Institution: University of Birmingham

Unit of Assessment: Psychology, Psychiatry and Neuroscience

a. Overview

This submission is based entirely in the School of Psychology, which is one of the largest in the country. The School is one of four within the College of Life and Environmental Sciences, which has invested heavily in the continuing success of research in the School, reflecting its position of prominence in the wider University. The School has long-standing areas of research strength, reflected in both the breadth and depth of its success across cognitive and behavioural neuroscience, forensic psychology, psychosis, ingestive behaviour, child development, language and cognition, vision and visual cognition. Since 2008 the School has built on its success in previous RAEs and on considerable University investment, with over 1000 peer reviewed journal articles, 17 books and 17 research prizes for our staff and research students. We have won over 100 grants between £1.3M and £50k coming from a very wide range of national and international funders including the European commission (20), ESRC (18), Wellcome (12), BBSRC (8), Leverhulme Trust (8), EPSRC (7), MRC (5) and the Department of Health (5). As detailed below, these markers of success are spread across our full range of research activity. The School houses four research centres: Birmingham University Imaging Centre, the Centre for Forensic and Criminological Psychology, the Cerebra Centre for Neurodevelopmental Disorders, and the Centre for Computational Neuroscience and Cognitive Robotics, providing points of focus for international recognition and large-scale funding. Our success is based not only on the strength of individuals' work, but also on the School's culture of encouraging collaboration among different areas of the School, interdisciplinary links with key local collaborators in Sport and Exercise Science, Computer Science and Engineering, and with many institutions beyond Birmingham (reflected in over 60 grants with national and international collaborators). This tradition has helped the School increase its grant capture in a challenging funding environment with changing national and international agendas that favour larger-scale interdisciplinary research. In adapting to these challenges we are launching a university-wide neuroscience programme, and are restructuring our strategic activity around a set of core research themes to enable strong responses to changing external funding priorities.

b. Research strategy

Strategy during the REF period. The 2008 RAE came shortly after the establishment of the Birmingham University Imaging Centre (BUIC). **Our first strategic aim** in 2008 was to consolidate the core work of BUIC, on sensory motor neuroscience and motor control, on supporting high-quality science, and maintaining and updating the infrastructure. Across the campus, BUIC has attracted £22M in related research grants, making it possible to update equipment, such as a recently-acquired 32-channel head coil for improved signal-to-noise performance. The success of BUIC is reflected in the University guaranteeing £0.5M internal support for funding bids to replace the scanner within 3-5 years. **A second strategic aim** was to broaden our research activity by building links between the new School research centres, and other areas of strength in the School and University. This has been achieved through the development of new infrastructure to support laboratory work with children (the Infant and Child Laboratory), which links with the Cerebra Centre; new appointments to bridge between existing areas of expertise in imaging, development, mental illness and criminal behaviour (A. Wood & S. Wood, McCleery, De Brito); and by the principle that new researchers may have access to scanning facilities regardless of funding. It has also resulted in the foundation of a new **Centre for Computational Neuroscience and Cognitive Robotics (CNCR).** This builds upon long-standing strengths in neuropsychology and sensory motor neuroscience, facilitating collaboration among cognitive psychologists and neuroscientists, computer scientists, engineers, roboticists, and rehabilitation scientists. Since its establishment in 2011 CNCR has brought in £11M in funding, generated high-quality research outputs, and has led to a range of industrial collaborations (see Impact Template). The fit between this work and UK national priorities is illustrated by George Osborne's recent speech to the Royal Society (9/11/2012), where he announced that robotics would be a priority area for government investment

in science. CNCR has brought 8 appointments across Psychology and Computer Science, provided by the University's initial major investment.

Our strategic aims over the next six years are focussed around 4 key areas: to build upon the success of CNCR by investment in new infrastructure and accommodation; to stay at the forefront of developing neuroimaging and electrophysiological techniques with new investment under the umbrella of BUIC; to establish cross-University neuroscience links with joint appointments; and to capitalise on our growing strengths in studying cognition and development across the lifespan. These aims are linked to our evolving profile of research strengths, and are tailored to national and international funding agendas in health and technology. In each case we will position ourselves to undertake larger and more ambitious projects that have higher impact than would be achieved with a less-coordinated approach.

First, strong **CNCR**-linked appointments and grant capture have enabled negotiations with the University to secure new accommodation that will co-locate researchers from Psychology, Engineering, and Computer Science, to enable significant leaps forward in the study of assistive devices, "smart prosthetics" and other human-robot/human-computer interfaces, and their application and commercialisation. **Computational neuroscience** will expand our understanding of complex biological and artificial systems and provide model-based approaches to behaviour and neuropsychological deficits, and link these studies to novel brain imaging analyses. We will build on existing strength in human, robot and computer vision, linking this with capacities for autonomous decision-making and intelligent action. We will apply insights from human sensory and motor neuroscience to the development of robots that can interact with dexterity and precision in realistic environments and machines able to interact safely and intelligently with users. We will build upon research in rehabilitation to develop human-machine interactions for a new generation of cognitive and assistive devices or training protocols for patients who have lost cognitive or motor function, including traumatic injuries. Our expertise in computational neuroscience is a vital input for devising these artificial systems, and for assessing their effectiveness in interaction with humans, and these implemented systems provide unique opportunities for testing theories about human perception and action. The University is developing medium-term plans to accommodate CNCR linked to a re-housed School of Psychology within one building complex, providing new accommodation and facilities for our rapidly expanding researchers and students. Our **second** key goal is to replace the 3T, research-dedicated MRI scanner at the core of **BUIC** and to co-locate MRI in the new School facility with existing neuroscience tools (fMRI compatible EEG/ERP and TMS), thus underpinning research in all our other key areas. New bioinformatics initiatives funded by the University will enable advances in mining large imaging data sets. We are capitalizing on the Birmingham-Nottingham partnership with a first joint appointment in MR physics (Mullinger), which will enable our continued access to, use and development of advanced MRI protocols and access to Nottingham's 7T magnet, and by a new joint appointment between the NHS, Psychiatry and Psychology that will seek biomarkers of Schizophrenia and dementia.

Third, in a further strategic move the School has recently received University funding via the Birmingham Institute for Advanced Studies to lead the creation of a cross-institutional **neuroscience initiative** linking groups engaged in neuroscience research and teaching across 16 departments. This initiative will extend our contribution to research-led training of elite, inter-disciplinary students in neuroscience and psychology at both under- and post-graduate levels. Moreover, cutting-edge research links being established as part of this initiative will enable us to bid competitively for large, centre-type grant funding and spawn new and innovative research across the breadth of neuroscience. We will investigate the mechanisms of neural information processing at all stages from perception to action using three novel multimodal approaches: (i) We will establish new research in the role of neural oscillations, a topic at the forefront of cognitive neuroscience, and we have 3 new appointments in this area (Shapiro, Wimber and Hanslmayr). (ii) We will move beyond "brain geography" towards a "neural networks" approach using concurrent fMRI/EEG (Bagshaw, Noppeney), resting state methods (Miall) and neural oscillations as mechanisms for communication between regions (Hanslmayr). (iii) We will investigate the causal role of oscillations and connectivity by perturbing neural processing using TMS or concurrent tACS-fMRI (Galea). We are developing our initial 2012 and 2013 ERP "bootcamps" (see Service to Discipline, below) into an annual event, with the addition of a research summer school in neural oscillations. As one example of intended future outcomes from the cross-institutional neuroscience program, a collaborative group from Birmingham and from the University of Nottingham is invited to

make a full proposal for a BBSRC sLoLa grant. This would investigate the physical and cognitive consequences of enforced inactivity (bed rest during recovery from illness) using many of the methods previously described. Our capacity to make further large funding bids of this kind is enhanced by Psychology's core role in the established MRC-ARUK Centre for Musculoskeletal Ageing and the Medawar Centre for Healthy Ageing Research, and by the School's role in the newly-created Institute for Translational Medicine.

Fourth, development to adulthood, and **ageing**. The School has a strong record of success investigating different facets of human development, including early psychosis, and child neglect (impact case studies 1 and 2), neurodevelopmental disorders (Cerebra Centre), cognitive and comparative development (early career prizes to Apperly and Beck), while ageing has featured as a component in several large-scale projects. Distinctively, rather than viewing child development as a topic in isolation, much of this work has examined developmental transition into the mature, adult state. For example, methodological innovations by Apperly and colleagues have made it possible to study theory of mind from 6 years to adulthood, and research by Birchwood and S. Wood has examined why the transition from adolescence to adulthood is a high-risk period for the onset of psychosis; identifying behavioural and neural risk markers, as well as mental health service interventions. Our strategic aims are to integrate this expertise in development to adulthood, exploit our strengths in neuroscience methods, and combine both of these strengths into a distinctive approach to ageing, with the addition of new appointments to support this theme in the coming year. Early evidence of success with this strategy comes from three 2013 grants: FP-7 strategic network grants on the neurobiology and treatment of conduct disorder in female adolescents (De Brito et al.), and on the neural basis of risk and transition to psychosis (S. Wood); and a Leverhulme Trust grant integrating expertise on cutting-edge cognitive and neuroscientific methods (McCleery, Apperly) and neurodevelopmental disorders (Oliver, Moss) to examine the development of social cognition in three populations. A key part of this strategy is integration of theories and methods innovated for studying early development into adulthood, which also enable new approaches to studying the elderly. Our diverse expertise will allow us to tailor applications to the many funding bodies that have placed research on ageing as a core strategic priority (e.g., EU, BBSRC, ESRC, MRC, and Wellcome Trust).

In a further initiative, recent investment to establish **genotyping** of our research participants is aimed to add value to a wide range of research in the School, across all keys areas outlined above. There is rapidly increasing awareness of the genetic contribution to both healthy variation in personality, cognition, and learning, and to psychiatric, developmental and health disorders. We have gained financial support from the College of Life and Environmental Sciences to collect saliva samples from the entire 2013 psychology undergraduate cohort. These will be assayed for a number of relevant Single Nucleotide Polymorphisms, securely stored so that further assays can be undertaken in the future, and results will be available to researchers, subject to our established ethical guidelines for such work. On the strength of this first phase we aim to secure funding to repeat this cycle in future years, and within the Developmental/Ageing and Neuroscience Initiatives we will strengthen our links with the experts in clinical and molecular genetics elsewhere in the University. Through this we intend genotyping to become an established method, easily accessible to researchers in the School but informed by specialists in this approach.

Research Structure and organisation

Research in the School is structured in two ways: Bottom-up organisation reflects the strengths and specialisms of individuals and groups of staff; while a top-down organisation allows the School to respond strategically to changes in the external research and funding environment.

Our **bottom-up structures** include well-established seminar series, the research centres, and collaborative groups sharing major infrastructure (Birmingham University Imaging Centre; Infant and Child Laboratory). Our seminar series provide focus and continuity for well-established areas of strength in the School, and are supported by School funds to enable seminar leaders to invite external speakers. These series are reviewed annually by the School Research and Knowledge Transfer committee, to ensure that they are well-tailored to current needs and interests, and to enable new series to be created in response to important developments in the discipline. For example, during the REF period a new seminar series on Social Cognitive Neuroscience was initiated in response to an emerging theme in the literature that brought together the interests of several long-standing and newly appointed staff. While major infrastructure and centres have often originated from top-down initiatives, once established they enjoy a high degree of autonomy.

Contributing members take responsibility for their management, with periodic reporting to the School. The success of these structures is reflected in significant grant capture and other markers of success and esteem that span widely across research groups. For example, BUIC has attracted £22M across the campus, the charity Cerebra recently awarded £1.2M over five years to maintain the Cerebra Centre for Neurodevelopmental disorders, and since 2008 two winners of the BPS Margaret Donaldson prize for early career research in developmental psychology have been members of the Infant and Child Laboratory.

Our **top-down structures** reflect an evolving response by the School to the increasing focus of policy-makers and research funders towards larger, interdisciplinary projects, in particular priority areas. We have adapted the organisation of the School to enable a co-ordinated approach to major new research themes that is not bound by static research topic areas or groupings. To oversee this strategy the School has established a Research and Knowledge-Transfer committee, with the key role of identifying a small number of research Themes that provide a strategic focus for research in the School. Each theme is led by a senior researcher as a formal component of their workload. Their job is to generate the necessary critical mass of expertise among internal and external collaborators, and to co-ordinate major collaborative grant applications. Themes have priority access to a portion of the School's budget for pump-priming research. They are expected to have a lifetime of just a few years, and are reviewed annually, changing in response to new research priorities, or because they have become self-sustaining (for example by becoming an established Centre). The committee is chaired by the School Director of Research, and attended by other key members of staff involved in research strategy at School, University and national levels (e.g., by sitting on funding council committees), and by senior staff involved in staff development review. The former ensure transfer of research intelligence on the priorities of funders and policy-makers, while the staff reviewers have oversight of current activity among staff, and thus our capacity to respond to these priorities. In 2013 the first phase of this new strategy is to establish a cross-school theme on development into adulthood.

Financial support for research. The School strategically allocates 25% of its non-pay budget directly to research, with an allocation model that allows all staff to have a small personal research budget, and to bid for additional funds to support specific projects. The Director of Research holds a budget that is used to pump-prime research activity, with significant portions of this being devolved to research theme leads. These funds are allocated via an annual competition, and are typically prioritised for supporting new theme-based and cross-disciplinary research, and for developing impact activities (see Impact Template). Our experience is that these activities are more difficult for individuals to establish than "standard", topic-specific, projects, and so benefit most from strategic pump-priming. All PhD students are allocated a budget to support their research. We also have two central funds for conference travel, for staff and graduate students, respectively. Staff can bid to the school equipment fund for small items, and in 2013 an equipment "library" was established, and will grow over the coming years, providing the most frequently requested items needed by research students. The College and University also run a variety of internal competitions for pump-priming funds and strategic block grant awards, which the School has a good record of winning, and of using to support external bids for funding. The Director of Research acts to highlight current opportunities to relevant members of staff, and to influence the agendas of these bodies by conveying the research priorities of the School effectively.

Seminar series and the annual research event are designed to strike the same balance between interdisciplinarity and specialist focus. School seminars are held regularly during term time and alternate between internal and invited external speakers. Speakers are expected to make their talks accessible to a wide audience and attendance is extremely high. We hold an annual 2-day research event that includes talks from PhD students, research staff, and faculty. A number of specialist seminar series provide a forum for integration across related research groups: there are separate bi-weekly meetings on clinical, forensic, developmental, language and cognition, CNCR/Imaging, and developmental disorders, and, as described above, the social cognitive neuroscience series was established during the REF period to promote new collaboration between research groupings. Numerous research workshops are held each year, including events sponsored by the University's Institute for Advanced Studies that supports cross-disciplinary work that has the potential to generate much larger future projects. Recent events include a workshop in human decision-making involving 70 academics from UK and international institutions. We are also particularly proud of our annual graduate-led workshops, funded by the School. These events are

well-attended internally, and draw a wide range of speakers and participants from outside of the University.

The School has a formal process of **peer review to support grant writing**, under the oversight of the Director of Research, to ensure that all applications benefit from review. All proposals receive a scientific appraisal from a qualified member of staff, a presentational appraisal from the Director of Research, and a technical appraisal from the College research support lead, who is highly familiar with the varying technical requirements of different research councils. Staff members who sit on grant panels provide one-to-one mentoring for staff applying to these funders. The Director of Research maintains a **library of previous successful grant proposals** from different research councils and funding schemes, which are made available to new applicants. In response to the growing importance of the "impact agenda" we have run **seminars on impact** and how to achieve it, and we have developed School-level schemes for public engagement, to which grant projects can contribute in order to achieve impact (see Impact Template).

The College and University organises regular **workshops on grant writing** for different research council schemes, specifically tailored for ECRs or more senior researchers. We supplement these with internal seminars in response to strategic need. In the past two years we have identified both the EU and charities as underexploited targets for grant applications, and we have held sessions where members of staff who have been successful with these schemes share their experience and advice with others. Monthly updates on relevant funding opportunities and deadlines are prepared by our College research support partner, and the School and College Directors of Research direct members of staff to specific schemes.

c. People

Staff recruitment strategy. The past 6 years has been a period of strategic expansion for the School. We have appointed twenty six new members, while fourteen have left. Many of these appointments have been in response to strategic developments in the School and the University, and as described in our Impact Template, we have recruited in order to bridge between areas of strength in "pure" and "applied" work, with the aim of extending the reach and impact of both. The new CNCR has provided a focus for attracting staff with expertise that spans neuroscience and computation (Noppeney and Bowman as professors; Beierholm, Bojak, Di Luca, as L/SL). McCleery was appointed with the establishment of the Infant and Child Laboratory, and Grunfeld as part of a University-wide research focus on Urban Resilience. We have enjoyed strong support and investment from the University through the Birmingham Fellows scheme, which has enabled us to recruit five outstanding young researchers in sensory-motor neuroscience (Galea, Mayhew), developmental neuroimaging (De Brito), development of culture in children and animals (Tennie), and psycholinguistic studies of participants with hearing impairment (Thompson). These researchers extend our range of activity, but mesh with our established strengths, meaning that we can offer excellent support for their career development. Finally, we have recruited to maintain strength in key areas of activity, including cognitive neuroscience staff using neuroimaging, MEG, EEG/ERP, TMS, and tACS/tDCS approaches (Hanslmayr, Mevorach, Noppeney, Raymond, Rotshtein, Shapiro, Wimber), forensic psychology (Woodhams), psychopharmacology (Lee) and social psychology (Stewart). Upcoming appointments for 6 new staff (primarily at senior level) will be made with the goal of strengthening existing areas of expertise in neuroscience and life-span development, and emerging links between clinical medicine and Psychology.

Sustainable staff structure. Through the new appointments described above we have been able to maintain our staff-student ratio over the REF period while managing a 25% increase in undergraduate numbers. To preserve the time research active staff can spend on research in the face of demands for increased contact time with students, we have also appointed two lecturers (Catling, Ludlow) and one senior lecturer (Büttner) on teaching-focussed contracts, all well-integrated into our research-led teaching culture. We encourage and support our staff for promotion within the School, with seven early career researchers in gaining promotion to senior lecturer during REF period, plus 6 promotions from SL to Reader or Reader to Chair.

Equalities and Diversity. A recent survey as part of the School's preparations for an Athena Swan Bronze application found generally positive views about the School's treatment of matters around equalities and diversity. Within the faculty genders are relatively well balanced, and women occupy prominent senior leadership positions, as director of BUIC (A. Wood), co-director of CNCR (Noppeney), director of education (Higgs) and director of postgraduate studies for both PhD (Beck)

and Masters (Raymond) programmes. We also have a workload log, which is transparent to all staff and enables them to see how workloads are allocated across gender. The Athena Swan process has also led us to rework our policies in relation to equalities and diversity to be more explicit and transparent. Importantly, while most of our current attention on equalities and diversity focuses on gender, our new policies will safeguard equalities and diversity in general.

The Athena Swan preparations highlighted return from maternity leave as a time when female staff experienced difficulty maintaining research in the face of competing responsibilities in teaching and administration. In response to this we have made significant changes. Firstly, staff returning from maternity leave (or equivalent paternity or adoption leave) will, for their first year of return, have the same reduction in teaching and admin afforded to new, junior, members of faculty (see below). In both cases the aim is to help protect time for research. Secondly, to assist with regaining momentum in their research, they will be guaranteed pump-priming funds for any suitable project. Thirdly, it is now an explicit principle that periods of maternity leave do not alter timing or entitlement to research sabbaticals. Appropriate representation of women on committees is now enshrined in the principle that the gender balance on committees should reflect the gender balance in the School, as should the gender balance among committee chairs. The head of school is responsible for most committee appointments, and to ensure transparency and oversight, figures on committee composition will be monitored by the Athena Swan working group, and presented annually to the School Strategy committee, which has the power to recommend changes where necessary. Our recent survey of the School also showed that most committee meetings, and many seminar series are scheduled during the middle of the day, so reducing potential clashes with caring responsibilities. As with committee composition, information on scheduling of such meetings will be monitored. Finally, it is a requirement that new staff undertake a Diversity in the Workplace training course as part of their induction to the University, and existing staff are strongly encouraged to take the training, with completion rates being monitored carefully.

Support for research and research time. In addition to **pump-priming funds**, described above, the value of **attending conferences** is recognised through annual allocation of £500 to each member of faculty, and University provides financial support to foster new overseas collaborations. This has led to collaborative grants with the University of Chicago, and the Birmingham-Guangzhou Brain Cognition Centre, China, and to Brazil and India. All staff have an annual **personal development review** with a senior member of staff in a relevant research area, where plans for projects, publications and funding are a standing agenda item. This regular support is enhanced by University-based Leadership Development Programmes, which are available to all staff. Workload in the School is managed in a flexible way so that permanent staff are entitled to apply for a one-semester **sabbatical** every fourth year, during which time they are relieved of teaching and administrative duties.

Support for new staff and early career researchers. Induction processes introduce new staff to the School and University, their local procedures, resources and opportunities for advice and support. Early career researchers are assigned a mentor, who will be an experienced member of staff within a linked research area, who advises on career development, research supervision, and training opportunities among the wide range of University courses on leadership, entrepreneurship, interpersonal skills etc. New lecturers are set objectives in a personal development plan, reviewed on an annual basis. To assist with establishment of their research, Lecturers have a reduced teaching and administration workload over their first two years, and continue to take fewer project students than more senior staff until their promotion. New Lecturers and Independent Research Fellows are also invited to attend a monthly lunch with the Director of Research, which provides an informal opportunity to meet other new staff, and to discuss commonly-occurring issues about establishing oneself as an independent researcher.

In line with the Concordat to Support Career Development of Researchers, **contract research staff have access to the vast majority of the support available to permanent members of staff**. For Personal Development Reviews they meet annually with a senior member of staff in a relevant research area, whose task is to provide independent advice on career choice, conference attendance, grant writing and training opportunities. This mentor can also provide guidance should difficulties arise between a PI and a research fellow. Grant writing support is equally available to research staff, and the School has a strong record of research contract staff gaining their own funding and independent fellowships, including ESRC Starting grants, RCUK Senior Research fellowships, and BBSRC David Philips and Wellcome Trust senior research fellowships. Research

staff in the School have also been successful in applying for Wellcome Investing in People awards, and Universitas 21 awards (6 in total) to gain research experience in other laboratories.

Representation, responsibility and participation by early career researchers. All staff are invited to School Committee meetings. A position on the School's Strategy Committee is reserved for a member of staff at lecturer level, enabling the participation of early career researchers in many aspects of School decision-making. A Research Staff Committee represents the interests of research staff and organises social activities, and the chair of this committee reports to the School Committee, and sits on the School Research and Knowledge-Transfer committee. The chair of the Research Staff Committee is a co-organiser of the School's annual research event, and research staff are actively involved in the School's research seminars. Research staff are encouraged to take on minor teaching responsibilities – such as organising a workshop, or supervising a project student – in order to gain experience that will be useful when applying for tenured posts.

Research Students.

We have a vibrant and diverse PhD student group, with 45 different nationalities represented among the 91 PhD students who completed in the REF period. **Doctoral funding and collaboration.** We are a key partner in the University's ESRC Doctoral Training Centre (one of the few single-institution DTCs in the country), in the BBSRC doctoral training programme run jointly with Warwick and Leicester, and the MRC-ARUK and EPSRC-Physical Sciences of Imaging in the Biomedical Sciences doctoral programmes. The high quality of our PhD applicants means we compete successfully for studentships from these centres, and from the College and University. We are a lead centre for one EU-Initial-Training-Network, and participate in another, and have been very successful with securing grant-linked studentships, including a number of programme grants from research councils (ERC) and charities (Cerebra, Wellcome). As described in the Impact Template, we have been able to use School and College resources, as well as ESRC and BBSRC CASE schemes to attract matching funding for 18 studentships from private and third-sector organisations.

Training. All PhD students attend the School's Taught Doctoral Programme, including compulsory courses in advanced research methods, and optional courses in topics ranging from "grounded theory" to Matlab programming. Many students also take courses from the University Graduate School, on thesis and viva preparation, and teaching. Most PhD students also gain valuable teaching experience through paid Teaching Assistance work, leading small group discussions, demonstrating on practicals, and marking 1st year research reports.

Progress monitoring. PhD students' progress and training needs are regularly assessed with their supervisors, recorded monthly on the University system and overseen by the Director of Postgraduate Studies. Formal progress monitoring and feedback occurs at 3 months (250 word summary), 9 months (5000 word report and viva voce examination with independent member of staff) and 24 months (thesis chapter / paper submitted for publication).

Strong and Integrated Research Student Culture. We create a number of opportunities for research students to participate in the academic life of the School. The School **Postgraduate Staff-Student Liaison Committee** meets four times a year, is chaired by the elected PhD student rep, and reports to the School Committee. Research students feature prominently at our **annual School research event**, with 1st year PhD and MRes students all presenting posters, and 2nd year PhD students all giving talks, alongside presentations from staff. An annual budget enables **research students to organise research workshops**, and they help organise School research seminars, at which they also frequently present. We involve research students in **outreach activities**, including "meet the scientist" events at Birmingham's Thinktank science museum, and Brain Awareness Week. From 2012 we have established an annual postgraduate workshop on **popular science writing and communication**, organised by research students and led by Dr Kenny Webster from Thinktank. The best short articles from this workshop have become part of the museum's displays. In addition to integration into the School, these experiences also prepare postgraduate students for conference presentations, and provide networking opportunities with other researchers.

Research Support and Facilities. All PhD students have **access to their own desk and computer**. The School **funds every PhD student to attend an international conference**. Students are encouraged to acquire **new research techniques** and use the equipment available in the school. School instructors and other members of staff organise workshops on techniques (e.g. eye tracking, EEG, transcranial stimulation) that PhD students are encouraged to attend.

Students who use fMRI in their PhD have free scanning time.

d. Income, infrastructure and facilities

The School has sustained and increased its **annual research income** throughout the REF period, winning grants worth over £5M in 2012-13. Excellent staff appointments, and institutional measures to maximise the quality of grant applications, have ensured this success despite the challenging funding environment.

The School has a wide range of **infrastructure and facilities**. Two mechanisms ensure that they achieve the maximum benefit for research in the School. Firstly, many facilities are housed in research space that is either freely bookable, or under the control of a committee of users. Secondly, for facilities housed in individual laboratories sharing is encouraged by our strong culture of collaboration, and by a School policy of prioritising pump-priming funds for collaborative projects.

Our largest facility is the **Birmingham University Imaging Centre**. BUIC is based around a 3T MRI scanner. MRC collaborative and co-operative grants supplied initial support positions in radiography, physics, and image analysis. Support from the University has ensured continuation of these positions. Equipment grants from the BBSRC (2), MRC (1) and ESRC have supplied major funds for stimulus delivery equipment. The Centre includes facilities for combined EEG/fMRI, for TMS and fMRI, for measuring eye, hand and limb movements, for providing controlled loads during hand movements, for high fidelity auditory stimulus delivery and for binocular visual displays. These facilities make BUIC exceptionally well-equipped for studies of perceptual-motor control. Data analysis takes place within a core functional imaging laboratory within the School, with recently renewed servers and data stores.

The **Infant and Child Laboratory** is a second major shared resource, established over the last four years as a specialist facility for developmental research. It houses an EGI EEG system, with nets to test participants between 2 months and adulthood; an Eyelink 1000 eyetracker that allows eye movement monitoring without head restraint; a sound attenuating booth especially for preferential looking time studies with infants; a large open laboratory area with multi-channel high-resolution video recording for both experimental and observational behaviour testing; a small behavioural testing room; and a reception/sitting room to host parents and siblings of participants.

In addition, the School houses three further EEG systems for testing adult participants, and two Biopac P150 systems and two MP36R systems for other forms of psychophysiological recording. It houses two further TMS systems with neuronavigation, three systems for transcranial current stimulation (tCS), and five eyetracking systems (Eyelink 1000 and Eyelink II). There are many individual laboratory spaces, including 19 bookable research cubicles equipped with up-to-date research computers and associated software.

Systems for maintaining and planning for the future. Firstly, the University of Birmingham underwrites funding council bids for substantial equipment, so we are not restricted by recent reductions in the proportion of equipment costs that can be recovered. Secondly, we have checks to ensure that equipment costs are included in funding applications, and to co-ordinate applications that could share the costs for expensive equipment. Thirdly, the School and College have annual competitive bidding processes for small equipment. Finally, in response to a growing expectation that major equipment be shared across departments and universities, we participate in the “M5” initiative, with the Universities of Nottingham, Leicester, Warwick, Aston, and Loughborough, which has created a joint inventory of research equipment, and a commitment to share access to these resources and co-ordinate on future bids. Complementing this we have recently entered into formal agreement with the University of Nottingham’s imaging group, gaining access to Nottingham’s 7T scanner and MEG facilities, and a shared physics post able to transfer new sequence developments between Nottingham and BUIC. Finally, we are currently seeking funding to replace our scanner, with the University committed to providing at least £500k. Integral to this development is the acquisition of high-quality new accommodation for the School, with the capacity to accommodate our continued expansion.

Policy and practice in relation to research governance.

All research in the School is subject to mandatory external **ethical review**, to oversee that it meets both local and external ethical criteria. Research involving clinical populations is subject to NHS ethical review. Our other work is reviewed by the University’s STEM ethics committee, comprised of academics and lay members. Members of the School (currently 5) act as reviewers

and provide expert advice on policy and practice. “Umbrella” protocols increase efficiency by covering clearly-defined kinds of work (such as eyetracking for text reading). If a new piece of work fits clearly within the remit of a protocol, then a researcher can receive fast-track approval.

e. Collaboration or contribution to the discipline or research base

We are widely engaged in the **peer review process** for both publication and funding. Such work is not only a critical contribution to the discipline, but also brings valuable expertise to the School. For this reason, contribution above normal expectations – for example, research grant board membership – is reflected in the School’s workload model, together with an expectation that such staff share their expertise, for example, by assisting with internal review of bids, and workshops on grant and paper writing.

Fourteen journal action/executive/guest editor positions: *Appetite; British Journal of Psychology (x3); Cortex; Diabetic Medicine; Early Intervention in Psychiatry; Experimental Brain Research; Frontiers in Cognition; Frontiers in Integrative Neuroscience; Journal of Intellectual Disabilities Research; Journal of Investigative Psychology and Offender Profiling; Journal of Neuroscience; Proceedings of the Royal Society, B; Qualitative Research in psychology*. **Forty-one Journal consulting editors**, including *Appetite, Health Psychology, Journal of Aggression, Journal of Applied Research in Intellectual Disabilities, JEP: General and JEP:HPP, Cognition, Pain, Journal of Neuroscience and Neuroimage*. Naturally, all members of staff are also involved in **ad hoc peer review** for journals across the entire range of our research activity.

Seven members of the school sit on **grant boards (**BBSRC x3); Diabetes UK; ESRC; Wellcome Fellowship interview panel x2), and twelve contribute to **grant panels** (for BBSRC; Cochrane Protocol reviewer; Epilepsy Research, UK; ESRC; ESRC postdoctoral assessor college; EPSRC; MRC; NIHR HTA; Scottish Research Management Authority; Wellcome Trust).

In addition to many ad hoc reviews for national funding bodies, members of the school also contribute to **international grant review**, including Australian Research Council; EU FP-7; FNRS (Belgium); NIH(USA); NSERC (Canada); Netherlands organisation for Health Research and Development; NSF (USA); Belgian Research Council, Belgian Princess Beatrix Trust, Binational US-Israel Science Foundation, Israel Science Foundation, CCS Israel, European Commission, German Volkswagen Foundation, The Netherlands NWO.

Awards and honours: Our success and esteem has been recognised in a number of awards and honours for our staff, including: BPS developmental section Margaret Donaldson Early Career Prize (Apperly, 2008; Beck, 2011); Jellinek International award for contributions to addiction studies (Orford); Early career prize from the European Association of Psychology and Law (Woodhams; 2010); BPS fellowship (Miall); Honorary Fellowships of the BPS and Society for Studies of Addiction (Orford); Vision Science Society Marr Medal (Welchman); American Psychosomatic Society, Paul D. MacLean Award (Derbyshire); Experimental Psychology Society Early Career Prize (Apperly); Significant Achievement award from the (American) Association for the Treatment of Sexual Abusers & Senior Award, Division of Forensic Psychology, British Psychological Society (Beech); Cognitive Neuroscience Society, Young Investigator award (Noppeney); BPS cognitive section prize (for best publication in 2011; Mavritsaki et al, 2011). We are particularly proud that this success is also reflected in **awards for our postgraduate students**: Society for the Study of Behavioural Phenotypes, Pat Howlin prize for early career research (Bull); Association for the Treatment of Sexual Offenders, graduate student award (Bartels); British Association for Psychopharmacology, Hannah Steinberg award (Thomas); BPS Junior Award in Forensic Psychology (Elliott).

Members of the School have also been awarded a number of **visiting Fellowships:** to UC Berkeley & UC Davis (Raymond); University of Macquarie (Apperly); Neurological Research Centre, Guangzhou (Bickerton); Queens, Belfast (Galea); Rikkyo University, Tokyo (Beech); University of Keio (McCleery); McGill (Schofield).

Keynote presentations: Breadth of recognition for work in the School is reflected in more than half of our staff (23) giving invited keynote presentations or plenary conference symposia, at events including the Annual Meeting of the Royal College of Psychiatrists, the Society for the Neural Control of Movement, the International Gambling Conference, and the European Society for Philosophy and Psychology. Our reach in these activities is both national and extensively

international, including conferences in many European countries, the USA, Japan, China, Taiwan, Hong Kong India, Australia, New Zealand, Israel, South Africa and Puerto Rico.

Service to learned societies. Members of the School are widely involved in academic service, illustrated by the following positions: Treasurer of European Society for Philosophy and Psychology (Apperly); Vice chair of Child Abuse Prevention, Child Abuse and Neglect: BASPCAN (Dixon); Secretary of the Society for the Study of Ingestive Behavior (Higgs); Board member, Neural Control of Movement Society (Miall); Chair, European Depression in Diabetes (EDID) Research Consortium; Chair, International Association for Attention & Performance (Raymond); Chair, Applied Vision Association & Organiser of AGM of Applied Vision Association, 2009 & 2012 (Schofield); Board member, International Early Psychosis Association (S. Wood). **Many members of the School have been involved in local, national and international conference organisation.** These include the following: Computational Principles of Sensorimotor Learning (Miall et al.); 2nd Joint Applied Vision Association / British Machine Vision Association meeting on Biological and Machine Vision (Schofield); Royal Society meeting on Active touch (Wing et al.); Workshop on Interpretive Phenomenological Analysis (Larkin); Connectivity inference in Neuroimaging (Noppeney); Rhythm production and perception (Di Luca, Wing); Programme committee member of the Society for the study of Ingestive Behaviour from (Higgs); Psychology program chair for European Society for Philosophy and Psychology (Beck).

Collaboration and service as expert advisors on policy. International. Consultant to the Dutch Government's Samsom Commission into sexual abuse in institutions and foster care (Beech); Scientific Committee Member, InPACT 2013 (Hamilton-Giachritsis). **National.** Management Board, NIHR West Midlands Stroke Research Network (Bickerton); NICE clinical guideline group schizophrenia (revision) and NICE guideline group, Children and young people with psychosis (Birchwood); Member of the National Steering Group for Feeding Disorders (Blissett); Invited presentation to Scottish Parliament (Dixon); Experts panel Philips Avent Breast feeding compliance Istanbul; Experts workshop texture acceptance, Danone, Amsterdam; Expert Witness force feeding The Old Bailey (Harris); International Life Sciences Institute Europe: Eating Behaviour and Energy Balance; Member of expert group on sweeteners (Higgs); Member, Executive Committee and Scientific Advisory Board, Australian Pregnancy Register for Women with epilepsy and Allied Disorders (A. Wood).

Service to development of the discipline and postgraduate education. The School is a major national contributor to professional training in clinical and forensic psychology. There have been 140 doctoral-level graduates from the ClinPsyD and ForenPsyD in the REF period, and many other students attend for continuing professional development, and courses at masters and diploma level. In 2012 and 2013 the School hosted Europe's first "ERP bootcamps" in advanced ERP/EEG recording, led by Prof. S. Luck of UC Davis, whose work in developing these activities is recognised through a .2 contract in the School. Together with the new Neuroscience Initiative, these 3-day events will cement Birmingham's international profile as a centre of excellence in training and use of neuroscience methods. **Externally**, two members of the School sat on the 2010 International Benchmarking Review of UK Psychology (Beech; Wing). Many other members of staff act as external postgraduate program examiners at other institutions, including Universities of Kingston, Warwick, Essex, Kent, Surrey, Sheffield, and UCL.

Our collaborations with many other universities are reflected in our many collaborative grants. We list those of one year or more: **Twenty nine have been held with institutions in the UK** (Bangor (x2); Cambridge; Cardiff; Edinburgh; Edinburgh/UCL; Kent (x2); Kings, London (x2); Manchester; Nottingham; Newcastle; Oxford (x5); Oxford/Brunel; Plymouth; Queens, Belfast; Sheffield; University of the Arts; UCL; Warwick (x2); Multi-site); **Nineteen have been held with European partners** in Germany, France, Spain, Italy, and Austria, and notably, major ERC-funded multi-partner projects: EU FP7 projects (x3); EU-ITNs (x2); EU STREP (x2); HFSP multi-partner grant (x2); **Sixteen grants have been held with Overseas partners:** University of Chicago (x3); University of Minnesota; Harvard; Michigan State University; UC-Davis; Duke & Singapore; University of Cape Town; Guangzhou First Municipal People's Hospital; University of New South Wales; University of Melbourne (x2); Keio University, Japan; Tamagawa University, Japan.