University's annual Objective-Setting and Review Process encompasses all academics and postdoctoral fellows and involves annual meetings between staff and their academic line manager. This provides an opportunity for self-assessment, a review of progress and objective setting. Clinical academics have a joint NHS/University appraisal process that complies with the General Medical Council requirements.

Implementation of the Concordat to Support Career Development. The Unit follows all principles of the Concordat to Support the Career Development of Researchers and is dedicated to supporting the development of its research staff and postgraduate researchers. The University is recognised by the European Commission for its "HR Excellence in Research" as an environment that supports excellence and increases focus and impact. The University's Researcher Development Programme is mapped to the Vitae Researcher Development Framework and meets QAA Code of Practice for Research Degree programme requirements and the Roberts recommendations on training.

Flexible Leave of Absence. The University has a policy for periodic/research leave, special leave (with pay) and special leave (without pay). Researchers submit a proposal detailing their proposed activity while on leave. Leave can be granted for research, impact, and knowledge exchange activities. The University also has a work/life balance policy that includes arrangement for absence due to life circumstances, including bereavement, maternity/paternity leave, fertility treatment, etc.

During the assessment period, colleagues and PhD students have benefited from periods of maternity leave, research leave, and periods of flexible working to allow full recovery following ill-health.

Reward and Recognition of Research and Impact. The University runs a supportive Annual Research Review (ARR), allowing researchers to highlight their research achievements (outputs, funding applications, knowledge exchange and impact, PGR supervision, esteem) and to identify barriers and challenges. Outputs are rated by internal peer review and the portfolio of research activities is assessed by a panel of senior colleagues, including an Associate Dean for Research from another school, for cross-calibration. The panel provides feedback on the portfolio and suggestions for how obstacles could be addressed, be it through mentoring, allocation of funds, professional training, or collaboration. ARR assessments feed directly into individual Objective Setting and Review (OSaR) meetings with Departmental heads which set out agreed priorities. The OSaR informs workload allocations, with dedicated allowances made to support impact activities, and feeds directly into the University's probation/promotion process. Using the recognition offered through the ARR, seven colleagues were promoted during this cycle, five women and two men, and one colleague successfully completed their probation period.

Postgraduate Research students. The Unit's PhD community is vibrant and plays an integral part in our research culture. During the assessment period, 36 students (33.7 FTE) have successfully completed their doctorates and a further 16 students were engaged in their PhD studies at the REF census date. The Unit has invested heavily in the PhD community, offering fully funded studentships to outstanding candidates and leveraging matched funding from external sources. Many of our students join our community with either UKRI, government (UK or Home Country) or industry funding.

All students are provided with office space in the same building as their supervisors, an office computer and a conference allowance of £500 p.a. They can access an undergraduate volunteer participant pool and all necessary research equipment and facilities. Regular internal and external seminar series are hosted by the Unit, where students are encouraged to present their own research as well as invite researchers. There are PhD forums within the Unit and students have a voice at departmental/divisional meetings, where there is formal representation from the PhD cohort.

The quality of our research training and development provision is evidenced by the career paths of our graduates. Of the 36 students who have completed during this review cycle, thirteen secured post-doctoral research positions, six progressed directly into lecturer (or equivalent) positions, six work in clinical settings, and four work as researchers in either the public or private sector. On average, PhD students published between 2-3 outputs in connection with their PhD research.

Student Recruitment. Our Psychology programme participates in 3 SGSSS pathways – (1) Psychology, (2) Linguistics, and (3) Health, Families, Relationships and Demographic Change. The Unit's PhD opportunities are advertised on University websites as well as on 3rd party recruitment sites (e.g., findaphd.com; jobs.ac.uk). Students from non-Western countries are encouraged to apply during regular overseas recruitment trips. We pursue our recruitment in full compliance with equal opportunity regulations. Of our 52 students (current and completed), seven have been from overseas, seven from the EU and the remainder from the UK.

Monitoring and Support Mechanisms. UoA4 provides high levels of supervisory support to all doctoral students. Following the University PGR Code of Practice, each student is allocated first

and second supervisors with expertise in their area of study. All first supervisors are experienced research supervisors who have completed training in supervision, equality and diversity. Second supervisors gain supervision experience through this process as well as providing breadth to the support system. A student's progress is monitored bi-annually by a 'Thesis Monitoring Committee', as described in the ILES. Students undergo an 'upgrade' review procedure at the end of their 1st year. For this, they submit a substantial piece of written work, give a public talk, and complete the University's 'Research Integrity' online course.

Skills, career development and integrated research student culture. PhD students are fully integrated into the running and activities of the University, with representation on Discipline and School boards. Our PGR students receive an extensive variety of training opportunities, following ESRC and MRC guidelines as well as the University Quality Code, as described in the ILES. The University offers a catalogue of workshops for 'generic skills' and students are encouraged to attend SGSSS training events and take up SGSSS-organised internships. Many of our PGR students also contribute to our undergraduate teaching, in line with the ESRC/SGSSS teaching training theme.

Equality & Diversity

As outlined in the ILES, the University of Dundee is an equal opportunities employer and gained an Athena SWAN Bronze award in 2013; both Schools also hold Bronze Awards. The Unit is fully committed to advancing our values of equality, diversity and inclusion for all staff and students. In line with recent restructuring of University Equality, Diversity and Inclusion (EDI) governance, EDI leads have been appointed within each School with responsibility for progressing the equality agenda. An equality impact assessment planning tool ensures that all decisions are equitable and fair, and that protected groups are not inadvertently disadvantaged. Our shared parental leave policy allows *both* primary care providers to benefit from paid leave. Completion of online EDI modules is mandatory for all staff and students.

The Unit has outstanding women scientists in key leadership roles (internally and externally), including: **Colvin** (Deputy Head of Division, Deputy Clinical lead of NHS Tayside Pain Service, Editor of the British Journal of Anaesthesia, Lead for NHS Research Scotland Pain Research Area/ Chair Scottish Pain Research Community; Vice-Chair of the Scottish Intercollegiate Guideline network (SIGN) Council, member of the Scottish Board of the Royal College of Anaesthetists); **Melinger** (Head of Psychology, Associate Editor of Journal of Experimental Psychology: Learning, Memory, and Cognition 2012-2018); **Ross** (Chair of the SoSS, Humanities and Business Research Ethics Committee); **Duncan** (funding panel member, Scottish Universities Insight Institute). As a reflection of the Unit's support for women academics, **Melinger** was sponsored by SoSS to participate in the Advance HE Aurora Leadership programme in 2019/20 and **Colvin** was nominated by Sian Jarvis CB, former Director General of Communications of the Department of Health, for the Women of the Year Award, 2019.

Both Schools continue to work towards reducing our gender pay gap. In 2019-20, SoSS undertook a review of working conditions and procedures contributing to the gender pay gap and a concrete proposal for action was approved by the SoSS Management Group. One step was the establishment of a SoSS Female Staff Support Network to complement existing BME, LGBT+, and disabled staff networks, extending opportunities for staff to connect, find peer support, and contribute to the School and University policies. SMED has signed up to the BMA Race Equality Charter, and have a Race Working Group, who are developing an action plan to tackle race inequality and discrimination.

Construction of REF submission

Outputs have been selected and attributed to individual staff by our UoA Planning Group to maximise the overall quality profile for the submission. All REF returnable staff were invited to suggest potential impact cases studies and those chosen reflect the strongest impacts arising over the REF period as deemed by the UoA4 Planning Group. The distribution of outputs across gender and age groups closely matches our overall gender and age characteristics. All UoA4 Planning Group members completed unconscious bias training in addition to equality, diversity and inclusion and information security awareness training prior to output selection. Our institutional Code of Practice was adhered to at all times.

Effective integration of clinicians and NHS-employed active researchers

Research within the Unit addresses several key clinically-relevant themes and includes studies with a range of clinical populations. Three members of the Unit are senior, active clinicians (**Colvin**, **Matthews, Smith**) with Clinical Academic appointments, who each work in leadership and clinical roles for NHS Scotland. **Hale's** non-clinical position is also partially resourced by the local NHS. **Matthews** leads a nationally commissioned specialist service for patients with chronic and refractory mood disorders and Obsessive-Compulsive Disorder. **Smith** is the National Lead Clinician for Chronic Pain and, together with **Colvin,** has led work to develop national clinical performance indicators and outcome measures for chronic pain. **Colvin** has led national treatment guidelines (SIGN) for chronic pain for children and adults, on behalf of the Chief Medical Officer. We are fortunate that the clinical service (NHS Tayside) has a Chronic Pain Service Improvement Group producing a route for focussed quality improvement that aligns to current research and service needs (e.g., opioid prescribing, social prescribing, pain and addiction). The location of SMED within the Ninewells campus of the teaching hospital fosters strong interaction between clinical academics and NHS teams, as well as supporting recruitment to clinical studies. SMED provides an integrated, well-developed and supportive environment for clinical and translational research, with high quality onsite research infrastructure, currently being modified because of COVID-19, to support clinical trials.

The integration of our Research Divisions and NHS-based research and service work has had a significant positive impact on clinical and translational research, capacity building, research training and service delivery. This strong partnership is facilitated by the Tayside Academic Science Centre (TASC), which provides the infrastructure and governance for clinical trials, including the Tayside Clinical Trials Unit (**Smith** – Co-Director). This is of direct benefit to UoA4 by enabling a portfolio of academically led non-commercial and commercial research projects (**Colvin, Smith**). TASC has an annual budget of £5.6 million, investing £4.8 million in staff and £800K in facilities support (informatics, neuroimaging, clinical trial facility; details below). Support for clinical research includes direct funding of clinical academic sessions (**Colvin, Smith**). **Colvin** provides leadership to NHS Research Scotland (NRS) platforms and networks related to pain, thereby supporting the set up and delivery of clinical and epidemiological research across Scotland.

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3. Income, infrastructure and facilities

Research Income: Throughout the assessment cycle, staff within the Unit have been active in applying for and securing research funding from a variety of sources. During the cycle, 118 grants were awarded, bringing in over £5 million in funds (~£285k/FTE), with 24% from charities, 28% from UK Research Councils/health funding bodies, 20% from government funding agencies, 18% from EU funders and 10% from industry. Of all awards, 40% were over £20,000.

Successful multi-year projects were secured from sources including EU Horizon 2020, the Chief Scientist Office, the National Institute of Academic Anaesthesia, ESRC, and the Volkswagen Foundation**.** Our recently appointed ECRs have had particular success, securing first grants from the Carnegie Trust for the Universities of Scotland, the British Academy/Leverhulme Small Research Grant scheme, Medical Research Scotland, and Wellcome.

All staff apply for research funding and receive recognition for this in their ARR. Across the Unit, 16 out of 20 current staff submitted funding applications in excess of £100k and 15 secured funding during this cycle (4 staff who did not receive funding are in their first 2 years of employment). Funding calls are circulated by the Schools' administrative leads for research. Research Finance Services (RFS) provide professional support across the process of applying for and managing research funding, as described in the ILES. Grant writing support, by way of writing groups, peer review, and mentoring, is provided for all staff, but particularly oriented towards junior colleagues. Seed and development funds, to fund pilot work and sand-pit events, are available through ISSR and Schools, to support the development of larger, interdisciplinary, funding applications.

Research infrastructure and facilities: Staff have access to excellent on-site research facilities, including observational, interview and focus group spaces, RT testing cubicles, as well as IT-equipped seminar, meeting rooms, and spaces designed to facilitate knowledge sharing. During the current REF cycle, the Unit invested in new, state-of-the-art equipment (identified in bold) accessible to all researchers within the Unit. Specialist equipment includes *inter alia*: four eye-tracking systems (Eyelink 2, Eyelink 1000, Eyelink 2000, **Tobii TX300**) enabling investigation of cognitive and developmental processes; three multi-channel EEG systems (**2x64 channel active**, 1x 64 channel passive) using Brain Vision Analyser 2.0 and one tCDS system (NeuroConn DC-Stimulator Plus) allowing for the investigation of brain activity and oscillations during cognitive processing; **two body composition scales** to support research into human health and dietary decision making; state-of-the-art mobile psychophysiological recording equipment (**4-channel BIOPAC amplifier**) that can record from multiple aspects of the peripheral nervous system (e.g., electromyography, respiration, electrocardiography) and, when combined with EEG facilities, provides a full picture of embodied cognition. The Unit also has access to MRI and PET scanners in the University's Clinical Research Centre. Dundee also has one of the nation's few foetal and neo-natal psychology laboratories, including state-of-the-art 4D ultrasound technology. Research beyond the laboratory is enabled by **touch screen laptops, video cameras and tablets**. The Unit has several specialist software packages (e.g., Eprime, Amos, Experiment Builder, NVIVO, Biiopac), a standardised test library, and online data collection tools (e.g., Gorilla, Online Survey) that have become particularly important during the COVID-19 pandemic. An online participant pool (using SONA software) is available to staff, postdocs and PhD students.

Preclinical translational research in the Unit uses molecular biology, tissue culture and electrophysiological laboratories. These laboratories are equipped with all the apparatus required for electrophysiological recording from tissue slices and cultured neurones under current and voltage-clamp. Patch-clamp amplifiers, digitisers and requisite software provide the capability to acquire and record macroscopic and microscopic currents. This combination of advanced neuroscience technologies enables a comprehensive approach to understanding opioid neuropharmacology.

Mechanisms for promoting research, sustaining and developing a vital research culture and delivering impact:

Access to and use of infrastructure. Our research facilities are maintained by in-house technicians as well as central UoD-IT support. Researchers needing specialist equipment oversee their own laboratory set-ups for their required specifications. These laboratory spaces are bookable by others in coordination with the primary user. In addition, shared laboratory spaces with general-purpose testing PCs are available to all researchers in the Unit through a central booking service. The Clinical Research Facility, which also houses the Clinical Research Imaging Facility is run by experienced staff with designated and trained research nurses allocated to funded studies. In the context of the current COVID-19 pandemic, physical laboratories have been closed and face-to-face research suspended, however online platforms such as Gorilla, Online Survey, and TEAMS have enabled some research to continue.

Seminar Series. The Unit organises weekly seminar series with external and internal speakers, and topical workshops, providing an excellent forum for ECRs to grow their networks. The seminars bring together researchers from both research themes and both Schools, fostering Unit-level interaction and discussion between academic staff, postdocs and PhD students. Seminar series and workshops related to our impact and outreach activities have been funded internally, by ISSR, and externally, e.g., by the Scottish Universities Insight Institute.

Public Engagement. A priority of the Unit is to engage with the local and wider community, aligned to the University priority to *transform lives locally and globally.* We recognise the importance of patient and public participation and engagement in research, and we foster this at local, national and international level. This principle is evident in our two impact case studies but not restricted to them. Notably, **Ross** sits on the University's Public Engagement Forum, and has been promoting art as an activity to stimulate healthy attachment through the 'Art at the Start' initiative, including sessions within Dundee Contemporary Arts and the surrounding community, and at family-friendly music and arts festivals across the country. Seed funds for public engagement from the University's Wellcome Institutional Strategic Support Fund were used to maintain this initiative during the COVID-19 pandemic, funding the distribution of arts boxes to participants whose access to art therapy had been paused, and to reach an additional 100 families in the local community who had been referred as 'at risk' due to maternal wellbeing or attachment difficulties. This project contributed to the portfolio of activities that led to the University's Gold Watermark for Public Engagement from the National Co-ordinating Centre for Public Engagement (NCCPE), only the third UK institution, and the only one in Scotland, to receive this.

In connection with his Volkswagen funded-project, **Hopkins** has co-produced films that depict the everyday experiences of Scottish Muslims, especially during the COVID-19 pandemic. **Colvin** and **Smith** have driven the establishment of a Scottish Chronic Pain Patient Reference group (with Versus Arthritis) and engage with patient groups through Maggie's Centre and Pain Concern. **Duncan**'s work (funded by the Carnegie UK Trust, Wellcome, and the Wolfson Foundation) engaged with families from disadvantaged backgrounds to link research around early brain, language and pre-literacy development.

Evidence of cross-HEI shared or collaborative use of infrastructure.
In addition to the on-site facilities, UoA4 staff utilise local shared facilities, both public and private. **Ross** uses the 'Create Space' within Dundee Contemporary Arts centre. This is a public, multi-use educational space and Ross uses it as a safe, accessible space for parent-infant art therapy groups and for public parent-infant play sessions. Ross also uses community venues to run groups

for local charities, or to facilitate community outreach. Tayside Clinical Trials Unit (TCTU) (Co-Director: **Smith**) provides pre-award design and methodology support for clinical trials (**Colvin, Smith**) as well as bespoke support relating to data management systems, drug management and statistical analysis. TCTU works on an international platform, recruiting participants for trials from across the UK and Europe, collaborating with several other universities. TCTU was recognised for the "gold standard" of its clinical research (2017) by the UK Clinical Research Collaboration. Dundee's **Health Informatics Centre (HIC)** is an ISO207001 certified research environment (SAFE HAVEN). It has extensive expertise, including in governance approval, software development, data linkage, and data entry. Many of the Unit's members utilise this world class facility when requiring safe storage and sharing of sensitive personal data. The online version of **Duncan's** eLIPS tool (see impact case study) is being developed through HIC and both **Smith** and **Colvin** have a number of large-scale projects involving HIC (e.g., DOLORisk, Opioid project) funded by the EU and the Chief Scientist Office.

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

Effective collaboration at the national and international level

The reach of our research activities extends far beyond Scotland. Our portfolio of funded research projects and outputs reflects our wide-ranging national and international collaborations, spanning the UK and Europe, and extending to US, Canada, Australia, India, Nepal and China. Indeed, many colleagues have long-standing memberships with international networks, think tanks, and projects such as the Challenging Racism Project, run out of Western Sydney University, the Centre for Resilient and Inclusive Societies (CRIS), a consortium of eight international partners, as well as newly established networks, such as the Different forms of Conflict Network, a DFG-funded network interested in cognitive conflict composed of researchers from 5 different countries, to name but a few. One of **Smith's** papers was recognised by the Cochrane Review for reaching 1st place for most citations in the publication year, demonstrating world-leading reach. The Unit influences policy and practice by holding senior roles with governmental (e.g., Scottish Government COVID-19 Advisory Group; **Hopkins**) and professional bodies (e.g., Royal Colleges of Anaesthetists and General Practitioners) as well as charities and community groups.

Colleagues have also promoted research nationally and internationally by engaging in conference, workshop, and symposium organization. **Colvin, Hales** and **Smith** have jointly organised Annual Scientific Meetings of the Scottish Pain Research Community (now NHS Scotland Research Pain) every year since 2011. **Smith** was also on the Management Committee of Neuropathic Pain Special Interest Group (NeuPSIG) of the International Association for the Study of Pain (IASP) from 2010 to 2020. He was Vice Chair from 2014 to 2016 and Chair from 2016 to 2018. Other notable examples include:
- **Melinger**: founding organizing member of the International Workshop on Language Production, the premier meeting for language production researchers
- **Acar**: governing council member of the International Society of Political Psychology
- **Matthews**: local Conference Organiser and Co-President for the Biennial European Society for Stereotactic and Functional Neurosurgery
- **Duncan**: organised two workshop series on language and literacy in connection to her impact case study.

Developing relationships with key research users to generate impact

The Unit encourages and facilitates the co-production of research with key stakeholders and beneficiaries. As a result, UoA4 colleagues have built strong links with government, public and 3rd sector organizations to ensure our research findings translate into real-world solutions. As outlined

in our impact case studies, our work on opioids has contributed to the development of national guidelines on clinical practice and has led to local and national changes in opioid prescribing, while our work on early literacy has resulted in the development of an early language assessment tool, developed in partnership with Fife Council Education and Children's Service.

As part of the Unit's strategy to develop strong relationships with key research users and to achieve societal impact, several projects involve non-academic beneficiaries. For example:

- **Hopkins**'s research on Exiting Prostitution has involved partnerships with the Protecting People team, located in the Dundee Health and Social Care Partnership, and Cre8te Opportunities, a social enterprise that provides support and training for women wishing to exit prostitution.
- In addition to work in her impact case study, **Duncan** has organised a knowledge exchange programme which brought together stakeholders from a range of sectors (researchers, early-years practitioners, primary and secondary teachers, education authority officials, speech & language therapists, educational policy makers) to discuss issues around language and literacy attainment. One outcome is the LALco network, which encourages multidisciplinary dialogue and the co-production of research. **Duncan** has recently co-produced a video study of bilingual pupil experience in Dundee, used by Dundee Council Bilingual Pupil Support Service.
- **Ross**'s Art from the Start project on art therapy in addressing attachment difficulties is in collaboration with art therapists and the Dundee Community Arts Centre. In 2020, this work won a UK wide 'Fantastic for Families' Audience Impact award for its work reaching vulnerable parents and infants.
- **Smith** and **Colvin** have active involvement of people with lived experience (PWLE) of chronic pain throughout the lifecycle in their research projects, from pre-funding input into shaping research priorities and project design, to dissemination, supported by the Patient and Public Involvement Manager at Tayside Clinical Trials Unit. They are also involved in working with PWLE at national (Chronic Pain Patient Reference Group, Health and Social Care Alliance) and international (Global Alliance of Partners for Pain Advocacy (GAPPA) Task Force (**Smith**, co-chair)) level to maximise relevance and impact of research.

We also encourage our PhD students to generate non-academic impact. PhD student Kerr received funding from SGSS for an internship with Skills Development Scotland, where she worked with the organization to develop new guidelines for improved employee engagement and inclusion and Jones had discussions with the Scottish Government Minister with responsibility for commercial sexual exploitation, whom she advised on issues regarding commercial sexual exploitation.

Contributions to the sustainability of the discipline and encouraging best practice
Unit members contribute to societal and economic benefits by leading on the translation of empirical research into policy and practice guidelines, for example:

- **Smith** and **Colvin** led the 2013 Healthcare Improvement Scotland SIGN guideline for treatment of chronic pain, and the production of Quality Prescribing for Chronic Pain - a 2018-2021 Guide for Improvement for the Scottish Government.
- **Hales** was a member of the management committee for CA15204 - European Platform for Outcomes Research into Perioperative Interventions during Surgery for Cancer.
- **Matthews** held a key role as Executive Advisor to the Psychiatric Neurosurgery Committee of the World Society for Stereotactic and Functional Neurosurgery, co-authoring the current international Consensus Guidelines.

- **Acar** has worked to create platforms for scholars in countries where their academic work is under political threat. This work includes connecting at-risk researchers with established scholars working in "freer" contexts. Acar has secured research grants and emergency funding for researchers under political threat, in some cases so that they can leave their home countries and continue their work abroad.

Indicators of wider influence on the discipline

UoA4 colleagues shape the direction of the field in a variety of ways, many of which have been described above. Some notable additions are provided below.

International and national advisory board membership. **Matthews** served from 2015-2019 as a Member of the UKRI MRC Neuroscience and Mental Health Panel and represented the MRC on the 2017 UKRI/RCUK collaborative exercise to develop and prioritise the cross–disciplinary research agenda for mental health. **Colvin** chairs the Scottish Pain Research Community, is the first Clinical Lead of the NRS Pain Research Area, is Vice-Chair of SIGN Council and is a member of the MHRA Opioid Expert Working Group. **Smith** is National Lead Clinician for Chronic Pain for the Scottish Government, co-chairs the International Association for the Study of Pain (IASP)'s Global Alliance of Pain *Patient* Advocates Task Force and is past chair of the Neuropathic Pain Special Interest Group (IASP). **Hopkins** recently joined the Scottish Government COVID-19 Advisory group. These roles ensure that research outputs can directly inform policy and service provision at a national level.

Membership of grant and fellowship awarding bodies. Several of the Unit's members play a leading role in funding body committees. For example:
- **Matthews** has been a member of the Swedish Research Council Clinical Therapies Research Panel since 2016.
- **Duncan** sits on the Governing Board of the Scottish Universities Insight Institute.
- **Sani** and **Kamide** are members of the ESRC Peer Review College.
- **Colvin** sits on the International Scientific Advisory Board of the new Advanced Pain Discovery Platform (UKRI/ Versus Arthritis).

Participation in the peer-review process. All colleagues are heavily engaged in the peer-review process as editorial board members, reviewers for journals, conferences, and funding bodies. Additionally:
- **Hopkins** was Editor-in-Chief for the British Journal of Social Psychology 2014-2016.
- **Colvin** is an Editor of the British Journal of Anaesthesia, having been on the Editorial Board since 2005.
- Others serve as associate editors for journals such as Journal of Experimental Psychology: Learning, Memory, and Cognition, British Journal of Social Psychology, European Journal of Social Psychology, Journal of Research in Reading.

Contribution to national and international priorities and initiatives: The Unit's research themes are internally aligned with the University's mission statement of *transforming lives locally and globally*. They are also aligned with national and international healthcare and education priorities, including the UN Sustainable Development goals. A focus on health-related issues is evident across the Unit and we work closely with policy makers to disseminate research outcomes beyond academia. Much of this work is aligned to international priorities outlined in strategy documents issued by the World Health Organization (e.g. Global Burden of Disease), Governmental policy reviews (Early Childhood Education and Care Provision (CRFR, 2013)), the Organization for Economic Co-operation and Development (OECD), international charities (e.g.,

Barnardos, Save the Children). Work on mental health by **Matthews** and **Sani** is also aligned to the ESRC mental health research priority and UKRI's mental health networks. **Duncan**'s work is in response to evidence from the latest Achievement of Curriculum for Excellence Levels (2019), which indicates that raising attainment and achieving equity are educational priorities, and the OECD, which has indicated that a stronger connection between education and research is necessary. **Koomen**'s work on how humans' social cooperative skills allow us to collectively sustain environmental resources is inspired by the UN's aims for sustainable development. Work on mass gatherings (**Hopkins**) has resulted in policy and practice recommendations (Social Issues & Policy Review, 2020). **Smith's** work on generating a tool to classify chronic pain has had international impact, with chronic pain being included in the International Classification of Diseases for the first time. Our response to these, and other, national and international priorities has resulted in ground-breaking research, as evidenced by our submitted outputs and impact case studies.