Institution: University of East Anglia (UEA)

Unit of Assessment: 4 (Psychology, Psychiatry, Neuroscience)

1. Unit context and structure, research and impact strategy

1.1 Overview

UEA has invested significantly in the expansion of research in Psychology, Psychiatry and Neuroscience in the last decade. The School of Psychology, formed in the Faculty of Social Sciences in 2012, is at the core of the University's research strategy in this area. The School of Psychology collaborates with several Faculties and Schools across UEA, most notably the Faculty of Medicine and Health Sciences, which has expanded its base of clinical psychologists and recruited key faculty in the area of cognitive neuroscience. The result is a substantially larger submission (30.7 FTEs) compared with the REF2014 submission (13.6 FTEs). Strategic growth is associated with significant step-changes in world-leading facilities, grant income, impact activities, and PGR numbers, reflected throughout the submission.

1.2 Unit Structure

Research is organised into four groups that meet regularly to share and discuss research findings, ideas for funding bids, and to showcase ongoing work from PGRs. The groups also host external speakers to contribute to the fortnightly research Seminar Series, which are co-ordinated by PGRs across groups.

The Research Groups are:
- Cognition, Action, Perception (led by Professor Kenny Coventry)
- Developmental Science (led by Professor Larissa Samuelsson)
- Social Cognition (led by Professor Andrew Bayliss)
- Clinical Psychology (led by Professor Niall Broomfield)

The **Cognition Action Perception Group (CAP)** (10.85 FTEs) was the largest group in REF2014, has grown further, with nine staff recruited since 2014. Appointments in the School of Psychology include Professor Will Penny (from UCL), Professor Michael Rugg (Texas, USA), Bonnici (UCL), Bengtsson (Karolinska, Sweden), Fitzgerald (Cambridge), Malcolm (NIMH, USA), Zhao (Tübingen, Germany), and Sambrook (Plymouth), and Grey (Birmingham) was appointed in the School of Health Sciences. CAP comprises clusters of activity in three areas:

1) Perception and High-level Cognition (Coventry, Collier, F. Smith, Malcolm, Zhao, and Category B staff Cai, Sperandio). The focus is on the interplay between top-down and bottom-up processes relating to visual, motor, and linguistic/semantic representations. Highlights include Coventry's research presenting a new model of the relationship between spatial language and non-linguistic spatial representation (Coventry et al., 2014, *Cognitive Psychology)*. This research was supported by Horizon 2020 EU MSCA ITN grants (values €3.82M and €3.46M) and was awarded the BPS Cognitive Prize in 2015. F. Smith's work has shown, in a series of fMRI studies, effects of high-level constraints on low-level visual processes (area V1) consistent with predictive coding (Vetter et al., 2014, *Current Biology*; Muckli et al. 2015, *Current Biology*). Malcolm has revealed the interaction between high- and low-level constraints on visual attention (e.g., Malcolm & Shomstein, 2014, *JEP: General*). Zhao has shown that top down and bottom-up processes both contribute to human navigation (Zhao & Warren, 2015, *Psychological Science*).

2) Memory (Rugg, Bonnici, Renoult). This subgroup focusses on long-term memory (autobiographical, semantic and episodic) using cognitive neuroscience techniques (structural and functional MRI, EEG, and TMS) in young and older adults. Highlights include an MRC New Investigator grant (Renoult; value £501K) building on his work developing the theoretical basis of the semantic-episodic memory distinction (e.g., Renoult et al., 2015, *Journal of Cognitive Neuroscience*). Bonnici's research has shown that the size of the CA3 region of the hippocampus predicts memory recall acuity (Chadwick et al., 2014, *PNAS*). In a series of papers, Rugg has identified the functional connectivity of distributed networks underpinning

successful event recollection in typical and atypical ageing (e.g., King et al., 2015, *Journal of Neuroscience*).

3) The Neural Foundations of Learning (Penny, Bengtsson, Fitzgerald, Sambrook). This subgroup focusses on learning in applied and ecological scenarios and within a predictive coding framework as applied to neuropsychiatry, using fMRI, EEG and a variety of computational modelling methods. Highlights include an ERC Starting Grant awarded to Fitzgerald (value €1.46M) building on his programme of work revealing fundamental reward-based learning mechanisms (e.g. Pooresmaelili et al., 2014, *PNAS*; Schwartenbeck et al., 2015, *Cerebral Cortex*). Penny's major contributions include the development of a new multivariate framework to characterise longitudinal changes in structural MRI using dynamical modelling (Ziegler et al., 2017, *NeuroImage*) and a new model of human choice behaviour (Klein-Flügge et al., 2015, *PLOS Computational Biology*). Sambrook has provided the first evidence of both model-based and model-free reward prediction errors and their place in a temporal sequence of events in the brain (Sambrook et al., 2018, *Neuroimage*).

The **Developmental Science Group (DEV)** (6.25 FTEs) formed in 2015, following the appointment of Professors Spencer and Samuelson from the University of Iowa (USA), bringing with them substantial funding from the National Institutes of Health (NIH, USA) and the Bill and Melinda Gates Foundation. Significant investment in a suite of developmental dynamics laboratories (including fNIRS) paved the way for additional hiring in this area, including Althaus (from Oxford), Gliga (Birkbeck), Ewing (Birkbeck), Cardin (UCL, Category B) and National Academy of Sciences Fellow Professor Linda Smith (Indiana, USA).

DEV uses observational (e.g., eyetracking, video coding), computational (dynamic field theory), and neuroscientific (e.g., fNIRS, MRI) techniques to investigate topics including language, spatial and working memory, social behaviour, and theory of mind. Highlights include a new (computational) model of the development of executive function (Buss & Spencer, 2014, *Monographs of the Society for Research in Child Development*). The Bill and Melinda Gates Foundation grant (Spencer, value £1.10M) has yielded important findings using fNIRS in rural India to examine brain development in children in low-resource settings (Wijeakumar et al., 2019, *Developmental Science*). L. Smith's utilization of novel head-mounted eyetracking techniques has uncovered the relationship between social interactions and executive function in early life (Yu & L. Smith, 2016, *Current Biology*). Gliga, using EEG, has revealed preferential processing of first language speakers in infants (Begus et al., 2016, *PNAS*). Althaus has shown how linguistic labels and visual perceptual information interact in category formation in 10-month-olds (Althaus & Westermann, 2016, *Journal of Experimental Child Psychology*). Samuelson has used a computational model to predict developmental differences and responses to interventions in a common measure of executive function (Perone et al., 2017 & 2019, *Child Development*).

The **Social Cognition Group (SOC)** (6.0 FTEs) was formed in 2015 and has been augmented with the appointment of Rovenpor (Ohio State, USA), Welborn (UCLA, USA), and Wyer (Plymouth). Researchers in SOC employ survey, experimental, and neuroscience methods to investigate interpersonal interactions and intergroup contact. Research highlights include a Leverhulme Trust Project Grant (Bayliss, value £270K), building on work elucidating the complex interactions between attentional orienting systems in shared attention (Edwards et al., 2015, *Proceedings of the Royal Society: B*). Wyer has shown construal affects holistic face processing (Wyer et al., 2015, *JEP: General*). Meleady was awarded a Leverhulme Fellowship to further develop her elaborations on intergroup contact theory (e.g., Meleady et al., 2020, *Journal of Personality and Social Psychology*). Rovenpor's work has highlighted the negative effects of exposure to intergroup conflict for intergroup relations (Rovenpor et al., 2019, *Journal of Personality and Social Psychology*). Finally, social neuroscience approaches (Welborn, Walsh) have yielded significant outputs showing how self-other processing influences moral decision making (Voltz et al. 2017, *PNAS*) and the developing adolescent brain (Dalgleish et al., 2017, *Scientific Reports*).

The **Clinical Psychology Group (CLIN)** (7.6 FTEs), mainly based within the Faculty of Medicine and Health Sciences, has been strengthened with the appointments of Professors Broomfield (Glasgow), Hornberger (Cambridge), Meiser-Stedman (Cambridge), and the further appointments of Lazar (Cambridge) and Grey (Birmingham).

CLIN comprises two clusters of activity:
1) Clinical Neuroscience and Neuropsychology (Hornberger, Broomfield, Rossit, Grey). The foci of this subgroup are dementia, stroke, and traumatic brain injury. Research highlights include Hornberger's work on the role of the cerebellum in Alzheimer's disease (Guo et al, 2016, *Brain*) and a global smartphone game-based investigation of navigation (Coutrot et al., 2018, *Current Biology*). Rossit's research has uncovered the neuropsychology of action control systems (Fernandez-Espejo et al., 2015, *JAMA Neurology*).

2) Clinical Psychology and Psychiatry (Meiser-Stedman, Hodgekins, Lazar, Fox). This subgroup examines disorders such as PTSD, psychosis, and risk factors for psychological health including sleep disruption and over-prescription of cognitively-debilitating pharmaceuticals. Research highlights include Hodgekins' randomised controlled trial (RCT) examining social recovery therapy for schizophrenia (Fowler et al., 2018, *The Lancet Psychiatry*), funded by an NIHR multisite programme grant ('SUPEREDEN', value £1.96M), Meiser-Stedman's programme of work on the role of cognitive processes in the establishment and maintenance of PTSD in children funded by an NIHR Fellowship (value £760K) (e.g., Meiser-Stedman et al., 2019, *Journal of Child Psychology and Psychiatry*), and Fox's programme of research examining the effects of anticholinergic pharmaceuticals on cognition in older adults (e.g., Richardson et al., 2018, *British Medical Journal*).

1.3 Research Strategy and Objectives: Looking Back and Looking Forward
In REF2014, there were three research groups: CAP, CLIN, and Social and Developmental Psychology. UOA4 in REF2014 focussed on the new School of Psychology, in a small submission with only two Professors and many ECRs (10.6 FTEs). The principal goals highlighted in the REF2014 submission were to i) increase the critical mass of researchers across groups, ii) grow the Social and Developmental Research Group into two separate groups, iii) hire senior Faculty to enhance leadership and mentoring capacity for junior researchers, iv) further develop facilities and infrastructure, v) continue to leverage collaborations and interdisciplinary opportunities within the Norwich Research Park (NRP), and vi) further expand PGR numbers. All of these objectives have been met.

Goals 1-3 have been achieved through a significant number of appointments since 2014, along with low staff turnover. This growth has transformed the UOA compared with the position at REF2014 – it is not only substantially larger (with additional staff submitted to UOA20, UOA30) but also benefits from a more balanced career stage profile. All four research groups have reached a sustainable critical mass. In CAP, strength has been built in cognitive neuroscience, computational modelling and neuroimaging methods. The key appointment of Penny (from UCL), one of the originators of Statistical Parametric Mapping (SPM) and connectivity analysis of neuroimaging data, together with the appointments of Fitzgerald, Bonnici and Sambrook, have achieved this goal. Moreover, the senior fractional appointment of Rugg facilitates further strategic developments in cognitive neuroscience. In DEV, strength has been built in cognitive development, with a focus on modelling and developmental neuroscience, achieved through the appointments of Samuelson, Spencer and the fractional appointment of L. Smith to guide further growth. In SOC, Bayliss was promoted to Professor and now leads the research group. The appointment of Welborn builds expertise in social neuroscience, and Wyer and Rovenpor complement the experimental social psychological focus of the group. In CLIN, the Professorial appointments of Broomfield (to lead the group) and Hornberger, with the further appointment of Meiser-Stedman, have increased the critical mass of researchers in CLIN, providing senior research leadership.

The already substantial research facilities have been significantly enhanced in the REF period with new Developmental Dynamics laboratories, the new Wellcome-Wolfson Brain Imaging

Centre, and investment in a new Sleep Laboratory. Further developments include the formation of the Norwich Institute of Healthy Ageing (NIHA) across the NRP, closely allied to a newly formed Cognition Across the Lifespan Initiative that brings together interdisciplinary expertise across research groups to focus on the cognitive system as an ever-developing system at all ages. PGR numbers across the Unit have also increased substantially with 171 doctoral completions (PhD/DClinPsy) in this submission compared with 53 in REF2014.

The facilities available for research in Psychology, Psychiatry and Neuroscience at UEA provide all the key tools needed to continue to pursue world-leading science. Nevertheless, there are several key objectives over the coming years:

i) Continued development of the laboratory footprint commensurate with projected further increases in grant income and continued expansion of research staff. In particular, the Wellcome-Wolfson Brain Imaging Centre footprint will be further developed to expand neurophysiological data collection capacity (including mobile scanning technologies).
ii) Continued building of SOC and CLIN. We had planned to recruit more staff in social neuroscience in 2020, but the advent of COVID-19 froze appointments. Therefore, a specific aim is to recruit a fractional senior Professor to enhance SOC similarly to the appointments of L. Smith (DEV) and Rugg (CAP). In CLIN appointments will target further expansion of both research clusters, complementing existing strengths.
iii) Further interdisciplinary developments will take place with two foci; a) the development of the Cognition Across the Lifespan Initiative as a UEA Research Centre, with further appointments planned in adolescent cognition (to complement the work of Ewing and Walsh) and ageing, working closely with NIHA. The goal is to leverage external Research Centre funding for sustainable research in these areas, including for cohort studies. b) the development of a brain-gut nexus collaboration with other research units in the NRP. This area - highlighted in REF2014 - has not yet been fully developed, but provides many opportunities aligned with NIHA, the Quadram Institute and the Institute for Food Research.

1.4 Impact Activity and Interdisciplinary Working

Psychology at UEA is positioned as a 'hub science' at the interface between biological and health sciences, social science, and the humanities. Interdisciplinary research is supported in several ways. First, our staff recruitment strategy aims to equip the Unit with both capacity and methodological flexibility. For example, we have recruited several researchers from a computer science or computational modelling background (Penny, Spencer, Samuelson, Fitzgerald, Bonnici). This enables the Unit to utilize innovative approaches to long-standing questions about brain development and disease. Second, interdisciplinary research is supported through our impact-related endeavours and are facilitated by several internal funding schemes associated with University-wide research themes (see Ref5a). Examples of impact-related interdisciplinarity include our interactions with environmental and climate scientists and with healthcare professionals in stroke rehabilitation, psychosis treatment, and PTSD alleviation. Finally, colleagues from the School of Psychology and Department of Clinical Psychology hold fruitful basic research collaborations with researchers from fields as diverse as experimental philosophy, creative writing, economics, international development, education, archaeology, cinema, and linguistics. Staff are encouraged to maintain and build upon these collaborations with the aim of enriching all involved disciplines, and to enhance the prospect of wider societal impact.

Staff at all career stages and from anywhere on the basic-applied science spectrum are encouraged to realise impact from their research via both institution-wide and local mechanisms. These activities are supported by Spencer (Impact Champion for UOA4) who regularly meets with staff at all stages of impact development to discuss their aims and to offer mentoring support. The Impact Champion liaises with Heads of School and Directors of Research to discuss strategic priorities, and with University services to secure and coordinate central support through seedcorn and continuing funding schemes available for impact generation (see Ref5a). Staff in the Unit have benefited from over £170K in internally-distributed impact funding support during the REF period. An underpinning principle continues to be that maximum impact is possible only if the research is both persuasively rigorous and genuinely meets the needs of

users. To achieve this, the Unit adopts a bespoke approach to each project that includes supporting staff to make first contact with non-academic users at the inception of the research, involvement of stakeholders directly in research design and dissemination, highlighting opportunities to link with national and international policy priority areas, and maximisation of impact through relationship formation with key policy-makers. Further support for impact comes through workload time allocation in addition to the 0.4 FTE research allocation, and impact is explicitly recognised in the criteria set out for academic promotion. All staff receive mentoring on impact during annual Research Activity Planning (RAP) meetings.

Examples of interdisciplinary projects include significant interactions between researchers in CAP and SOC with environmental scientists in the School of Environmental Science, the Climatic Research Unit and the Tyndall Centre. As part of ClimateUEA, these collaborations work to improve climate science communication (Coventry) and encourage pro-environment behaviour change (Meleady). Research in DEV has implications for development in a range of interdisciplinary and applied contexts. For example, in a project funded by the Bill and Melinda Gates Foundation, Spencer is developing portable neuroimaging technologies to scan children in the field in remote and rural environments, and is developing interventions to support early brain development in low-resource countries. Samuelson and Althaus investigate individual differences in early word learning, Gliga studies the sensory, language and cognitive differences of children with or at-risk of being diagnosed with ASD, and Ewing studies person perception in neurotypical children and people with neurodevelopmental disorders (including ASD and Williams Syndrome). Doherty examines moral reasoning in collaboration with researchers in the UEA Health and Social Care Partnership.

CLIN benefits from direct and iterative feedback with non-academic users. For example, the Patient and Public Involvement in Research (PPiRES) programme was set up by UEA with the NHS Norfolk and Waveney Primary Care Trust to enable members of the public to actively engage with research not just as participants but to have input into the delivery of successful research programmes. This initiative involves the public in all stages of the research process, from inception to dissemination. Staff in CLIN have also served on NIHCE panels, completing the circle from patients to policy makers. There are also strong links between members of CAP, DEV and CLIN and the Norfolk and Norwich University Hospital (NNUH). Rossit, Broomfield and Grey (CLIN) work closely with consultants at the NNUH on stroke and with colleagues in rehabilitation sciences. Grey leads the SCORES study ('Screening Cognitive Outcomes after Repetitive head impact Exposure in Sport') applying research to understand the influence of sub-concussive head injuries in sport on later-life cognitive function. Rossit is pioneering novel virtual reality training to ameliorate spatial neglect in stroke survivors. Moreover, Broomfield is currently developing a treatment model for post-stroke emotionalism following a large cohort study (TEARS) and publication of a first clinical psychometric measure (TEARS-Q). Fox (CLIN) works with an international team of researchers to develop and disseminate tools to aid general practitioners to reduce anticholinergic prescriptions that can lead to deleterious effects on cognitive ability.

These and other impact activities have produced a broad body of impact initiatives from which three Case Studies have been selected, illustrating the Unit's achievements across research groups in informing policy guidelines, developing clinical applications, and generating take-up widely among stakeholders. Moreover, the diversity of interdisciplinary and impact-related activity has been developed to be sustainable over the long-term. This is reflected in the nature of the case studies themselves. One represents a development of work on treatment for psychosis submitted to REF2014, another from CLIN is driven by new hires on treatment for childhood PTSD, and the third emerges from fruitful collaborations with environmental science to inform the Intergovernmental Panel on Climate Change (IPCC) about more effective climate science communication and is the Unit's first non-clinical impact case study.

1.5 Open Research

The Unit is committed to open science practices, taking the view that Open Research is an indicator of rigour and quality. Open research practice is a topic of discussion at group and

individual-level mentoring and training. At research away days, time is spent discussing indicators of research quality, and (self)-replication and reproduction are emphasised as important elements of quality research. Several members of staff engage in pre-registration (e.g., OSF, aspredicted) and uploading data to online repositories, both emerging cultural norms for UOA4. In 2017 the bi-weekly 'Open Science and Statistics' reading group was established, wherein topics have included non-frequentist approaches to statistical analysis, and open science (e.g., the replication crisis, pre-registration). Our PGRs and ECRs now run this group as a chapter of 'ReproducabiliTea' - a cross-disciplinary and international initiative for supporting open science - contributing greatly to the bottom-up movement in psychology towards greater open science. In CLIN, clinical trials are initiated and registered at clinicaltrials.org, with work facilitated by the dedicated Clinical Trials Unit. All such studies involve publishing protocols prior to data collection and researchers make data available where possible.

1.6 Research Integrity

Research ethics is supported by two sub-committees of the UEA Research Ethics Committee, which apply the highest standards of ethical scrutiny in accordance with APA, BPS and Helsinki Declaration guidelines. The Ethics Committees support researchers at all levels, from undergraduate research students to principal investigators. The committee Chair oversees processes, and reviews are coordinated by four Deputy Chairs representing the specialisms across research groups. The committee provides support for the preparation of research grants where ethical approval or plans are required. Cases beyond its remit (e.g., use of human tissue or recruitment of NHS patients) are referred to an appropriate alternative. NHS ethics applications are supported by the Faculty of Medicine and Health Science ethics committee, and if needed by central support of the University Ethics committee. The approach taken by all committees is to actively support and facilitate high quality research. All researchers in UOA4 serve as peer reviewers, and the committee is comprised of external representatives from other Schools and two lay members of the community. Since the inception of the School of Psychology laboratory footprint in 2012, the Ethics Committee has worked in concert with the Director of Research and the Systems Engineer (lead technician) to produce Standard Operating Procedures for the ethical and safe use of laboratory equipment such as EEG, TMS and TDCS. CLIN works closely with the NNUH to ensure adherence to best practice for clinical work, and there is much experience and knowledge-sharing of NHS ethical protocols across Faculties.

2. People

2.1 Staffing Strategy and Staff Development

As planned in REF2014, staff recruitment has been supported by strategic increases in student numbers and continued enhancement of research facilities, ensuring a focus on the direct alignment of teaching programmes with research groups. Expansion of all research groups has established or maintained critical mass in each group, resulting in the provision of leadership and mentorship for colleagues at all levels. The recruitment of new senior staff in tandem with promotions in the School of Psychology and in the Faculty of Medicine and Health Sciences has created a balanced staff base, representing a significant change in profile compared with the predominance of ECRs recruited in earlier stages of growth (and submitted to REF2014). Moreover, the fractional appointments of senior Professors Rugg and L. Smith offers the Unit the benefit of their considerable experience in research planning and grant capture, further enhancing the mentoring of staff at all levels. Their complementary focus on ageing (Rugg) and child development (L. Smith) has been an impetus for the establishment of the Cognition Across the Lifespan Initiative, working closely with the UEA-wide NIHA.

As set out in REF5a, the two types of academic contract at UEA mean that ATR staff are guaranteed at least two days per week to focus on research. UEA has adopted a high threshold of publication quality for ATR staff appointments consonant with REF expectations, and clear communication during the hiring process and beyond ensures that staff are on the right career trajectories. All staff have annual appraisals and RAP meetings with a senior colleague (see REF5a), which provide a means for individual support and discussion of research development, in turn feeding into workload planning. Appraisals include specific discussion of career

progression (e.g., preparation of promotion applications) and development and training needs, with action points agreed and followed-up. In addition, regular meetings with a mentor are mandatory for all staff on probation, and optional for all colleagues. There is an annual promotion round (see REF5a) and during the relevant period three staff were promoted to Professor (Bayliss, Fox, Meiser-Stedman), six staff promoted to Associate Professor, and 11 staff confirmed in post.

Part of the RAP process involves establishing individual resource requirements for research plans over the coming 24 months. An outcome of the process is allocation of research funds tailored to the individual's needs. Funds are ring-fenced for international conference attendance, data collection costs (e.g., participant payments, software licences, on-site or off-site neuroimaging costs), publication fees, and research training. The RAP process also provides a feedback route for researchers to the Research Committee to help guide strategic capital spend. This feedback has directly led to the recent acquisition of additional eyetrackers and updates to the EEG laboratory in the School of Psychology.

Recognition for high quality research includes reward through token economies. The publication of an output reviewed internally as 4* leads to access to supplementary research funds. Researchers in the School of Psychology receive a proportion of overheads as additional internal research funding to further enhance research activity. Time on FEC grants is also included in workload allocation, protecting more time for researchers who secure funds that cover salary costs. Moreover, time is allocated in workload planning for impact activities, which has given 25% of staff additional time to develop impact projects in the REF period. Consultancy activity is also incentivised, with staff receiving a proportion of income directly as payment or as supplementary research funds. In addition, staff are encouraged to apply for external recognition for their excellent research and impact, and to nominate others for national and international awards where applicable.

To facilitate larger blocks of time for focussed research activity colleagues can elect to frontload or backload their academic year with non-research commitments (e.g., teaching) during workload planning. The University-level Study Leave policy allows colleagues six months of focussed research activity. Researchers are encouraged to apply for Study Leave as soon as they are eligible to do so. During this REF cycle, 10 staff have benefited from study leave, allowing them to write grants, pursue impact activities, or complete major outputs. For example, the Study Leave programme afforded Doherty the time to develop a major theoretical article with Josef Perner in Salzburg (Doherty & Perner, 2020, *Developmental Review*).

In these ways, staff in UOA4 are well supported to achieve their personal research objectives, and anonymous annual staff surveys recognise the strength of support provided (as evidenced in Athena SWAN Silver Award submissions). Within the REF period, staff turnover has been generally low. In the School of Psychology, three ATR staff moved to posts elsewhere (two to posts outside the UK), while in CLIN two staff moved to posts elsewhere in the UK.

2.2 Early Career Researchers

ECRs are allocated a mentor from within their academic School or research group and research staff (RAs/postdocs) also have support from School-level Research Staff Co-ordinators. ECRs additionally receive reduced workloads, factoring in the increased time it can take for teaching preparation, but also critically to give time for training and grant preparation and planning. Newly-appointed Lecturers in the School of Psychology also gain priority access to supplemental Psychology Research Fund allocation for the first three years of their appointment.

A dedicated ECR Group is chaired by Professor Samuelson (co-Director of Research), and serves as a discussion, support, and training forum. The group covers topics including publication strategy, time management, and the transition between postdoctoral and lectureship positions. Contextualisation of the UK HE sector for researchers moving to the UK is also a key topic of discussion. An annually-rotating seat on the School of Psychology Executive Committee, is held by an early career academic to afford direct input into School strategy. Postdoctoral

researchers are members of the ECR group and have opportunities to expand their CVs beyond research into areas that can enhance their career prospects (aligned with the Researcher Development Concordat). For example, they are given the option to co-supervise (with their mentor) two undergraduate project students. These postdoctoral researchers receive a small research fund allocation. PGRs and postdoctoral researchers in the Norwich Medical School have ring-fenced pump-priming funds available to them to pursue independent training and research opportunities.

2.3 Academic-non-academic exchange

Researchers are encouraged to initiate and embed interactions with business, industry and other third-sector partners as an integral part of their research programmes. This is facilitated by the Director of Engagement and External Relations, who sits on the School of Psychology Executive and chairs an Impact and Employability Steering Group (that includes external public- and private-sector stakeholders). This committee facilitates engagement of stakeholders at every point in the research and impact cycle and advises researchers on how to engage with new stakeholders. Dedicated placement and external relations administrative staff and Research and Innovation (RIN) Relationship Managers support researchers at all stages of engagement with external organisations.

These support measures afford a natural progression from initial consultancy with an organisation, to co-working on impact activities. This worked particularly well with Coventry's links to the IPCC that led to an Impact Case Study. Other types of consultancy activity and industrial collaboration have included research with local organisations such as Norwich City Football Club, Norwich City Council, Anglian Water, Norfolk Museums and international companies and bodies, such as Microsoft and the OECD. In CLIN, all staff are HCPC-registered psychologists and have seamless links with regional NHS trusts and their associated networks including patients' groups. For example, Broomfield and Rossit have strong links with the NNUH Stroke Unit and associated patient networks, Hornberger is the co-lead for the Multimorbidity & Ageing Theme of the NIHR Applied Research Collaborative, and Fox is lead for the National Dementia Research Portfolio group.

2.4 Equality, Diversity and Inclusion

Equality, Diversity and Inclusion are at the heart of all activities across the Unit. The commitment to equality and diversity has been recognised by the award of Athena SWAN Silver to the School of Psychology (2018), and the Norwich Medical School (2019, 2012). The Equality & Diversity Committee (School of Psychology) and the Norwich Medical School's SEESAW committee propose improvements to School policies and develop strategies within and beyond the Athena SWAN remit. They draw membership from research- and teaching-focussed staff across research interests, career stages, and include student members from each level of study. The School of Psychology has ensured that advertising of all posts encourages applications for positions as part-time or full time, with flexible working, and that shortlisting accounts for career breaks. One indicator of success in this is that the School of Psychology has an even gender balance across ranks. Appointment panels are constituted ensuring gender balance and panel members undertake recruitment training including equality and diversity best practice. Return from parental leave and periods of illness are managed so as to ease colleagues back into the workplace gradually (see REF5a).

Across the Unit, flexible working includes working from home and changes to FTE (e.g., two researchers have moved from 1.0FTE to 0.6FTE during the REF period). Part-time PhDs have also been introduced, allowing candidates to continue with working part time or with caring responsibilities. Moreover, CLIN has recently secured a £75K HEE grant to develop equality, diversity, and inclusion workstreams into the DClinPsy programme, including a BAME mentoring scheme. Workload planning involves comparisons across rank and gender to monitor equity across groups. The mean workloads by gender and rank are made available to staff to offer transparency. Moreover, meetings are scheduled between 10am-3pm to support those with caring responsibilities to attend.

Equality and diversity also plays a key role in research practices. There is training and awareness of issues surrounding the disciplinary over-focus on participants from WEIRD (Western, educated, industrialized, rich and democratic) societies, and data collection across diverse groups is actively encouraged. An example comes from DEV where collaborations with researchers in India is highlighting the impact of resource inequality on brain development (Spencer). Equality and diversity informs teaching and training practices at all levels, from decolonising the taught curriculum, to training of PGRs. Finally, equality and diversity are considered at all stages of research mentoring and assessment. For example, internal seed-corn funding allocations are monitored for equity of allocation to research groups and gender. In preparation for REF, reviewers are recruited with diversity and gender balance in mind. All internal staff assessing research outputs have undertaken unconscious bias training, and the recruitment of former REF panel members as external reviewers ensures that internal reviewers are calibrated and that standards are applied fairly and consistently.

2.5 Research students

The UOA awarded 171 doctorates in the REF period, compared with 53 in REF2014. This large increase is a direct result of prioritising internal funding for PGRs and success with securing external funding including from the European Commission (MSCA ITN awards), Leverhulme Trust, NIH (USA), Bill and Melinda Gates Foundation, MRC, BBSRC, ESRC, NIHR, Stroke Association and the NHS (funding the DClinPsy programme).

Recruitment: PGR recruitment in the School of Psychology is supported by a PGR Director, PGR Admissions Officer, and by the Social Sciences Faculty PGR Office (part of the UEA Graduate School). In addition to externally funded opportunities, and membership of the ESRC doctoral training partnership SeNSS, the School of Psychology advertises 6-8 internally funded studentships each year. Priority to advertise a project topic is given to new ATR staff, ECRs, and staff without a funded PGR. A PhD can commence at one of four points in the year, affording convenient start times for PGRs. Interview panels are comprised according to similar guidelines as for staff appointments (e.g., gender representation), and all panel members receive recruitment training.

In the Faculty of Medicine and Health Sciences, doctorates are awarded on the DClinPsy programme as well as PhDs in the FMH Doctoral School. The DClinPsy programme is the largest in the East of England and is funded by ~25 NHS-funded 3-year positions annually. In addition, research students in Clinical Psychology can be drawn from the Medical Degree programme in the form of small-scale internships, Masters-level intercalations, and medics wishing to pursue a PhD. All staff supervising PhDs/DClinPsys are given workload allocation in addition to their research time allocation, and supervisory teams are assembled ensuring gender balance and experience as appropriate.

Monitoring and Support: PGRs are supported by two or more supervisors, at least one of whom must have previously supervised a PhD to completion. Supervision is structured with regular informal and formal meetings. Across doctoral programmes, formal annual review meetings (months 9, 21, 33) are chaired by an Internal Assessor (an experienced academic outside the supervisory team) to provide feedback and to ensure the team is operating optimally. The first Annual Review serves as the probationary review where a collective decision is made regarding the outcome (pass probation or requirement of a 3-month plan to reach probationary standards). PGRs maintain online records of meetings, annual reviews, and training. They are encouraged to publish their work as their PhD unfolds, and in the DClinPsy programme a thesis portfolio model is adopted which includes a systematic review and empirical study of publishable standard.

Supervisors receive regular training in best supervision practices and to inform them of institutional regulations on PGR policies. Additional sources of support for PGRs include the Postgraduate Directors who serve as Academic Advisor for all PGRs. Peer support is offered by the PGR Research Support Group that meets fortnightly and complements skills and career development opportunities offered elsewhere (see REF5a). Annual prizes are available across

Faculties for categories including best publication produced by a PGR, engagement activities, impact and teaching. In the REF period, the Best PGR Paper in the Faculty of Social Sciences was won three times by Psychology PGRs, with other awards for engagement and impact activities.

Skills & career development: Each PGR receives a £2250 Research Training Support Grant that they administer with advice from their supervisory team. This can be used to fund external specialist training courses (e.g., brain anatomy, TMS training), or for conference attendance to provide networking opportunities and experience with academic presentations. As a member of the Psychology pathway of the ESRC SeNSS Doctoral Training network, PGRs can attend training events hosted by all 10 universities in the network. Additional opportunities are afforded by the Eastern ARC collaboration with Kent and Essex. The Social Sciences Faculty Graduate School's Director of Postgraduate Training, a member of the School of Psychology, coordinates a wide range of bespoke formal training courses for PGRs, including courses in advanced statistics, programming, and presentation techniques. Our PGRs also design and run their own training sessions, for example they have co-ordinated an "Introduction to R" for the Eastern ARC collaboration. In the training session format of the Research Support Group, training is provided on diverse topics including sessions on academic job interviews, effective public engagement, and the relevance of the REF to PGRs in the UK. PGRs are integrated into their Research Group and co-ordinate and meet with speakers for the School's Seminar Series.

External funding networks have also opened up further opportunities for training of all PGRs. For example, the three EU MSCA ETNs led by Coventry have offered interdisciplinary training opportunities for PGRs in cognitive robots, entrepreneurship, linguistics, and technical skills including motion tracking and virtual reality, led by leading companies (e.g., Qualisys, Danieli Telerobotlabs). The development of research communication skills is supported and encouraged. For example, PGRs deliver presentations at Research Group meetings, take part in 3-Minute Thesis competitions at the School of Psychology Annual Mini-conference, and present at the doctorate-focussed Clinical Psychology Research Conference. PGRs also communicate with general audiences at the annual Norwich branch of the 'Pint of Science' programme and the Norwich Science Festival.

3. Income, infrastructure and facilities

3.1 Funding Strategy and External Income

At its inception in 2012, a strategic plan for the School of Psychology was produced, forming a blueprint from which specific developments have spawned. A major strategic expansion for the Unit has been in neuroimaging. All four research groups use fMRI and other imaging techniques to study human cognitive function in early life, adulthood, and in normal and complicated ageing. Since 2014, strategic recruitment of senior staff with neuroimaging and computational skills (e.g., Penny, Hornberger, Spencer) paved the way to the establishment of the new Wellcome-Wolfson Brain Imaging Centre in the School of Psychology. This was possible through significant targeted investment at UEA (~£2.1M) and external funding from the Wellcome Trust (Multiuser Equipment grant; £1M) and the Wolfson Foundation (£300K) awarded to Penny, Coventry, Spencer, Hornberger (and Pomeroy - UOA3).

During the REF period, researchers have been PIs or Co-Is on external grants with a total value of over £34M, with £25M of this led by UEA researchers. Indeed, research income for REF4b purposes (£10.4M) is five times greater than in REF2014. Research and consultancy income during the period represents 210 awards (with UEA scientists lead applicants for 163 of these). These include 158 research grants, across a wide range of funders, such as UKRI (AHRC, BBSRC, EPSRC, MRC), EU Horizon 2020, NIHR, and charities including the Bill and Melinda Gates Foundation, Wellcome Trust, Leverhulme Trust, Alzheimer Research UK, BIAL Foundation and British Academy. This increase has been achieved through strategic recruitment, investment in facilities, and through a range of mechanisms to encourage and support external grant applications. These include investing overhead funds in research assistant support for data collection and implementing mentoring schemes to facilitate the grant-

writing process. Funding applications to UKRI are supported by University-level review committees and for non-UKRI bids, senior researchers review each application at the School-level, with additional reviewers for large grants or those written by ECRs. RIN facilitates communication of funding opportunities, assists with costing and drafting of applications.

All four research groups have received substantial external grant income during the period. In CAP, Coventry was the Coordinator on a Horizon 2020 EU MSCA ETN across eight countries on deictic communication (value €3.46) and PI on two further MSCA ETNs (total value €7.92M). Fitzgerald won an ERC starting grant (value €1.46M), and Bengtsson a grant from the Swedish Research Council (value £224K). UKRI grants were awarded to Renoult (MRC, value £493K) and Cardin (BBSRC, value £392K). DEV has been successful in the capture of large grants awarded to Spencer and Samuelson from the USA NIH (values £1.4M and £1.1M) and the Bill and Melinda Gates Foundation (value £1M). Other grants to DEV have included a Wellcome Seed grant awarded to Gliga (with Lazar in CLIN as Co-I; value £99K). In SOC, Bayliss secured a Leverhulme Trust grant (value £270K) and Wyer's work has been funded by the EPSRC (with UEA computer scientists; value £204K). Additionally, Meleady has been successful winning a Leverhulme Trust Fellowship. CLIN researchers have secured large-scale funding for multisite RCTs in particular. For example, Fox was Co-I on a series of HTA-funded grants totalling over £3.5M and Hodgekins was Co-I on three NIHR grants (totalling over £5.6M) underpinning one of the presented Impact Case Studies. Hornberger secured funding as PI and Co-I from sources including Alzheimer Research UK, MRC, NIHR (grants totalling over £5M) including the MRC-funded UK Genetic Frontotemporal Dementia Initiative. Meiser-Stedman received a NIHR Fellowship (value, £760K) and was awarded an MRC grant as Co-I (value £1.1M). Finally, Lazar (ECR) was awarded a Wellcome seed grant as PI (value £107K).

3.2 Infrastructure and Facilities

The laboratory footprint outlined in REF2014 has been significantly expanded and refreshed with further investment. Laboratory space includes suites of testing rooms and a large participant waiting room. Capacity for group testing is afforded by laboratories with bespoke dividers and testing stations with E-Prime and other stimulus presentation software, CRT and TFT monitors (including large touch screens) and response boxes. A Vision and Action suite of laboratories includes a psychophysics laboratory, a neuroimaging analysis room with six dedicated PCs, and a large kinematics arena housing state-of-the-art motion tracking equipment, eye tracking facilities, and fully immersive virtual reality equipment with built-in eyetracking. This large space can be flexibly split into two rooms with a sound-attenuating divider. An EEG laboratory houses a 64-channel MRI-compatible EEG system. The TMS laboratory features multiple stimulation coils suited to single-pulse and rTMS, and also features a TDCS system and a range of psychophysiological measurement tools (e.g., EMG, GSR). There are also several further sound-proof individual testing rooms, and dedicated eye tracking facilities (two Eyelink 1000's; Tobi TX300) as well as general purpose interview rooms.

Since REF2014 additional space and investment has afforded the establishment of entirely new laboratory facilities. Most significantly, there has been substantial investment (~£1M) in developmental science facilities and in a new brain imaging centre (~£3.45M; see above). Following the appointment of Professors Spencer and Samuelson, a new Developmental Dynamics facility was established in a wing of the building in which the School of Psychology is situated. The new 201m^2 suite of laboratories contains an fNIRs laboratory, three Eyelink eyetrackers, six remote observation rooms equipped with multiple HiK Vision CCTV cameras, a parent and child waiting room, and a large complement of data analysis PCs. The décor is colourful and engaging for infants, and parents can avail themselves of refreshments, and access the facility using dedicated parking spaces.

The second major development is the opening of the Wellcome-Wolfson Brain Imaging Centre. With a footprint of 290m^2, the centre houses a new Siemens 3T Prisma MRI scanner, an adjacent (second) EEG lab, a phlebotomy lab, waiting room, and multiple other testing rooms. This is a major new facility for UEA (and other regional users) and complements the GE 3T MRI facility that is primarily used for patient scanning (one day a week for research) at NNUH.

In addition to these major developments several additional new facilities have been established. First, a new 101m^2 group testing space houses six sound-attenuating booths and nine PCs (with software for stimulus delivery and data analyses). Second, a new 27m^2 'Language and Memory' laboratory has been developed to support CAP research, with an 86in horizontal touchscreen and other stimulus delivery equipment. Third, a new 66m^2 sleep laboratory was constructed to support Lazar's research, with force plates/torque sensors, Embla N7000 recording system and Dreem 2 sleep monitoring devices.

Technical support comes from a team of in-house dedicated staff, comprising a Systems Engineer, and three further technical staff, with specialist programming skills. The Wellcome-Wolfson Brain Imaging Centre appointed an experienced MR Physicist (joining from the Bristol MRI centre) and is in the process of recruiting a radiographer and additional technical staff as needed. High performance computing and associated data storage is used for computationally intensive applications with over 3000 CPU cores using more than 6TB of memory and over 100TB of UEA's High Performance tiered data storage services. We also have all the office space and computer rooms one would expect for a Unit of this size, and our facilities were recently commended by the British Psychological Society during the recent accreditation visit for being "nationally leading", particularly in relation to the access we afford our students to our extensive facilities through a vibrant internship programme.

The School of Psychology maintains four participant databases, overseen by the ethics committee. These are 1) the Research Participation Scheme with ~600 Psychology Undergraduate participants, 2) the Psychology Research Panel with ~2000 individuals from the local population, 3) the Cognitive Neuroscience Participation Panel for fMRI and TMS research participants, and 4) the Developmental Dynamics Laboratory Participation Panel (managed by dedicated staff), comprising ~1950 families (~2850 infants and children). Access to non-local participants and representative samples is supported by the extensive use of online software (e.g., Gorilla, Qualtrics) and recruitment services such as Prolific. Mechanisms for access to clinical patient groups is arranged via links with the adjoining NNUH, and in collaboration with the School of Medicine and Health Sciences, where many colleagues have joint appointments with the NHS Trust. Clinical research is further supported by access to several local and national patient cohorts, and the PPiRES programme enhances patient involvement in all stages of research. Moreover, the UEA Clinical Trials Unit, specialising in the implementation of behavioural interventions, facilitates the coordination of RCTs across research groups.

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

Research across the Unit benefits from collaborations with several national and international formal academic networks, and with a wide variety of non-academic stakeholder partnerships. These include a highly integrated research base with clinical and healthcare providers, research collaborations with companies and charities, and engagement with the general public.

4.1 Academic collaboration

Researchers hold collaborative links with colleagues at more than 130 institutions in over 30 countries including France, Germany, Hungary, Italy, China, India, USA, Mexico and Australia. These collaborations have been formalised through honorary positions, for example at the University of Queensland (Bayliss), University of Western Australia (Ewing), NTNU Norway (Coventry), and staff members have made numerous research visits to institutions including University of Salzburg (Austria), Western University (Canada) and to companies including Google DeepMind. Collaborations also involve the co-supervision of PGRs in the UK (N=11) and overseas (N=47; e.g., Australia, Canada, Germany, Denmark, Norway, Spain, Sweden and USA). Many collaborations cross disciplinary boundaries. For example, the Deictic Communication MSCA ETN (led by Coventry) involved collaborations across eight countries with computer scientists, linguists, roboticists, and charities, and companies including Qualisys (Sweden) and Ordnance Survey (UK). Other examples include work with climate and environmental scientists, including collaborations with the IPCC (Coventry) and Anglian Water

(Meleady), and fruitful collaborations with archaeologists and anthropologists (Spencer) leading to joint publications on neuroarchaeology (in *Nature Human* Behaviour and *NeuroImage*).

Several conferences and workshops have been hosted at UEA by members of each research group including the first 'Deictic Communication International Conference' (2019, Coventry), and workshops including 'Perception and Action' (2014, Rossit, F. Smith), 'Multidisciplinary developmental dynamics' (2018, Spencer), 'Psychological Perspectives on Autism' (2015, Doherty), 'Bodies and Cognitive Selves' (2019, Renoult), and 'The Future of Social Cognition' workshop funded by the Experimental Psychology Society (2018, Bayliss, Wyer). UEA also hosted the BPS East of England Branch Annual Meeting (2018, Rossit). Prominent keynote speakers at these events and at our Seminar Series have included Professor Mel Goodale (Western University, Canada), Professor Barbara Wilson, OBE (Oliver Zangwill Centre), Professor Josef Perner (University of Salzburg), and Professor Rupert Brown (University of Sussex). National and international events organised by researchers in the Unit include Gliga chairing the BASIS Network Annual Meeting at Birkbeck, and Rugg organising the Dallas Aging and Cognition International Conference (2015-17).

4.2 Wider collaboration and Public Engagement

Academics across the Unit hold active collaborations with over 50 non-academic UK and Europe-based organisations including companies, charities, and healthcare providers. Researchers have utilised internal Innovation funding to establish research collaborations with companies and the PPiRES facilitates researchers reaching and working with patient groups. These relationships allow the Unit to push the impact strategy of each research group and at all levels of seniority. Beyond the highlighted impact case studies, there are many examples of fruitful impact-related activity. Rossit (CLIN) works with Animorph and Evolv Rehabilitation Technologies to develop Virtual Reality approaches to stroke rehabilitation. This work was recently recognised with a UEA Achievement Award for Outstanding Contribution to Public and Community Engagement. Fox (CLIN) works with major healthcare providers and networks to support the medical community to reduce harmful overprescription of anticholinergic medications. This includes Fox's membership on Alzheimer's Research UK national clinical policy advisory panel. Hornberger (CLIN) serves on the Eastern Academic Health Sciences Network as a non-executive director to support its mission to bring together academia, citizens, health services and industry to more quickly realise the value of innovations. Lazar and Broomfield are part of the SINEA collaboration (Sleep and Insomnia Network East Anglia) which aims to harness clinical research collaborations in behavioural sleep medicine across UEA and the region. Meleady (SOC) has major ongoing collaborative and consultative relationships with regional bodies (Anglian Water and Norfolk County Council) where she tests and provides advice regarding behavioural interventions to support environmental protection, for which Meleady (with PGR Lede) received internal UEA recognition as Finalist for UEA's "Partnership of the Year" award.

Other collaborations include research projects with education companies (Pearson Invigos, Bengtsson; OECD, Bayliss) facilitating the application of psychological methods and theory to education. Members of DEV have collaborated with Proctor & Gamble (Gliga) and members in CAP have worked with AI companies (AITRAK, Malcolm; Danieli Telerobotlabs, Coventry). CLIN also works with a broad range of clinical bodies, including the NHS (Hornberger, Lazar: NHS Norfolk and Suffolk Foundation Trust; Norfolk and Waveney Dementia Partnership Board) and brain injury charities (Rossit, Grey: Headway Norfolk and Waveney). Grey is a trustee of the UK Acquired Brain Injury forum, and as part of a recently-funded SCORES project works with the Rugby Health and Wellbeing Group and the Football League Managers Association.

The general public is engaged with research in several ways. For example, Hornberger engages with several dementia interest groups including the Rare Dementia group, NNUH Dementia Fayre, and Wymondham, Thetford and Hunstanton dementia cafés. In the local region, academics and PGRs frequently contribute to the annual Norwich Science Festival, where members of the public interact with scientists presenting posters and Café Scientifique-style talks. Walsh (SOC) engages several organisations on issues relating to development and mental

health, including Ormiston Academies Trust, Inspiration Trust, Universities UK and the Mancroft Advice Project. Significant public engagement events include Ewing's collaboration with the London Science Museum, where over 2,000 children and adults completed a study on face perception in early 2017 as part of the Live Science Programme (for which Ewing received a UEA Engagement Award). In addition, DEV works with several primary and secondary schools, and Ewing contributes her expertise in developmental psychology through her position on the School Governing Board at St Clements Hill Primary Academy. Samuelson also works with the Norfolk Museum's Service on child-facing activities. The Unit invites the general public to Research Open Days, many funded through the ESRC Festival of Science Programme focussing on "Healthy Ageing and Cognition" (led by Renoult) and "Research on Child Development" (led by Doherty). The local community is also engaged with popular Psychology and Mental Health issues through the "Norwich Psychology Meetup" initiative led by Walsh where café scientifique-style discussions are held on thematic topics of interest to the community, for which Walsh was recognised by a UEA Engagement Award (2017).

Research findings are disseminated to the public via the UEA Press Office, leading to 874 stories about research across the Unit during the REF period. Research has been covered by outlets including the BBC (World Service; BBC News Website), Aljazeera, CNN, The Times, The Guardian, New York Times, Washington Post, and German media outlets (ARD, ZDF, RTL, ORF). Social media channels (Twitter, Facebook) are also well utilised by CLIN and DEV to engage with participant groups. For example, a recent Facebook post to request parents to take part in a sleep study (Gliga, Lazar) reached 32,938 people on Facebook with 1790 engagements in the first round.

4.3 Indicators of wider contribution

Researchers across the Unit have contributed to the discipline through 34 editorial service roles during the REF period. These include representation from all four research groups such as Editor-in-Chief of *Neuropsychologia* (Rugg, 2009-17) and 11 Associate/Action Editor roles including *QJEP* (Bayliss 2013-16), *Group Processes and Intergroup Relations* (Wyer, 2011-2013), *Journal of Alzheimer's Disease* (Hornberger 2015-), *Infant & Child Development* (Doherty, 2015-20), and *Royal Society Open Science* (Gliga, 2018-). Researchers hold 20 Editorial Board/Consulting Reviewerships including *PNAS* (L. Smith), *JEP:HP&P* (Rossit), *Child Development* (Spencer), *Cognitive Science* (Samuelson), *Journal of Cognitive Neuroscience* (Rugg), *Cognition* (Bayliss), *Psychonomic Bulletin & Review* (Bayliss), *Emotion* (Rovenpor, ECR), *Spatial Cognition and Computation* (Coventry) and *Human Brain Mapping (*Penny). Academics in the Unit have provided *ad hoc* reviews for over 200 different outlets including *Nature*, *Science*, *PNAS*, *Current Biology*, *Nature Neuroscience*, *Nature Climate Change*, *Nature Reviews Neuroscience, Nature Human Behaviour*, *Trends in Cognitive Science*, and *Trends in Neuroscience*.

Service for funding Review Panels include the ESRC Peer Review College (Coventry, Wyer), NIHR (Fox), Alzheimer's Research (Hornberger), the Leverhulme Trust (Spencer), and the European Commission (MSCA Review Board memberships – Bayliss, Coventry). Rugg holds several senior roles on NIH and NIMH boards (e.g., Chairpersonship of the USA NIH Neurobiology of Learning and Memory Study Section and USA NIMH BRAIN initiative). L. Smith is a permanent member of the National Institute Child Health and Human Development panel. Moreover, researchers in the Unit have provided ad hoc grant reviews for over 50 funding agencies across the world, including UKRI (BBSRC, MRC, ESRC, EPSRC), Wellcome Trust, Leverhulme Trust, NIHR, National Science Foundation (USA), National Research Council Canada, German Research Council, Swiss National Science Foundation, the Dutch Research Council, and the Australian Research Council.

Researchers in the Unit have delivered more than 350 academic talks in the UK and overseas in 20 countries in the REF period. These talks include over 40 Keynote Addresses, including to the International Convention of Psychological Science (L. Smith, DEV, 2017), and the European Conference of Cognitive Science (Spencer, CAP, 2019), with others by Lazar (ECR, CLIN), Coventry, Penny (CAP), and Bayliss (SOC). Staff in the Unit have examined over 70 PhD

theses, including over 25 outside the UK (e.g., Australia, Canada, Denmark, Finland, Norway, Sweden, Switzerland, Republic of Ireland, Italy, Spain).

Researchers have also contributed to doctoral and post-doctoral training nationally and internationally, in addition to contributions to the ESRC SENSS DTP training programme. For example, Spencer has organised Dynamic Field Theory (DFT) courses at the Cognitive Science Society (2017), and at the Institute for NeuroComputing, Bochum, Germany, (2019), as well as hosting several fortnight-long DFT bootcamps at UEA. Penny runs sessions on Event-Related fMRI analysis and Dynamic Causal Modelling at annual SPM courses at the Wellcome Trust Centre for Human Neuroimaging at UCL and the MRC Cognition and Brain Sciences Unit in Cambridge. Coventry contributed a week-long training course for international PGRs in psycholinguistics in Norway (Scandinavian LingPhil Summer School in Linguistics). Finally, three MSCA ETNs (Coventry) have funded international PGR training collaborations that have opened up international training opportunities for local PGRs, such as participation in workshops led by a broad range of academic and non-academic beneficiaries, bringing UEA PGRs into contact with those from eight other countries across disciplines. The ETN model has also served as a vehicle to enhance the breadth of training for PGRs at UEA.

4.4 Recognition and Awards

Research in the Unit has been recognised by external awards at all seniority levels. Awards to PGRs include three wins for best Abstract at the Rovereto CAOS conference (2017, 2018 x 2), an EPS President's Commendation award (2019), the Patrice L. Engle Dissertation Grant in Global Child Development (2018), a Professional Development award, USA Society for Neuroscience, and the award of the Coup de Coeur from Dreem. Moreover, PGRs have been supported to seek external funding and have secured more than 15 travel grants to attend conferences from sources including the EPS, the Guarantors of Brain, VSS (Elsevier/Vision Research Award), Human Brain Mapping and the British Association for Cognitive Neuroscience.

External recognition of output quality includes the *Neuroimage* Editor's Choice Award - Best Paper to Penny (for Lopez et al., 2017). ECR Rovenpor won the Early Career Best Article Award from the *European Journal of Social Psychology* (for Rovenpor et al., 2016), and received an honourable mention 2018 Otto Klineberg Prize, Society for the Psychological Study on Social Issues (for Rovenpor et al., 2019, *JPSP*). Meleady received an honourable mention from the Society for Psychological Study of Social Issues Gordon Allport Intergroup Relations Prize (for Hodson et al., 2018, *Perspectives on Psychological Science*). Malcolm received the Psychonomic Society Associate Member Select-Speaker Award (2013), and Coventry received the 2015 BPS Cognitive Prize (for Coventry et al., 2014, *Cognitive Psychology*).

Career contribution prizes/awards include the 2018 May Davidson Award (BPS) to Meiser-Stedman (CLIN) for outstanding early-career clinical psychology. L. Smith (DEV) is a Fellow of APS, AAAS, Cognitive Science Society, recipient of the David E. Rummelhart Prize in Cognitive Science, the APA Distinguished Scientific Career Contribution Award, APA William James Fellow (2018), was elected to the National Academy of Sciences (2019) and received the Koffka Medal (2020). Samuelson is a recipient of the APA Distinguished Scientific Award for Early Career Contribution to Psychology. Gliga received the BA Rising Star Engagement Award (2016) and the BPS Neal O'Connor Award (2016). Spencer is an APA Fellow, Coventry a BPS Fellow. Finally, Rugg is a recipient of the Henri Hecaen Award for Contributions to Neuropsychology, is a Fellow of the Royal Society of Edinburgh, the AAAS, and the APA.