

Institution: University of York

Unit of assessment: 4 - Psychology, Psychiatry & Neuroscience

Section 1. Unit context and structure, research and impact strategy

Achievement of Strategic Aims During the Assessment Period

Research in Psychology, Psychiatry and Neuroscience at the University of York is conducted within the Department of Psychology and the York Neuroimaging Centre, our flagship facility administered and financed entirely by the Department's activities. Our overarching goal is to provide the infrastructure and support to enable staff to produce world-leading research in an environment founded on the principles of equality and inclusivity. Our Gold Athena SWAN award demonstrates our commitment to these principles.

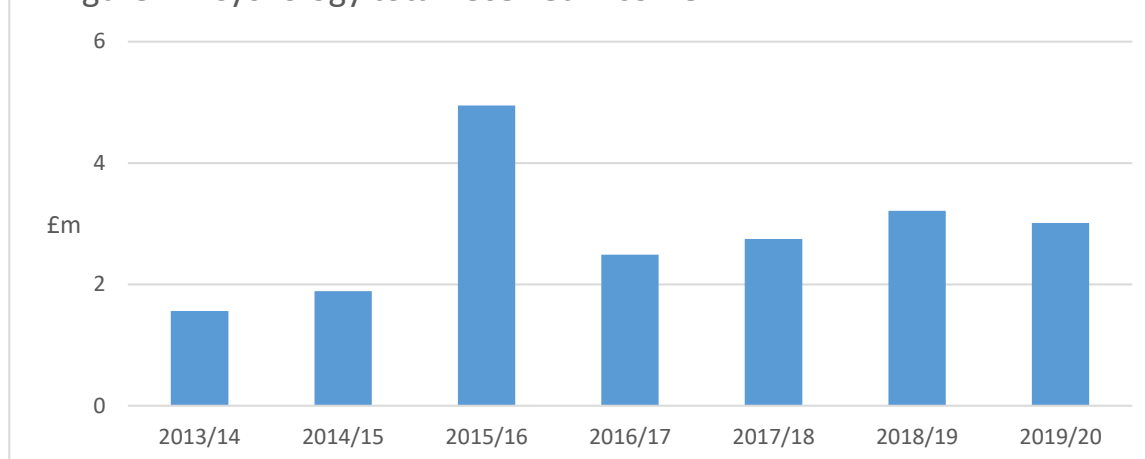
The strategic aims outlined in REF2014 focused on research within five different research groups (1. *Perception & Action*, 2. *Cognition & Communication*, 3. *Development*, 4. *Social Perception & Interaction*, 5. *Neuroscience Theory & Methods*), each of which aimed to develop and support collaborative research programmes that (a) had potential for impact and interdisciplinarity, (b) would result in significant funding and discipline-leading publications, and (c) would attract high-quality research students.

Over the assessment period, the five groups have evolved into three broader research themes—1. *Language, Memory & Cognition*, 2. *Vision & Face Perception*, 3. *Development & Cultural Processes*—which are linked to the University's Research Themes (Section 4, Institutional Environment Statement (IES), paragraph 4). These changes were driven by increasing collaboration across the REF2014 groups and the integration of neuroscience methodologies into all of the sub-disciplines of psychology represented in the Department. This evolution is testament to our success in achieving our goal of creating a collaborative research environment. Moreover, these themes were formulated through Department-wide discussion and consultation with all staff.

The appointment of a new full-time Department Research Facilitator, the development of regular research seminar series on cross-theme areas (e.g., *Social Minds; Cognition, Learning and Memory Interest Group*), robust internal review processes for grant applications (see Section 3) and research mentoring of new staff have been instrumental in our success. Most of the submitted researchers are included in more than one of our themes, providing additional evidence for the highly collaborative nature of our research. The following further demonstrate how we have achieved our goal to organise our research into productive and intellectually supportive structures.

1. Our Impact Case Studies are drawn from all three research themes, with each theme achieving additional significant impact beyond academe (see below and Section 4).
2. Researchers in all three themes have published with collaborators from other disciplines (see Section 3).
3. Our researchers have produced world-leading publications in the areas of research targeted during the assessment period (see below).
4. The dominance of co-authorship among York staff in the submitted outputs highlights the collaborative nature of our research within and beyond the Department: almost half of submitted outputs have more than one York author, around one third involve co-authors from other UK institutions and almost half have overseas authors.
5. All three themes have researchers who have won funding from diverse sources, including UKRI, European Commission, major charities in the UK and abroad, overseas funders and industry; our received income has increased significantly in comparison to REF2014 income (£20m cf. £6.5m) (see Figure 1 and Section 3).

Figure 1: Psychology total received income



6. The Athena SWAN Gold Award made to the Department in 2019 reflects the highly supportive environment for staff, including all those engaged in research.
7. To ensure that we continue to attract high quality research students, we have made significant investments in order to provide departmental studentships, recruiting 49 PhD students to this scheme over the assessment period. Since 2018, we have also funded four Strategic PhD Studentships, which focus on an area linked to the developing research agenda of a specific member of staff (see Section 2). Two of these studentships have fostered new collaborations between newly-appointed lecturers and professorial staff.

Our major achievements over the assessment period in the *Language, Memory & Cognition* theme are built on our long-standing expertise in behavioural memory research, which is complemented by cognitive neuroscience and computational modelling approaches to understanding language and cognition. Researchers in this theme have regularly published in leading journals, including *Cerebral Cortex*, *Cognition*, *Current Biology*, *PNAS* and *Psychological Science*. Research on spatial memory has important implications for early detection of dementia, and is the focus of one of our Impact Case Studies (Hartley, Four Mountains Test). McDougall's research demonstrating the positive impact of prisoners' use of digital technology to give them more cognitive control over basic activities (e.g., scheduling visits) is another Impact Case Study from this theme. A significant line of research on sleep has elucidated its involvement in the stabilisation of word meaning representations and the consolidation of non-emotional and emotional memories. The basic science revealing the role of sleep in learning and memory is relevant to education and mental health, and we aim to develop this area of research into a future REF Impact Case Study.

Publications in the assessment period have cemented our reputation in producing internationally-leading research in *Vision & Face Perception*. Our outputs in this theme—in journals such as *Cerebral Cortex*, *Cortex* and *Journal of Neuroscience*—have elucidated the constituents of visual processing in typical functioning and in disease, providing an important framework for understanding the functional consequences of sensory deprivation in conditions such as macular degeneration. Applying this research to inform attempts to restore function in visually deprived individuals is identified as a future REF Impact Case Study. Other work on radiologists' understanding of image properties can support the development of automated aids for medical screening. Researchers in this theme have identified the neural processes underlying face recognition, simulated the key properties of familiar face recognition, computationally modelled how facial appearance relates to personality judgements and demonstrated how implicit encoding of gaze cues influences altruism and trust. These findings have been published in journals such as *JEP: General*, *PNAS* and *Psychological Review*. In an important applied strand of this work, Burton and Jenkins have examined face recognition in

security-critical settings, such as passport control and police surveillance. The poor performance of highly-trained professionals has led to an emphasis on selection over training, and this research is the focus of one of our Impact Case Studies.

Much of the research in our *Development & Cultural Processes* theme focuses on identifying early predictors of children's development. This research often involves extended longitudinal work. Findings published in journals including *Journal of Child Psychology and Psychiatry*, *Child Development* and *Psychological Science* have highlighted (a) speech sound disorder at age 3 as a risk factor for poor spelling and reading in primary school, (b) developmental outcomes of children at high risk of dyslexia and developmental language disorder, (c) how arithmetic skills are predicted by children's ability to translate between Arabic numerals and their verbal labels, and (d) the role of sleep in predicting novel word learning and vocabulary consolidation in typically developing and dyslexic children. All of these research strands have significant potential for impact over the next five years. Meins' research on parental mind-mindedness as a long-term predictor of optimal development has proved influential in informing interventions to improve the quality of early caregiver-child interaction, and is the focus of one of our Impact Case Studies. Our research on cultural processes has been published in journals such as *Cognition*, *Nature Human Behaviour* and *PNAS* and has shown (a) how social norms influence prosocial behaviour in children and adults from rural and urban communities across the world, and (b) how perceptual experiences are represented in the languages used in different cultures. Again, this research has considerable potential for real-world impact.

Strategic Objectives for the Next Five Years

Our underpinning strategy is to provide the resources necessary to produce internationally authoritative, well-resourced research in areas that have the potential for significant practical application or interdisciplinary collaboration. Since 2017, we have had an integrated Research and Impact Strategy, underlining the fact that impact is viewed as an integral part of research. We will continue to (a) facilitate impact-related activities through providing monetary support and recognition in the workload model (see Processes to Support Impact), and (b) support the departmental research themes (being responsive to requests from theme leaders, providing funds for speakers' expenses for the seminar series, etc.) while reviewing them annually to establish whether new thematic groupings would be advantageous.

There are also a number of new objectives for the next five years:

1. *Mental Health* will be developed as new research strength. Several members of the Department already conduct research on various aspects of mental health, often collaborating with colleagues in the Hull-York Medical School and the departments of Health Sciences and Education. We will appoint an established researcher in mental health who can take on a leadership role in this area in the Department; we will also make a lectureship appointment in mental health. The senior post will help shape the Department's contribution to University-wide interdisciplinary initiatives and open up new funding opportunities via the MRC, NIHR and major health charities. We envisage mental health becoming an additional departmental research theme, providing existing staff with new opportunities for research and collaboration in alignment with the University's strategy on mental health.

2. *York Neuroimaging Centre* plays an essential role in enabling us to produce excellent research. Neuroscience is now embedded in all of our research themes, and will also play an important role in expanding our research in mental health. We aim to use our neuroimaging expertise to forge new interdisciplinary collaborations with colleagues from disciplines such as chemistry, health sciences, computer science and biology, building on the potential for interdisciplinary research through Psychology's strategic role in the recently-formed York Biomedical Research Institute (IES, paragraph 44).

3. *Interdisciplinary research* will be prioritised across all aspects of our research, exploiting existing collaborative links across the University and in other institutions. In addition to the research on mental health and through the York Neuroimaging Centre, this work will be focused in areas relating to the University's Research Themes. We plan to capitalise on recent

appointments (especially Bailey & Majid, see Section 2) whose research spans different cultures in order to lead interdisciplinary research programmes that are relevant to the Global Challenges Research Fund, in line with the University's strategy on interdisciplinarity (IES, paragraphs 10, 11, 18, 42-45).

4. *Collaborations with non-academic partners* will build on links established in the current assessment period with developers of gaming and new technology. We plan to expand our industry partnerships (a) with app developers to produce technology that can be used by professionals working in the NHS in areas such as health visiting, perinatal mental health and social prescribing, (b) with an international engineering company to develop head-mounted portable cameras for infants for use in research, (c) to develop automated aids for medical screening and therapy, and (d) with an international video game developer to explore relations between cognitive functioning and gaming performance.

5. *Open Science* policy and practice in the University has been led by our Department. We were the first to form an Open Science Interest Group (see Open Science and Reproducibility), which has been highlighted within the University as a model of good practice (IES, paragraphs 15-17). This group is highly active in supporting colleagues to develop their Open Science practices, and will be instrumental in helping us achieve our aim to have all suitable data made available for sharing and all suitable projects and publications pre-registered.

6. *Enhancing career development* for our PhD students and Early Career Researchers (ECRs) is a priority for the next five years. In line with the University's drive to increase the number of fellows via the recent formation of the University's Fellowship Coordination Committee (IES, paragraph 20), we will expand our efforts to publicise fellowship opportunities via our website and proactively recruit fellowship applicants. Our well-established ECR Forum will play an important role in this process via its well-established links with alumni (see Section 2).

7. *Equality and diversity* will continue to be central to our research. We aim to build on our Gold Athena SWAN award to enhance our equality and diversity yet further. We will systematically evaluate support provided to staff returning from leave in order to ensure that such absences do not impact negatively on our staff's research. We plan to improve the gender balance of our staff at professorial level and will use search committees to encourage more diverse applicants for future posts.

Processes to Support Impact

As discussed in the sections above, our overarching goal for the assessment period was to develop research groupings that are capable of achieving significant impact, reflecting the University's goal for our research to have excellent impact and relevance beyond academia at the local, national and international level. We sought to put impact at the heart of all of our research, rather than drawing a distinction between impact-related versus pure research, or making assumptions about areas of research that should achieve impact more easily than others. Our Impact Case Studies are based on research from all of our current research themes and each of the four content-related groups identified in REF2014, demonstrating the successful achievement of our goal. The diversity of our portfolio of Impact Case Studies highlights our ability to facilitate and achieve impact from a wide variety of research, inspired by classic paradigms used to assess face perception and memory, Vygotskian perspectives on the social origin of cognitive development and theories of behavioural change.

Throughout this assessment period, the Department has had an Impact Lead who has worked closely with staff to develop the impact of their research. We have an Impact budget to support impact-related and outreach activities across the Department as a whole. These funds can be used to provide pump-priming money for ideas that are at early stages of development and to enhance the impact of areas identified as current or future Impact Case Studies. For example, we have funded a collaboration with *YorkCares*, a York-based charity, to produce a volunteer training protocol designed to support disadvantaged primary school pupils in their numeracy. The Department devotes half of its annual Research Away Day to impact-related and outreach activities, inviting potential users of our research to give presentations and network with our staff. From 2017, we have introduced annual internal exercises to collect Department-

wide data on outreach and impact-related activities, and these activities are formally recognised in the Department's workload model, with up to 100 hours per year designated for individual members of staff.

The University's Impact Acceleration Accounts (IAAs) are also used to support and stimulate impact, and several members of staff have received funding from these accounts (IES, paragraphs 49-50). One of these projects was a joint venture between Psychology, Health Sciences and Education that collaborated with schools across the north of England to trial a Mental Health in Schools programme that was designed to be delivered as part of the school's Personal, Social, Health and Economic Education curriculum. Other projects facilitated collaborations with industry partners. For example, a collaboration with an engineering firm in Lisbon is developing wearable biosensors for use in infant research, and a collaboration with an app developer has produced a smartphone app to help improve infant-parent interaction.

Open Science and Reproducibility

Open Science is of fundamental importance and our focus is on producing highly rigorous science that can be scrutinised and communicated to key stakeholders and the public. The Department has developed a research culture where the highest standards in research practice are expected, based on the principles of honesty, rigour, transparency and reproducibility. Concerning the latter, we aim, where possible, for substantial multi-experiment publications, meaning that replicated findings are a key feature of our research outputs.

Our Department is at the forefront of championing open science practices. A Departmental *Open Science Interest Group* was established in 2018, and in 2019 the *ReproducibiliTea* journal club was formed by our postdoctoral researchers and PhD students. *ReproducibiliTea* is supported by the UK Reproducibility Network, and our Department was the ninth institution in Europe to launch this initiative. These groups provide expertise and support for staff on ethics and funder requirements in relation to open science. Engagement with open science practices is monitored via an annual questionnaire, and we hold an annual lecture dedicated to open science issues.

With regard to basic practices on open access, the Department's policy on research publications goes beyond ensuring funder compliance and requires that all research outputs are deposited in the institutional repository (White Rose Research Online). In addition, many of our articles are Gold open access and placed on other outlets such as Researchgate, with pre-prints available on PsyArXiv. The data described in our publication outputs are openly available for further analysis and scrutiny either on the University PURE system, or other open data sources such as the Open Science Framework (OSF). Indeed, our staff are increasingly placing data in an open source prior to the publication of their research articles. In 2020, 55% of our staff reported uploading at least one pre-print of an article (up from 26% in 2017), with 52% completing at least one pre-registration of a study or project (up from 6% in 2017).

Research Integrity and Ethics

The Department's research integrity and ethics processes are embedded within the wider University's structures, policies and provision in support of research. The overarching University policies are reviewed on a three-year rolling cycle, with new policy and guidelines developed where required. The University also subscribes to the UK Research Integrity Office (UKRIO), enabling our researchers to benefit from the support provided by UKRIO (IES, paragraph 14). The Department is therefore compliant with the UUK Concordat in terms of codes of practice on research integrity, principles of good ethical governance and research misconduct.

No data collection of any kind can be undertaken without having explicit approval granted by the Departmental Ethics Committee. The Committee convenes formally twice a year to approve undergraduate and Master's projects. Applications from staff, post-doctoral and doctoral researchers are responded to on a rolling basis, with a response being given within 5 days on average over the assessment period. The Committee comprises six members of staff together

with two lay members. In addition, from time-to-time, we also call upon the lay members to offer opinions about the kind of work we wish to undertake. Their advice has been invaluable in informing decisions about the suitability of our planned research, particularly that involving children. Projects concerning non-human animal experimentation are considered by a sub-panel of the Ethical Committee in the Department of Biology and experiments on brain imaging are considered by York Neuroimaging Centre's Ethics Committee. Research projects involving patients or participant recruitment via NHS facilities are additionally subject to NHS HRA/IRAS approval.

The Departmental Ethics Committee Chair sits on the Departmental Research Committee and the University-wide Research Integrity/Ethics Panel and contributes to all new developments, such as the requirement for all staff to undertake training in General Data Protection Regulations (GDPR).

Section 2. People

Staffing Strategy and Staff Development

Our goal is to have good representation at all levels of seniority in all of our three research themes, making new appointments with this in mind. The fact that we have professorial and more junior staff with research expertise in the sub-disciplines represented within our three themes illustrates our success in achieving this goal. We always endeavour to recruit academic staff who are, or have the potential to become, international leaders in their fields. We also strive to ensure that staff in each of the themes actively engage in exchange with non-academic collaborators and audiences to facilitate the impact of our research (see Section 4).

All departments in the University operate on a rolling five-year financial planning cycle, and our prudent approach ensures that all appointments are affordable and sustainable. Fourteen of the 42 submitted researchers have been appointed during the assessment period. We have used these recruitments to enhance our research strengths, looking for synergies between new and existing researchers and identifying potential for interdisciplinary lines of investigation and real-world impact. Our strategy has been to appoint at different levels of experience, recruiting a blend of established research leaders at professorial level (*Burton & Majid*) and outstanding researchers at lecturer level (*Cairney, De Bruin, Geangu, Hobson, Horner, House, Hymers, Kaiser, McCall, McNab, Pitcher & Preston*). Our strong international reputation is underlined by the fact that seven of the 14 staff appointed in the assessment period came from non-UK institutions (*House & McCall* from Max Planck Institutes, *Majid* from Nijmegen, *Pitcher* from NIMH, *Kaiser* from Freie University Berlin, *De Bruin* from the Basque Centre for Cognition, Brain & Language, and *Preston* from the Karolinska Institute). Our ability to appoint creative and productive researchers at all levels speaks to our outstanding research environment and the long-term sustainability of our staffing structure. We are also in a strong position to thrive over the coming years, as the average age of our staff is 47 years and the distribution of seniority supports a sustainable future. New appointments have been complemented by investment in research infrastructure to ensure that all researchers have access to the facilities they need (see Section 3).

During this REF period, many of our most significant achievements have been gained by our more junior members of staff, reflecting the vibrancy and high levels of support we provide to nurture research careers. Staff development is supported through a system of annual performance review, which enables staff to reflect on successes, identify areas for improvement and consider personal and career development aspirations and priorities. Training needs are also identified as part of the annual performance review process. Staff appointed at all levels are assigned research mentors who provide support in developing research strategy in relation to publications, grants, collaborations, dissemination and impact. All new members of permanent academic staff are given a light first year (50% teaching load and no academic citizenship duties) in order to enable them to focus on establishing their research in the Department. In

addition, the Department provides generous start-up funds for new academic staff (ranging from £6K to £40K during the assessment period), with funds being used to establish wide-ranging new laboratory facilities (see Section 3).

Staff appointed to their first lectureship must serve a two-year probation during which they are provided with regular support and guidance from assigned mentors. In the REF period, all appointed staff have completed probation successfully and progressed to permanent posts. All Category A staff apart from three are on permanent contracts. One of these fellows has a proleptic lectureship appointment while holding a Fellowship from the MRC, and will become a permanent member of our staff in 2022. Another won an ESRC New Investigator award which our Department is hosting, and this member of staff has secured a permanent lectureship at another institution to commence at the end of the award. The third only began a 3-year British Academy Fellowship in our Department at the beginning of 2020 and is at a very early stage of their research career.

The Department does not have a formalised system of research sabbaticals. Throughout the assessment period, sabbaticals have been regularly discussed in Department-wide staff meetings, in which different models for sabbatical leave have been proposed and voted on. Our staff have consistently opted to retain the current system. This entails all permanent members of academic staff teaching an equitable load, which typically consists of delivering one full-term specialist final year module on their area of research (capped at 40 students), one four-week teaching block at first or second year and project and literature survey supervision. Staff may request to have all of their lecturing blocked into a single term to enable them to have more dedicated research time; these requests are invariably accommodated. Our policy is for staff on teaching and research contracts not to have very heavy coursework marking and project supervision loads. This is achieved through providing excellent training and support to a dedicated team of Graduate Teaching Assistants, who mark all first and second year coursework. During the assessment period, we have enhanced our commitment to teaching and scholarship posts in order to secure maintenance of manageable teaching and marking loads across the Department. In 2018, we created the professorial post of Director of Teaching and Learning as part of our strategy to establish a career and promotion path for teaching-focussed staff. In 2019, we appointed two new lecturers on permanent teaching and scholarship contracts to join our existing permanent teaching-focussed staff (two Lecturers and two Senior Lecturers). This well-managed and fair workload has resulted in staff feeling that formalised periods of dedicated research leave are not necessary, but we continue to review arrangements for optimising staff research time (see Equality and Diversity). In the assessment period, 10 staff have held externally-funded fellowships involving staff buy-out to enable them to devote extended periods of time to research and impact activities; such fellowship applications will continue to be supported in the future.

Our workload model for full- and part-time permanent members of academic staff devotes 40% of time to research, and additional time (to up 100 hours per year) for impact and outreach. All permanent members of academic staff receive an annual departmental allocation (c. £2.5K) which can be used in any way to support research and impact. As mentioned in Section 1, there is an Impact budget to support impact-related and outreach activities across the Department as a whole, and University IAA funds are also available.

There are additional Department budgets to support scanning, publication costs, dissemination (e.g., Open Science practices) and undergraduate summer research bursaries. Extra support is given to encourage grant applications; for example, applicants seeking grant-funded scanning hours are allocated a proportion of these hours (normally one third) whether or not the application is successful. In addition to Department-level funding opportunities, the University provides pump-priming via a number of schemes (IES, paragraph 10). Over the assessment period, the interdisciplinary Wellcome and University Centre for Future Health and the University's Research Priming Fund have contributed over £3m in pump-priming funds for research projects in the Department; this has been especially supportive of early career staff.

We are keen to enable members of staff at all levels to achieve research excellence, and realise that mid-career researchers may require additional support. We have nominated mid-career researchers for University grant writing boot camps in order to facilitate grant applications. Each year, we also award one of our departmental PhD studentships to a member of staff who is actively applying for major grant funding (over £100K) but who currently does not hold a major external grant or supervise a PhD student. Mid-career staff (who have often returned to full-time employment after parental leave) often meet these eligibility criteria. Three mid-career researchers have also benefited from being awarded a Departmental Strategic PhD Studentship (see Research Students) to support a specific research project that will facilitate a major grant application.

The criteria for promotion are clear and accessible, and are discussed at meetings with mentors and performance reviewers. The effectiveness of the Department's support for staff is reflected in promotion success, with all but one member of staff who applied for promotion during the assessment period being successful; eight staff have been promoted to Senior Lecturer, three to Reader and two have been awarded personal Chairs.

We take very seriously the need to integrate and develop all researchers, of which an important group are our PhD students, postdoctoral researchers and junior lecturing staff. In 2007, the Department established an Early Career Researchers Forum (ECRF) to provide an environment in which these researchers can find support from their first day of arrival at York. The forum is supported financially by the Department, but otherwise operates independently and reflects members' interests and needs. There is a weekly ECRF coffee club meeting, with additional social events, talks and workshops on various aspects of research and employment. A permanent member of academic staff acts as the ECRF Champion, representing their needs to senior management. In this assessment period, our ECRF has (a) created a new website for sharing information and established an Alumni Book, which involves a Linked-In page and alumni database, (b) introduced a keynote lecture to the annual Postgraduate Research Day Conference, and (c) begun an annual Psych 101 session to provide new PhD students with guidance via resources compiled by veteran ECRF members. Our ECRF has been so successful during the assessment period that it has been highlighted as a 'beacon activity' by the University, and disseminated within the institution as a model of good practice. It also formed a significant component of our Gold Athena SWAN award, with members of the ECRF contributing substantially to the application.

The Department is committed to adhering to the principles of the Concordat to Support the Career Development of Researchers (IES, paragraphs 27-28), and this process is overseen by the Department's Inclusiveness and Development Committee (see Equality and Diversity) and the University's Research Excellence Training Team (RETT). Since 2018, one of our ECRs has been working alongside the RETT as a Research Staff Liaison Officer. This role enabled her to share her lived experience as a researcher and contribute ideas towards institutional planning and implementation via Concordat Implementation Group Committee meetings with senior University staff. Her main responsibility was to organise and coordinate groups of researchers to respond to the Concordat consultation. Thanks to these efforts, the University demonstrated exceptional engagement with the Concordat consultation, with the highest total number of group responses across 134 higher education institutions.

Research Students

The Department has recruited a total of 103 PhD students over the assessment period. Approximately half of the students are self-funded or supported by external agencies (e.g., ESRC, ERC, Leverhulme, MoD), with the remaining students funded by departmental and university support. We have made significant investments in order to provide departmental-funded studentships, offering on average five per year over the assessment period. In a new initiative since 2018, staff have had the opportunity to apply for a PhD studentship to fund a specific research project that is relevant to short- and medium-term plans for applying for major

external funding. Four of these Strategic PhD Studentships have been awarded, supporting the research of staff across all levels of seniority (see above and Section 1).

Each student is allocated a desk in a shared office and provided with a new PC on arrival. PhD students have very regular scheduled meetings with their supervisors (weekly or fortnightly), and can request additional meetings if needed. These meetings and students' progress are closely monitored via the SkillsForge online system and twice yearly meetings of a Thesis Advisory Panel (TAP); the Deputy Chair of the Graduate Board of Studies is alerted to any problems. The TAP consists of the supervisor(s) and two members of academic staff independent of the PhD project. In addition, there are yearly progression meetings in years 1 and 2, during which a panel consisting of the two independent TAP members and an additional member of staff from a research area unrelated to the PhD topic assess the student's progress in the absence of the supervisor(s) (IES, paragraphs 31-34).

A 'PhD buddy' system pairs first and second year PhD students to create a sense of community across year groups. Furthermore, all students become members of lab groups involving academic staff and post-doctoral fellows where they are exposed to discussions of the latest findings in their field and provided with a safe and supportive environment for presenting their own findings. They give talks or posters on their work to the whole Department at an annual research day event, and present their work in the third year of their PhD as part of the Department's research colloquium series.

As well as the training events described above, first year PhD students attend compulsory training courses in research skills and professional and generic skills. These courses introduce PhD students to post-doctoral fellows and junior staff, and encourage them to think about career progression. All PhD students are members of our ECRF and can benefit from its wide-ranging activities (see above). To ensure a wide exposure to different research fields, all students are required regularly to attend the weekly Department research colloquia, and to participate in the associated 'meet-the-speaker' sessions. During these sessions, the students have an hour-long meeting with the colloquium speaker, which provides them with the opportunity to discuss research and career development in a more informal setting. Furthermore, the University runs institutional inductions and a vibrant programme of events for PhD students (e.g., 3 minute thesis) integrated into the Festival of Ideas, YorkTalks, and the Department's annual open day in the city centre, where research activities are highlighted and demonstrated to the public. We are also part of the ESRC White Rose Doctoral Training Partnership which gives PhD students access to training opportunities and facilities across the Universities of Leeds, Sheffield, Sheffield Hallam, Manchester, Manchester Metropolitan, Bradford and York.

Students are allocated £750 p.a. for travel to conferences or other meetings during their PhD, and many receive much greater support from their supervisors to ensure attendance at meetings to present their work and network with future employers and collaborators. They have access to a pool of undergraduate research participants who are paid by the Department, with each PhD student having an annual allocation of £200.

Careful selection, supervision, training and monitoring of PhD students has resulted in 97% of full-time PhD students submitting their theses within four years. We expect each PhD student to appear as first author on at least one paper in a refereed journal. Our PhD students have won various awards reflecting the high quality of their research (e.g., Coggan: K.M. Stott Award 2019; James: Frith EPS Prize 2019), as well as grants to attend conferences and provide additional research support.

Equality and Diversity

The Department prides itself in treating all staff equally and providing them with the resources and management structures to succeed. Our approach builds on the University of York's long-standing support for the career development of researchers, holding an HR

Excellence in Research award since 2010 (IES, paragraphs 27-28). The Department held a Silver Athena SWAN Award continuously from 2007, and we were awarded a Gold Athena SWAN award in 2019, making us only the second Psychology Department in the UK to achieve this status. These awards recognise our sustained and progressive commitment to equality and inclusivity and have informed our staff development and recruitment policies.

In 2015, the Department established an Inclusiveness and Development Committee, which works closely with the ECRF to guarantee that the development needs of all researchers are met. The Inclusiveness and Development Committee monitors and oversees all departmental practices to ensure equality, conducting annual surveys to gather information on equality and diversity issues for use in future planning. Information on flexible working, managing career breaks and parental and sick leave has been available on the departmental staff wiki throughout the assessment period. The Department has accommodated all formal requests for flexible working, with seven members of staff moving from full-time to part-time work. In addition, the Department is supportive of the many members of staff who work flexibly or remotely on an informal basis, and this is particularly beneficial to staff with children or other caring responsibilities. Our recent survey data show that 86% of staff have been able to work flexibly, and 88% believe that the Department does a good job in managing flexible working. Parental leave is formally covered by employing additional staff, and staff members on leave are encouraged to take up Keeping in Touch days; many staff continue to attend departmental social events with their children during their parental leave. Staff have a return to work meeting with the Head of Department (for academic staff) or their line manager (for research staff). Academic staff returning from parental leave receive a sabbatical term with no citizenship or teaching responsibilities. In the assessment period, thirteen staff have taken maternity leave, ten of whom have returned to work on a part- or full-time basis (three fixed-term contracts ended during the leave); there have been four periods of paternity leave and two periods of shared parental leave. One member of staff successfully passed probation after returning from maternity leave, and a second was promoted to Senior Lecturer while working part-time after two periods of maternity leave. In addition, three members of staff won significant ESRC and ERC awards shortly after returning from maternity leave. Since 2018, the Department has appointed members of academic staff in a number of new Champion roles, including Parent & Carer, Wellbeing and LGBTQ, all of whom report to the Inclusiveness and Development Committee.

As discussed above, our inclusiveness and fairness are reflected in the fact that we ensure teaching and administrative roles are spread equally across staff at all seniority levels. Furthermore, although some minor adjustments are made to accommodate the extra pressures of large research awards, major administrative roles and impact work, all staff contribute to the full range of teaching, citizenship and research activities. This inclusiveness and fairness also pertains to our administrative and support staff, who are vital to our success and benefit from the inclusive culture that is reflected in our Athena SWAN Gold award. We have made significant progress toward gender equality over the assessment period. We have achieved a 50:50 gender balance at Senior Lecturer/Reader level for the first time in our history (up from 29% women in 2014), and have attained the national benchmark of 33% women at Chair level (up from 21% in 2014). The diversity of the Department has also increased in terms of sexual orientation and ethnicity over the assessment period. The Department Research Committee monitors grant applications and funding as a function of gender and reports these data (which show gender equality in terms of volume and success of applications) to the Inclusiveness and Development Committee. Our submitted outputs show no evidence of bias with regard to gender or age; two of our four Impact Case Studies are authored by women and our Impact Case Study authors range from Senior Lecturer to Professor.

Section 3. Income, infrastructure and facilities

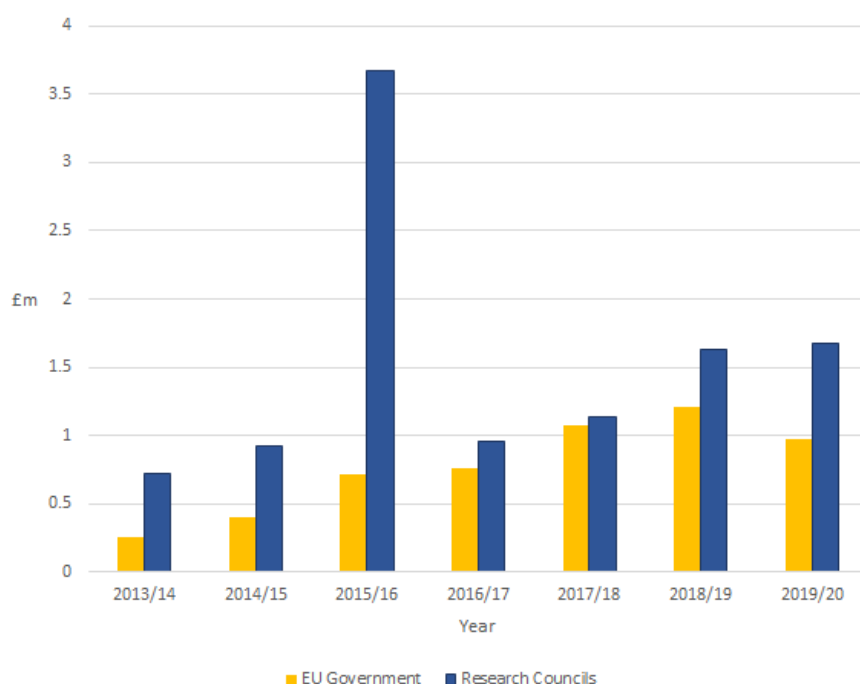
Income

We have well-structured research management to support research applications and infrastructure. Research policy and strategy in Psychology are overseen by a Department Research Committee chaired by the Director of Research. Its membership reflects the composition of the Department and includes representatives from the ECRF. Our full-time Research Facilitator in Psychology provides the essential role of identifying sources of research funding and supporting the submission of high-quality applications by organising grant talks and arranging internal peer reviewers. Researchers planning to submit a grant application make a presentation within the Department at an early stage in order to obtain feedback while the ideas are still fluid. When the application has been drafted, it is reviewed by at least two colleagues, one of whom has expertise in the research topic. The Research Facilitator checks the draft application against funder requirements and helps staff with costings and submission. The Director of Research oversees the internal peer review system and organises internal triage for staff proposals where necessary. Our Research Facilitator also coordinates meetings with other departments and research centres in the University (to discuss interdisciplinary research opportunities) and with external organisations to facilitate impact.

These processes have reaped significant dividends for our staff, with a substantial increase in funding income during this assessment period: £20m (£16.4m over the last 5 years) compared with £6.5m in the previous REF period. This income includes ESRC Professorial Fellowship (Meins, Burton), ESRC Future Research Leader (Over), ERC Starting Grant (Over), ERC Consolidator Grant (Smallwood, Jeffries, Slocombe), ERC Advanced Grant (Burton) and MRC Independent Fellowship (Cairney) awards. As part of larger consortia, we were awarded a capital grant from the MRC (Green) to fund a new 3T MRI scanner, and three members of staff led the Department's involvement in an EC-funded Innovative Training Network award.

Over the assessment period, we have also obtained grants from BBSRC, EPSRC, ESRC, European Commission, British Academy, Royal Society, AHRC, Advanced Bionics UK, NHS, Department of Education, Home Office, Big Lottery Fund, Deafness Research UK, Stroke Association and the Leverhulme Trust.

Figure 2: Income from EU Government and Research Councils



Of particular note, the Department has been especially successful with funding from the ERC (five awards totalling £4.2m) and the ESRC (see Figure 2). Despite the University's strength in Social Science, our ESRC income accounted for 31% of the entire University ESRC grant income over the assessment period, with our income in the last two years being over five times higher than any other University department. These grants have enabled extensive research and impact to be generated. For example, over 30 papers have emerged from Smallwood's ERC grant, and the ESRC Professorial Fellowships to Burton and Meins have resulted in considerable real-world impact that forms the basis of two of our ICSs. We have a separate Impact Lead role in the Department, responsible for facilitating and supporting all impact-related and outreach activities and dealing with applications and funding through the Department's Impact budget (see Processes to Support Impact).

Infrastructure

In addition to the organisational infrastructure described above to support income generation, we have excellent technical support in the Department. Our technical workshop employs two full-time members of staff who support the running and maintenance of our research laboratories and equipment; two full-time IT staff provide support for all of the Department's research and impact. A high level of administrative and technical support for neuroimaging research is provided by six members of staff (including a Manager of Imaging Services and two Senior Research Technicians) based at the Department's York Neuroimaging Centre. The level of support from the technical staff is recognised by them being authors on research outputs.

Beyond the Department, the Director of Research works with the University's Associate Deans for Research, University Research Theme Champions and the University Research Forum to assemble and shape bids for interdisciplinary funding (IES, paragraph 38). University Research Committee also facilitates interdisciplinary collaborations, oversees the establishment of new research centres and disburses research priming funds. This committee produced the University Research Strategy and a Statement on Research Performance Expectations (IES, paragraphs 9 & 22); the latter led to the Department drawing up new guidelines and expectations for researchers in 2019, which detail expectations relating to publication, grants and dissemination. The Department's expectation is for staff to submit at least one substantial grant application a year if they do not have current major (>£100K) funding, and this process is supported via the annual performance review.

Our researchers are actively engaged with four of the University's Research Themes—*Health & Wellbeing, Risk, Evidence & Decision Making, Technologies of the Future, Culture & Creativity*—contributing to theme-based research days and impact-related activities. Over the assessment period, we have collaborated with colleagues from a wide range of disciplines, publishing jointly with researchers from Computer Science, Biology, Chemistry, Sociology, Linguistics, Music, Health Sciences, Electronic Engineering, Philosophy, Social Policy and Social Work. Current multidisciplinary projects include (a) a University-wide initiative to investigate robotics and autonomous systems and their future application, (b) collaborations with Computer Science to establish computational models that can be used to detect cancer in radiographs and process large amounts of naturalistic data to create a taxonomy of emotional contexts encountered by infants, (c) a collaboration with Chemistry to investigate olfactory processes and perception, (d) collaborative research with Biology to create animal models of Parkinson's disease and dementia, and (e) interdisciplinary research with Health Sciences on smoking cessation and behavioural change. These projects have considerable potential for impact over the next five years. Of particular note, one of our members of staff (Wade) is Director of the Wellcome and University Centre for Future Health and plays a strategic leadership role for the Department in promoting the Centre's research and impact.

Facilities

The York Neuroimaging Centre provides a major focus for researchers across the entire Department, as well as contributing significantly to our ongoing ability to recruit excellent staff.

The Centre is run and financed entirely by the Department of Psychology. The assessment period has seen a £3.1m investment in a new MRI scanner which, in combination with the existing 3T scanner, substantially increases neuroscience research capacity and capability. As a result of the recent investment, new protocols for functional and spectroscopic imaging are now available, enhancing the provision for cutting edge investigations of the human brain. The Centre also plays an essential role in fostering cross-HEI collaborations. During the assessment period, the Centre has hosted researchers from the following institutions: Centre National de la Recherche Scientifique, Donders Institute, Queensland University of Technology, and the Universities of Groningen, Nijmegen, Magdeburg, Birmingham, Bradford, Durham, Hull, Leeds, Lincoln, Newcastle, Northumbria, Oxford, Sheffield and Southampton. These collaborations have led to cross-HEI publications in leading journals (e.g., *PNAS*, *Cerebral Cortex*). In addition to the two MRI scanners, the Centre also houses a MEG scanner, as well as well-equipped transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (TDCS) laboratories. Our Department has been instrumental in forging a new partnership between the University of York and Maastricht University (IES, paragraph 6), the core focus of which is the link between psychology and neuroimaging. Since MEG facilities are not available in Maastricht, our capability in this area has been key to developing this partnership, providing complementarity to the high-resolution scanning facilities in Maastricht.

The Department has extensive research laboratory space and this has recently been supplemented by a major £1.6m extension to the Psychology building, providing extra research space for a number of groups, as well as purpose-built space for the sleep laboratories. The latter comprises two bedrooms equipped with PCs for running experiments, video cameras, speakers for playing auditory stimuli and a monitoring suite equipped with state-of-the-art polysomnography systems. Researchers from a number of other universities have benefited from our sleep laboratories by establishing new collaborations with our staff. These links with researchers at the universities of Birmingham, Cambridge, Leeds, Northwestern (USA), Sheffield and UCL have led to funding from the ESRC and the Waterloo Foundation, as well as high-impact publications. As discussed in Section 1, this research has considerable potential for impact. Family-friendly facilities for developmental research are housed in the Wolfson Suite. The main observational developmental laboratory has recently been entirely refurbished and equipped with state-of-the-art video cameras and recording facilities funded by an ESRC award. Our infant observational research forms the basis of one of our Impact Case Studies, and has also been instrumental in forging links with technology and engineering companies who have collaborated in developing a smartphone app to improve parenting and head-mounted infant cameras and biosensors for use in research. The Wolfson Suite also houses a new infant EEG laboratory established using start-up funds. This facility adds to the four other EEG laboratories in the Department that are available to all staff. Staff appointed in the assessment period have also used start-up funds to establish a new Virtual Reality facility and a purpose-built olfaction laboratory for investigating interactions between smell and cognitive/social processes; the latter was jointly funded by a University contribution of £130K. These major developments in the Department's research facilities are in addition to numerous other start-up investments in research resources to support new staff.

Important developments in advanced neuroscience methods are taking place in the Centre for Hyperpolarisation in Magnetic Resonance, which was created by the Departments of Chemistry and Psychology with additional involvement of researchers in the Department of Biology and the Hull–York Medical School. It is equipped with three NMR machines, a preclinical MRI system, a chemistry facility, low field MRI facility, biological preparation and incubator facility, and equipment for infra-red spectroscopy, gas–liquid chromatography and mass spectrometry. These developments hold out the prospect of novel, fast, high resolution imaging which will be used to develop animal models of ageing and neurodegeneration, and will continue to be a major focus of interdisciplinary research in our Department over the coming years.

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

Effective Collaboration

Collaborative research is highly valued at York and all staff are encouraged to develop broad research networks. Support is provided via research allocation funds distributed to all staff to enable conference attendance and visits to collaborators. As discussed in the sections above, a specific Impact budget supports links with end users of our research. The Department's broad-based research themes provide a central mechanism for facilitating effective collaboration by exposing staff to a wide range of potential collaborators; internal collaborations naturally lead to greater involvement with external collaborators (from other disciplines at York or other institutions) already contributing to ongoing projects. Our Research Facilitator also plays an essential role in fostering effective collaboration by publicising University events focused on the University Research Themes and organising scoping exercises for interdisciplinary collaborations and impact-related activities (e.g., meetings with NHS staff, a visit from Cabinet Office staff).

The success of these procedures for fostering collaboration is evidenced by the extent to which our researchers are sought after as collaborators. Of our total outputs over the assessment period, the majority involve authors from other institutions, and over a quarter of our grant applications included applicants from other institutions (29% of which involved an international collaborator). A number of our projects represent international collaboration at a grand scale: (a) a programme of research with McGill-University and the Sorbonne Institute is using very large data sets involving hundreds of MRI scans to shed light on the contribution of macro-scale cortical organisation to higher order cognition, (b) York data on parrots contributed to a *PNAS* paper exploring the evolution of self-control across 36 species, and (c) York data contributed to a large-scale study across nine laboratories worldwide that attempted to replicate findings on probabilistic prediction in language comprehension. The latter is one example of our commitment to reproducibility (see also Section 1).

Engagement with Non-Academic Audiences

Our industrial and public sector collaborators during the assessment period include *Bruker Biosciences*, *Unilever*, *Heinze Europe*, *MemRise*, *Reckitt Benckiser*, *Daimler*, *PluX-Lisbon* and *ICMobile Lab*. These collaborations with non-academic partners have resulted in a smartphone app to improve parenting, wearable cameras and biosensors to record and analyse infant psychophysiological signals in the home, knowledge on the social/cognitive implications of driverless cars and the commercialisation of next-generation magnetoencephalography. Several of these links are long-standing; for example, Tipper's research projects with Unilever span over 20 years. Researchers are also collaborating with the NHS to inform clinical practice in areas including sensory loss, breast cancer screening, autism, dementia, stroke and mental illness. Research at the York Neuroimaging Centre into hardware, analysis protocols and software implementation for MEG was exploited commercially by a start-up company, *York Instruments*, which traded from October 2015 until October 2019. This company won multi-million dollar investment from North America and provided 45 technically skilled jobs in York, representing a £1 million annual investment into the local economy.

Our research also has implications for educational practice and policy in relation to literacy, mathematics, sleep and children who have English as a second language. The UK Prison Service has benefited from our large-scale randomised controlled trials evaluating the effectiveness of programmes to manage offending behaviour. Government bodies (*Ministry of Justice*, *Home Office*, *Shengen*, *Swiss Security*, *Australian Senate* and *MoD*) are using our research to inform practice in police forces, border control, passport issuance and work in stressful environments.

Our goal in engaging with non-academic audiences is to involve them in shaping our research agenda and contributing to our research outputs rather than merely being passive recipients of our findings. We have achieved considerable success in achieving this goal, as

demonstrated by the wide range of non-academic affiliations for authors on our outputs over the assessment period: Unilever Research and Development Laboratories, Marwell Wildlife Park, Edinburgh Zoo, Riot Games, Australian Passport Office, Probation Trust Director of Public Protection, Durham Tees Valley Probation Trust, York Criminal Justice Economics, HMP Wetherby Young Offender Institution, HMP Hull, Tees Esk Wear Valley NHS Foundation Trust, Christchurch Hospital (New Zealand), York Teaching Hospital Department of Radiology, Brigham and Women's Hospital Department of Surgery (USA), Public Health England's Behavioural Insights Unit, Department of Education's Behavioural Insights Unit, and HM Courts and Tribunals Service. The York Neuroimaging Centre's scanning facilities are used by the NHS for diagnostic purposes and the Centre also hosts research projects of NHS investigators.

Finally, we have engaged with the public at large via reports of our research on broadcast media, featuring on *Channel 4*, *BBC 1*, *BBC 2*, *Sky News* and other international channels, as well as national and international radio. The Department's research and impact activities are also disseminated on social media via our Twitter account.

Contribution to Sustainability of the Discipline

We contribute to the sustainability of the discipline in many different ways. Our research and outputs are highly influential in shaping several sub-disciplines in psychology and inspiring the next generation of researchers. We support and advise other departments, both in the UK and overseas, through our work as external examiners and programme reviewers, with all but three members of our staff taking on these commitments during the assessment period.

Of the 18 staff we appointed during the assessment period, 15 were younger than 45. By appointing young lecturers and nurturing their academic careers, we are contributing to the discipline's sustainability by helping to establish the next generation of senior academics. In line with the University talent management practices of succession planning, our staff engage with the development assessment centre for academics who aspire to develop their leadership skills. The success of our approach is demonstrated by the fact that several young members of staff have been recognised as future leaders of the discipline: Horner was awarded the BPS *Spearman Medal*, Laird C. Cermak Award from the Memory Disorders Research Society and the Psychonomic Society *Early Career Award*, Over was awarded the BPS *Margaret Donaldson Prize* and a *Philip Leverhulme Prize*, Baker won the *David Marr Medal* from the Applied Vision Association and *Bernard Gilmartin Award* from the College of Optometrists, Slocombe won an *APA Distinguished Scientific Award for Early Career Contribution*, Cairney was awarded a *MRC Career Development Fellowship* and McNab was awarded a *Wellcome Trust Career Development Fellowship*. Researchers in the very earliest stages of their careers have also achieved success: *British Academy Postdoctoral Fellowship* (Mair), *ESRC Postdoctoral Fellowship* and *EPS Frith Prize* (James). Section 2 details the impressive grant income of our future leaders. These achievements are underpinned by our enhanced responsiveness to national and international priorities and initiatives, achieved by the work of our Research Facilitator, Director of Research and Impact Lead (described in the sections above).

Our ECRF plays a central role in ensuring the sustainability of the discipline by providing support and advice to our research students, postdoctoral researchers and junior members of academic staff (see Section 2). Our postdoctoral staff have authored numerous journal articles in this assessment period, providing them with a spring-board to future lectureship positions. Of the postdoctoral staff whose contracts ended during the assessment period, two-thirds continued in careers in research, 57% of whom secured lectureship positions. A further 20% of our postdoctoral staff went on to professional careers related to psychology.

Indicators of Wider Influence

The positive work environment we have created to support research that is innovative and rigorous is reflected in the awards with which our more senior staff have been honoured: *Member of the Most Excellent Order of the British Empire* (Summerfield), *EPS Bartlett Lecturer Prize* (Young), *US National Academy of Neuropsychology Lifetime Achievement Award*, *Major*

Advancement in Science Prize from the International Union of Psychological Science, *Honorary Degree, University of Bristol* and *BPS General Book Prize* (Baddeley), *Ammodo KNAW Award* from the Royal Netherland Academy of Arts and Sciences and *Benjamin Meaker Visiting Professorship*, University of Bristol (Majid), *Psychonomics Best Article Prizes* (Burton: Clifford T. Morgan award 2018; Jenkins: Cognitive Research Award 2018), two British Psychological Society *Cognitive Psychology Awards* (Andrews & Young, 2014; Burton & Jenkins, 2017) and *Web of Science* most highly cited researchers 2019 (Smallwood).

Members of the Department are Fellows of the *Royal Society* (Baddeley), the *British Academy* (Baddeley, Burton, Tipper & Young), the Academy of Social Sciences (Burton, Meins, Tipper), the *Learned Society of Wales* (Tipper), and the *Royal Society of Edinburgh* (Burton). They have also served as officers in learned societies during this REF period, such as *President of the British Science Association – Psychology Section* (Tipper), and *President of the Experimental Psychology Society* (Burton). Several senior members of staff have won funded fellowships allowing them to focus on research for part of the assessment period: *ESRC Professorial Fellowships* (Burton, Meins), *British Academy Research Fellowship* (Jenkins).

York researchers are actively engaged in the peer review process, with roles on a range of funding panels: *MRC Neurosciences and Mental Health* (Jefferies), *ESRC* (Gaskell, Mattys), *Leverhulme Trust* (Burton, Majid, Tipper), the *Stroke Association* (Jefferies), *ESRC Peer Review College* (Barraclough, Burton, Gennari, Jefferies, Meins, Tipper); *British Academy Committee* (Baddeley, Tipper), *UKRI Future Leaders Review College* (Quinlan), *EPSRC Peer Review College* (Burton), *NIHR* (Meins), the *Netherlands Scientific Organisation Committee* (Majid) and the *Ireland Postdoctoral Fellowship Scheme* (Quinlan). The majority of our staff have editorial commitments, with active editorial roles on almost 30 journals. Of course, all staff are continuously engaged in assisting with the reviewing of journal manuscripts and grant proposals.

Scientific societies and conferences remain a major focus for disseminating and exchanging ideas. Our staff have acted as members of organising committees for conferences and given invited and keynote lectures that are too numerous to mention. These lectures include contributions to conferences of various non-academic bodies that form an essential component of disseminating our research beyond academia and facilitating impact. Staff are regularly involved in the University's public engagement events, such as the Festival of Ideas and York Talks (IES, paragraph 13), and have delivered hundreds of public and outreach engagement activities during this assessment period.