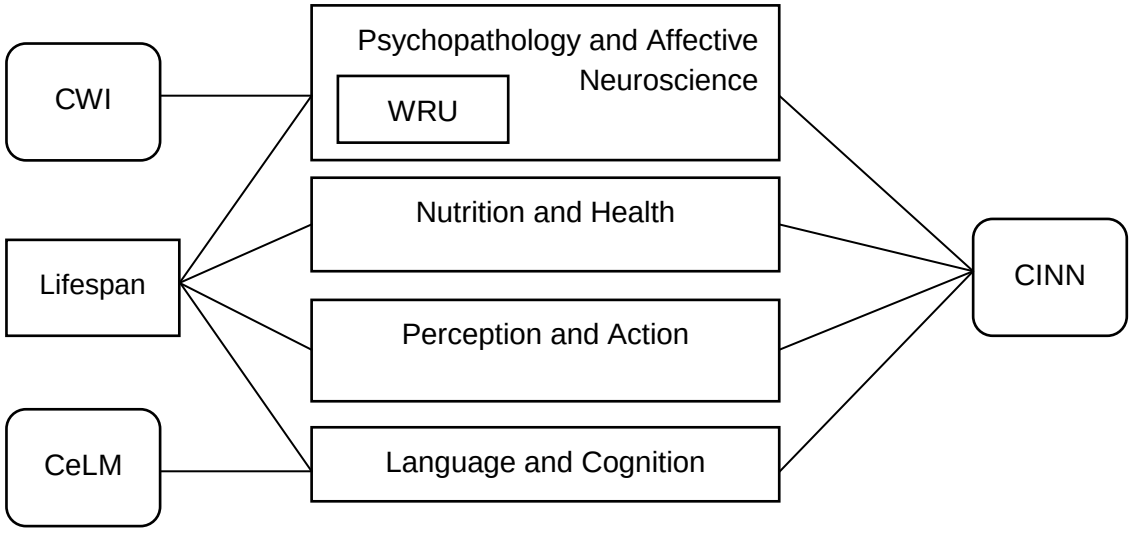
Institution: University of Reading

Unit of Assessment: 4 Psychology, Psychiatry and Neuroscience

a. Overview

The School of Psychology and Clinical Language Sciences at Reading (PCLS) has expanded significantly since 2008 (40 FTE submitted in 2013; 29 for UoA44 in 2008), having benefited from a major University investment in posts and infrastructure to consolidate the School's key areas of strength. Researchers in the School make a world-class contribution to psychology and neuroscience across a number of disciplines and in many areas are in a unique position to bridge the gap between fundamental and applied research including, in particular, the treatment of clinical disorders. The School reaches out to the local community in a variety of ways including, unusually, hosting two large-scale NHS-funded clinics within the School which ensures that fundamental research is both informed by and influences new approaches to patient treatment.
Interactions between researchers in the School are supported through four research groups (*Psychopathology and Affective Neuroscience*; *Nutrition and Health*; *Perception and Action*; *Language and Cognition*) including many cross-group links fostered by the Neuroscience and Lifespan themes, so that researchers from both departments (Psychology and Clinical Language Sciences) belong to at least one group and at least one cross-School theme. This structure successfully promotes multi-disciplinary interactions. The School hosts a number of research centres including the Winnicott Research Unit, Charlie Waller Institute of Evidence Based Psychological Treatments; the Centre for Integrative Neuroscience and Neurodynamics; and the recently-formed Centre for Literacy and Multilingualism, each of which have a distinctive research mission aligned to relevant national and international research priorities and a focused approach to raising research income.



Relationships between research groups and the Charlie Waller Institute (CWI), Winnicott Research Unit (WRU), Centre for Integrated Neuroscience and Neurodynamics (CINN), and the Centre for Literacy and Multilingualism (CeLM).

b. Research strategy

The research strategy of the School is based on establishing the underlying neuroscientific basis of disorders and developing evidence-based interventions that will achieve a marked scientific and clinical impact. In order to accomplish this, the School will build on its highly

respected reputation in (amongst others) psychopathology, lifespan, and language research. Across the School, research will remain strongly interdisciplinary with both the research group/theme structure and the appointment strategy for new staff fostering this goal. For example, the University's strategic investment in neurodynamics and neural field theory between PCLS, Maths and Systems Engineering has established Reading as a world-leading centre in this novel, multidisciplinary area and will lead, during the next REF period, to a major University-backed collaboration to apply data assimilation techniques developed by Meteorology to neural field models pioneered by CINN. The collaboration with Food and Nutritional Sciences and Pharmacy on flavonoids and cannabinoids will soon move to Phase II clinical trials and will lead to increased investment in this area. The new Centre for Literacy and Multilingualism, in which the University has made a £1.5M investment (with 3 new Academic Investment Project posts including two at Professorial level), brings together international experts in the field to provide a new hub for research into linguistic, clinical and educational aspects of multilingualism and literacy. These initiatives come at a time of significant growth in the School, including an increased number of academic research posts. This is set to continue during the next REF period, reflecting the expansion in undergraduate and postgraduate intake. The School has thriving links with industry and will continue to diversify and expand its sources of research funding. A key component of the School's strategy will be to establish a large-scale clinical facility at the University of Reading, in which the School will play a major role. This will reinforce the strong emphasis in the School on fundamental research that informs, develops and evaluates clinical treatments. The plan is to add a Memory Clinic to the two existing NHS units located in the School (Berkshire Child Anxiety and Speech and Language Therapy clinics), to expand into adolescent care and set up an Autistic Spectrum Disorder diagnosis clinic to serve the South of England. A new School advisory board drawn from industry, the NHS, education, academia and Local Government will help to inform the School's strategy and widen the reach and influence of its research.

Psychopathology and Affective Neuroscience (PAN) group (**Chakrabarti**, **Christakou**, **Cooper**, **Creswell**, **Dodd**, **Harvey**, **Ho**, **Johnstone**, **McCabe**, **Murray**, **Reynolds**, **Salomons**, **Steel**, **van Reekum**, **Vogt, Williams** (T))

The overarching research strategy will be to ensure that clinical benefits derive from PAN's internationally-recognised research on the neuroscience and clinical aspects of psychopathology. The group's current research is dedicated to identifying the processes leading to psychopathology and to improving treatments for depression, anxiety, psychosis, eating disorders and autism in children and adults. Members have affiliations with the Winnicott Research Unit (which studies the interplay between environmental and biological factors in child development), the Charlie Waller Institute of Evidence Based Psychological Treatments, the Berkshire Child Anxiety Clinic, the Berkshire Autism Research Network and the Centre for Integrative Neuroscience and Neurodynamics. Members are strongly inter-connected with joint grants, jointly supervised PhD students, and joint meetings and conferences organised in Reading. They combine expertise in a range of methods including behavioural genetics, EEG, ERP, fMRI, TMS, psychopharmacology and behavioural observation. Over the next REF period, the group will extend its reach into clinical areas by expanding the CWI remit to include the treatment of depression and anxiety in adolescence; validating basic clinical work on neural biomarkers for depression in clinical groups; and developing an evidence base to assess and remedy atypical social behaviours in autism. In all of the following examples, systematic research into development and maintenance mechanisms, leading to piloting of interventions and, finally, the conduct of clinical trials in the NHS, means that the impact of this research is likely to be widespread and profound.

Examples of the group's basic and applied research concern the impact of postnatal depression on offspring development, with large-scale longitudinal studies showing specific causal pathways to disturbances in both the cognitive and emotional outcome of children and adolescents (Murray *et al*. (2008, 2011), *Child Dev., JAACAP*). This research has led to the development of a targeted intervention that is currently being evaluated in a clinical efficacy trial in the UK and a mother-infant intervention in South Africa (Cooper *et al*. (2009), *BMJ*), now widely adopted within the South African NGO sector. Similarly, through a large-scale RCT in the Berkshire Child Anxiety Clinic, the group has developed a first-line intervention for child anxiety (Thirwall et al. (2013), *BJP*) that is currently being systematically evaluated in primary care services across Oxfordshire (£325K NIHR grant to **Creswell**). Together, this basic and applied research stands to have a major impact on

the management of child anxiety disorders in the NHS.

The group carries out closely related fundamental research on Affective Neuroscience, with many grants held either jointly between clinically-oriented and neuroscience members or with a strong focus on clinically-relevant outcomes (e.g. £356K MRC grant to **Cooper**, **Murray**, **Johnstone**; £532K BBSRC to **Johnstone**; £480K MRC to **Chakrabarti**). The strategic aim is to build on the group's established international reputation for identifying cortical and sub-cortical mechanisms involved in emotion regulation and the way in which these influence disturbances of affect and empathy, including anxiety, depression, and autism. Highlights of the group's research include the demonstration that development of cortico-striatal connectivity during adolescence is associated with indices of improved, foresighted decision-making (Christakou *et al.* (2009), *JNeuroscience*); coupling between amygdala and pre-frontal cortex predicts individual variation in the ability to regulate emotion (Lee *et al*. (2012), *NeuroImage*); variations in fronto-striatal activity predict the capacity of individuals to maintain positive emotion in major depression (Heller *et al*. (2009), *PNAS*) and, in autism, atypical organisation is present in parts of the cortex that preferentially respond to self-information (Lombardo *et al.* (2010), *Brain*).

Language and Cognition (**Athanasopoulos**, **Beaman**, **Bose**, **Butler**, **Ellis**, **Feredoes**, **Ho**, **Houston-Price**, **Loucas**, **Marinis**, **McCloy**, **Meteyard**, **Murayama**, **Riddell**, **Robson**, **Rothman**, **Saddy**, **Sakaki**, **Schafer**, **Stojanovik**, **Tsimpli**)

The Language and Cognition group will, like PAN, develop a greater evidence-based clinical focus informed by theory and modelling. There will be a significant expansion of the Speech and Language Therapy Clinic and the School will introduce a new Memory Clinic for older adults with suspected dementia. The plan is to bring together the assessment and treatment of language and cognitive breakdown in groups that typically have been studied in isolation from one another (e.g., autism, Williams, Alzheimer's, Parkinson's, stroke). The Centre for Literacy and Multilingualism (CeLM) will contribute to this strategic goal. Recently launched, and having attracted major EU funding (CeLM leads one of three work packages in a €5M EU grant representing the main EU investment in multilingual research), the Centre brings together researchers from Linguistics, Modern Languages, Education, Psychology and Neuroscience to understand better the interaction between literacy, language and cognition in multilinguals. Thus, in the area of language research, Reading will provide a unique confluence of expertise in a single centre for basic research in multilingualism and the delivery of treatment.

In addition to literacy and multilingualism, the Language and Cognition group also focuses on language and cognitive processing and on neurophysiological mechanisms underlying atypical language performance. It is driving the international research agenda in a number of these areas. Two large-scale studies have demonstrated dissociations between typically developing bilingual children and children with Specific Language Impairment (Marinis and Saddy (2013), *Lang. Acq.*). The group has developed new models of second and third language acquisition (Rothman and Cabrelli Amaro (2010), *Bilingualism: L&C*) and demonstrated an implicit effect of language-specific terminology on human colour perception (Thierry *et al.* (2009), *PNAS*). The group will investigate the effect of different types of bi- and multilingualism on cognitive abilities and executive functions. The research will lead to evidence-based interventions and inform multilingual language policy. Highlights of the group's work on cognitive processing in typical and atypical populations include the discovery that maintenance of working memory information by posterior areas in the brain is dependent on activity in the frontal cortex (Feredoes *et al*. (2011), *PNAS*). Boosting memory and improving students' learning is a potential outcome of the group's work, based on research on the neural mechanisms by which intrinsic motivation and extrinsic incentives interact in the brain (Murayama *et al.* (2010), *PNAS*).

Perception and Action (**Field**, **Glennerster**, **Ho**, **Holmes**, **Horwood**, **McSorley**, **Riddell**)

Much perceptual research investigates observers' passive responses to stimuli. By contrast, the research strategy of the Perception and Action group has been to focus on the more natural cases of an observer responding to changing stimuli with motor outputs such as saccadic eye movements, accommodation and vergence movements, rapid hand movements, navigation and control of steering. As with other groups, there will be a strong clinical focus to the research, influencing clinical practice in relation to the development of normal binocular vision, hand-eye

coordination in children with Developmental Coordination Disorder (eg a recent £461K MRC grant to **Holmes**) and evaluating new methods to improve speech deficits in degenerative neurological conditions. The group will develop its computational focus, expanding on current links with *Microsoft Research* in Cambridge and the Robotics group in Oxford (eg recent £420K EPSRC grant to **Glennerster**) and will contribute to a broader understanding of the key problems in perception and action, partly through a growing collaboration with members of Philosophy in the new University of Reading Centre for Cognitive Research.

Highlights of the group's research include a demonstration that the internal representation of visual space is unlikely to be a single entity with a one-to-one mapping to the external world, which has been the subject of a long-standing debate in visual neuroscience (Svarverud *et al*. (2012) *PLoS*). A high-fidelity virtual reality laboratory in the School makes this type of investigation possible and has now been used as a model for virtual reality labs in Bristol, Aston and UCL. The group has identified a region of parietal cortex that is selectively stimulated during active steering and proposes a unifying explanation for a wide range of paradigms affecting this region (Billington *et al*. (2011), *Proc. Roy. Soc.*). In more clinically-focussed work on young children, the group has identified the pattern of accommodation that predicts successful treatment outcomes in early hypermetropia (long-sight) with important implications for management (Horwood and Riddell (2011), *BJOphth*).

Nutrition and Health (**Butler**, **Ellis**, **Field**, **Harvey**, **Ho**, **Houston-Price**, **McCloy**, **Williams (C)**). This group has a particularly close working relationship with industry, including an exciting collaboration on developing novel anti-epileptic therapies. In relation to nutrition, the group studies the interplay between dietary intake and measures of psychological well-being such as cognitive performance, food preference, mood, and quality of life using a wide range of techniques (e.g. neuroimaging, survey methods and randomised controlled trials) and population groups (e.g., breast-feeding mothers, infants, older adults and patients with mild cognitive impairment). Goals for the next REF period include: developing interventions to improve quality of life (e.g. in Huntington's disease); collaborating with companies to develop pharmaceutical products (e.g. GW Pharma); informing public policy and designing interventions to encourage healthy behaviours (e.g. recent £523K ESRC grant (**McCloy**) with Agriculture on cognitive biases in food demand).

The group has demonstrated the potential effect of behavioural interventions, for example showing that children's eating habits can be modified by exposure to pictures of foods in books they take home to read (Houston-Price *et al*. (2009), *JECP*). Improvements in spatial working memory induced by a high flavanoid diet were documented by the group and linked to *de novo* protein synthesis in the hippocampus (Rendeiro *et al*. (2012), *Psychopharm*) with implications for the development of nutraceutical foods. Rapidly developing work on the anti-epileptic properties of particular cannabinoids has shown strong evidence that seizures can be minimised in both acute and chronic conditions (Hill *et al*. (2012), *BJPharm*) based on *in vitro*, slice and animal models. This work is an example of flourishing cross-disciplinary collaborations within the University and of the increasingly close ties that the School has with the food and pharmaceutical industries (e.g. recent £977K GW Pharmaceuticals grant (**Williams**, **C**) with Pharmacy).

Lifespan theme. Research on lifespan development remains a major strength of the School. Weekly meetings bring together researchers from all the above groups covering development of typical and atypical language, reading, binocular vision, parent-child interactions and healthy eating behaviour, many of which are examined in both older adults and children. Research across the Lifespan theme is critically underpinned by two large participant panels the School has built up, one of infants and their parents (with over 8000 members since 1996) and a more recent one of older adults (currently over 400 members).

Neuroscience theme. During the current assessment period, Neuroscience research has blossomed in Reading (see section *c* on appointments and *d* on infrastructure). CINN is based in the School but includes members from Mathematics, Systems Engineering, Pharmacy, Food and Nutritional Sciences and the Henley Business School. University-wide support for Neuroscience research, through core funding and investment in a wide range of posts in many different Schools, has generated a critical mass of neuroscientists so that Reading now has an international

reputation in several areas including neural field theory and emotion regulation. CINN holds bi-weekly lunchtime seminars to discuss recent results and plans for experiments, and maintains a NeuroHub platform for disseminating information, coordinating scheduling of resources and maintaining a secure workgroup environment.

c. People, including:

i. Staffing strategy and staff development

The School's staffing strategy in relation to research has been to build on existing strengths in order to maintain and enhance the School's international standing in areas where it is already prominent and to cement links between groups where this will generate a greater critical mass. The appointment of **Tsimpli, Athanasopoulos** and **Rothman** (from Universities of Thessaloniki, Newcastle and Florida) illustrates the international draw that the School exerts and exemplifies the strategy of recruiting in concentrated areas of strength. All three have taken up major investment posts funded by the University to set up the new Centre for Literacy and Multilingualism. Similarly, in neuroscience the School and CINN have been boosted by the appointments of **Feredoes** (UCL), **Murayama** (UCLA), **Sakaki** (USC), **Salomons** (UToronto), **Holmes** (HUJI, Israel), **Chakrabarti** (Cambridge), **Christakou** (IoP), **McCabe** (Oxford), making the School a flourishing hub for neuroscience within the University. With other members of CINN, this group of researchers now has an established international reputation. Similarly, the appointments of **Reynolds** (UEA) to head the Charlie Waller Institute (CWI) and **Dodd** (UEA), who studies the development of child anxiety, consolidates the position of the School as a leading centre in the country for the development, evaluation, and dissemination of evidence-based psychological treatments and supports the strategy of increasing the clinical impact of fundamental research on psychological treatment carried out across the School (especially WRU and PAN). Throughout the School, there is extremely effective integration of clinical academics and NHS-employed active researchers, as described in section *b* for clinics in Speech and Language Therapy and Child Anxiety. Indeed, several academics hold honorary NHS contracts (15 staff in all, including **Creswell**, **Horwood**, **Williams** (T)), so patients participate in much of their research.

The remarkable success rate of the School's recent appointees in grant applications is a testament to the efficacy of the mentoring scheme, under which early career staff receive close scrutiny and assistance when applying for their first grants. As early career researchers (ECRs) **Holmes**, **Chakrabarti**, **Christakou, Johnstone**, and **van Reekum** have all been awarded New Investigator Awards from MRC, BBSRC or HFSP (total value over £2M). The University Research Endowment Trust (RET) scheme has provided critical support to staff at an early stage in their career by funding pilot experiments to gather preliminary data for larger grant applications and enabling them to establish a thriving research group (total grant support from the RET scheme during the REF period has been over £200K). External funds for pump-priming also enable ECRs to pilot work in advance of grant applications, including £400K for pilot projects funded by EPSRC. Early career staff are integrated within the supportive research culture of their research group(s), with several examples of young staff applying for grants jointly with other staff after they have succeeded in obtaining their New Investigator grant. More established staff have the opportunity to apply for research leave and also take part in the grant mentoring scheme. Teaching load in the School is reduced by the appointment of teaching-intensive staff which, across the two departments, totals 6 FTE. The School encourages and supports the career progression of successful staff and, during the assessment period, has seen a total of 22 promotions: to Senior Lecturer/Associate Professor (8), Reader/Associate Professor/Research Grade 8 (10) and Professor (4). The School has also succeeded in retaining staff who were offered positions elsewhere, including the University of Cambridge. This is a testament to the growing reputation of the School's research environment in key areas.

The University of Reading was among the first 10 UK universities to win the European Commission Excellence in Research Award for implementing the national and local Research Concordats for research staff. In line with the Concordat, and supported by the University Centre for Quality Support and Development (CQSD), the School ensures that each member of research staff receives an induction, agrees a statement of objectives and responsibilities with their PI, and

is mentored by an experienced academic member of staff other than their PI. In addition, they receive an annual Staff Development Review to assess progress and consider career progression. Researchers are encouraged to teach and supervise students where appropriate, including co-supervision of PhD and MSc students, and receive training for this from CQSD. It is expected that research staff, like academic staff, will spend a minimum of 5 days each year on professional, personal and career development. Research staff play an active role (and often coordinate) meetings of the Research Groups and, like staff, they attend School Staff Meetings. The School has recently received an Athena SWAN Award and has a working group that continues to monitor and improve equality and diversity in the workplace.

ii. Research students

Since RAE 2008, the School has acheived a significant increase in research student numbers: entries per year have risen substantially since 2008, with 32 new PhD researchers starting in 2013/14. This success has been dependent on a variety of awards including an ESRC doctoral training centre for social sciences (South East DTC) and a School-specific MRC Doctoral Training Grant for PhD studentships on the 'development of affective regulation and disturbance'. In addition, the School has won several University-wide EPSRC Doctoral Training Grant studentships and has been particularly successful (5 currently) in winning Felix Scholarships (open to Reading, Oxford and SOAS) which boost the already strong connections with Indian and African research organisations (eg National Brain Research Centre, India and University of Stellenbosch, South Africa) within the School. PhD places have also been awarded to individuals through CASE awards with Royal Berkshire Hospital and Unilever, two MRC Training Fellowships and a Microsoft PhD Scholarship.

All PGRs in the School have both a first and second supervisor and, in addition, are allocated two 'monitors' for the duration of their degree who provide bi-annual feedback to students and supervisors on the basis of written progress reports and an annual interview with the student. The rigour of this regime maintains constructive pressure and ensures a very high completion rate within 3½ years (and 100% completion within 4 years). PGRs now also undertake a training and professional development programme at the new Graduate School and the CSQD which include courses on academic writing and career management. All PGRs' research is fully resourced and PGs have access to Research Training Support funds for travel and conference attendance. Research students are strongly integrated within the research culture of the School, often coordinating the weekly meetings held by each research group (these, unusually, include undergraduate project students in most groups). In the final year, PGRs present their PhD findings in the same internal seminar series as staff. Students from the School have been highly successful at moving straight from their PhD into jobs in academia (e.g. Harvard), government (e.g. Cabinet Office) and industry (e.g. Glaxo Smith-Kline).

d. Income, infrastructure and facilities

Research Income.

Many different funding bodies support research in the School, extending from EPSRC- and NERC-funded projects in collaboration with Maths and Engineering through to MRC-, NIHR- and charity-funded projects for more clinical projects. The funding the School receives through NIHR is a good example of the patient-focused but academically rigorous approach that is common to many groups within the Unit of Assessment. **Horwood** and **Riddell**, for example, have been funded to investigate the development of vergence and accommodation control in children through MRC and NIHR grants for closely related projects with emphasis respectively on basic and clinical aspects of this problem. Research on child anxiety has a similar pattern of funding across both sides of the patient-focused/academic boundary. The large majority of the School's income during the assessment period has been from UK Research Councils and the British Academy (£7M) but there has also been funding from a diverse range of other income sources (total £2.8M) including charities (Autism Speaks, Felix Trust, Wellcome Trust, Parkinson's Disease Society, European Huntington's Disease Society, Leverhulme Trust, Nuffield Foundation), EU and international

funding agencies (EU-Autism Imaging Multicentre Study, FP7, HFSP) and industry (GW Pharma, Granada Learning, PepsiCo, Ella's Kitchen).

Research infrastructure and facilities.

The School has seen unprecedented investment in its research infrastructure and facilities, having received a major University investment in equipment and refurbished space in a number of areas, most notably the Centre for Integrated Neuroscience and Neurodynamics (CINN) which is based in the School. The Centre has generated significant research income over the REF period (more than £6M in total across the University) and is essential to the research of many members of the School. In addition to the major awards to established members of the School (**Saddy**, **Butler**, **Johnstone**), several new members of the School have won grants dependent on research based in CINN (**Holmes**, **Chakrabarti**, **Christakou**, **van Reekum, Robson, Meteyard, Bose,** and **Tsimpli**). Equally, attracting new, high-quality academic staff (most recently, **Feredoes**, **Murayama, Sakaki, Salomons**, and **McCabe**), is critically dependent on the state-of-the-art facilities in CINN which include a 3-Tesla fMRI scanner, two high-density electroencephalography (EEG) systems, a high-speed eye tracker, a transcranial magnetic stimulation system and a bioelectric physiological recording system, all of which are MRI-compatible. A dedicated hybrid (CPU and GPU) cluster allows researchers adequate computing power and storage. In the next REF period, CINN will collaborate with Meteorology to apply climate change simulation techniques to neurodynamics. Funding for CINN comes not only through central University support (£220K p.a.) and research grant income but also through partnership arrangements with industry including *Britvic* and *Neurosense Ltd*. CINN is, of course, a facility that, whilst based in PCLS, is shared across many Schools within the University and underpins many active university-wide projects (see section *b*). Equally, members of the School participate in projects across the University that are supported by other major infra-structure investments, for example, the collaboration by **Williams** (**C**), **Butler** and **Ellis** with Food and Nutritional Sciences and Pharmacy uses the animal facilities in Biological Sciences (which has received £840k University investment over the assessment period). In addition, the School has excellent facilities for studying child development and mother-child interactions with a brand new suite of clinical rooms with excellent observation facilities and audio-visual recording equipment; high-speed, high-precision eye tracking systems to complement the fMRI compatible eye-tracking; a 'hand lab' for tracking and disrupting (with TMS) hand movements to investigate underlying control mechanisms; and a state-of-the-art immersive virtual reality system for the study of visual processing in moving observers. These services and infrastructure are critically dependent on the support of a team of experienced technicians in the School that includes four new members with a wide range of complementary skills.

Other facilities that are vital for the School's future research strategy include extensive participant panels: the long-established parent and child panel, autism panel, ageing panel and clinics based in the School for Speech and Language Therapy and the anxiety clinic that, with a planned inclusion of adolescents is to be renamed the 'Anxiety and Depression in Youth' clinic. These panels will be expanded in other areas, too, to include bilingual and multilingual communities. Ethics applications for projects and grants are assessed at a School level by one of three experienced academics to judge which applications require University approval. At a University-wide level, the School benefits from the oversight of the University Research Ethics Committee, an efficient and largely open-access database of research outputs (CentAUR) and a supportive Human Resources department.

Research governance.

Research governance within the University is structured through the PVC and University Board for Research and Innovation. At a School level, to ensure that planning and implementation of research and impact is well-integrated, the Research committee, chaired by the School Director of Research, comprises a representative from each Research Group, the Director of Post-Graduate Research, the Head of School, Unit of Assessment leader, Director of Impact and an early career member of staff. The leader of each of the four Research Groups attends a Research Committee meeting at least once a term to report on planned and progressing grant applications, significant

publications and achievements and to discuss how best to implement the School's research strategy within the Research Group. Research grant mentoring is managed by the School Director of Research. This demands a significant commitment from senior members of staff, including the Director of Impact. The Research Committee has access to funds to support conference travel and pump priming projects for which research groups bid. The Research Committee also assesses research leave applications from staff. The School is a regular beneficiary of funds awarded by the Faculty Director of Research and the PVC for Research and Innovation (RET and research incentive fund) for new cross-disciplinary research, research studentships, research leave and critical infrastructure.

e. Collaboration or contribution to the discipline or research base

The School has a prominent international profile in a number of areas, especially developmental psychopathology and multilingualism, and burgeoning international collaborations are boosted by the connections of new staff recruited from across the world. Nationally, the School is closely integrated with external agencies such as the NHS, HM Treasury and a range of industries.

Collaborations: *The School invests in a number of ways to increase the international reach and dissemination of its research, including funding international visits by staff to develop new research links and advertising for and hosting visiting scientists.*
Cooper and **Murray**'s projects in South Africa to improve maternal interactive behaviour and child emotional and cognitive development have led to a collaboration with Stellenbosch University and the NGO sector to disseminate these interventions more widely in Africa; **Marinis** with the University of Amsterdam (funded by the Dutch Research Council) is comparing the profile of sequential bilingual children and children with Specific Language Impairment; **Marinis** and **Tsimpli** are assessing bilingual children with SLI through the COST Action IS0804 in 33 countries; members of CINN collaborate widely with, for example UCLA, Dartmouth, Charite (Berlin), Marburg (Germany), U Toronto and Wisconsin-Madison leading, in the latter two cases, to recruitment of new staff (**Salomons** and **Feredoes**); **Christakou** leads *Human Frontiers* funded research with Haifa University, Princeton University, Institute of Psychiatry, Okinawa Institute of Science and Technology on striatal mechanisms of reward learning; **Chakrabarti** runs *MRC*-funded studies of genetic and environmental influences on autism in India. The new University of Reading Malaysia campus will include a 7T scanner with a planned research collaboration on high resolution neural field methods (**Saddy**).

Integration with NHS, Government and industry: *The School research and impact strategies ensure that its research will continue to be closely integrated with NHS, Government and industry*.
In the case of the NHS, two clinics are based in the School (Speech and Language Therapy and the Berkshire Child Anxiety Clinic, with a Memory Clinic planned), there is significant NIHR and NHS- supported research in the School (**Horwood**, **Cooper**, **Schafer**, **Creswell**, £0.85M) including collaborations such as with DeNDRoN (Dementias and Neurodegenerative Diseases Research Network of the NHS, **Saddy**) and 15 members of staff have honorary NHS appointments (see Section *c*). The School influences NHS policy and practice, e.g. NICE guidelines on management of postnatal depression and child anxiety (**Murray**, **Cooper**, **Creswell**) and the Royal College of Ophthalmologists' guidelines on management of strabismus (**Horwood**, **Riddell**). Clinical awards to staff in the School include MRC Clinical Scientist Fellowships (**Creswell**, **Horwood**) and Stroke Association Senior Research Training Fellowship (**Robson**). The first Oxford Academic Health Science Network scientific meeting was held in Reading (**Creswell** spoke) with 3 more planned in Reading. The School has contributed to Government policy, notably in the area of behavioural change where **McCloy** was seconded to HM Treasury for 1 year, to DEFRA for 1 year and holds a British Academy Fellowship to continue work at DEFRA. A new Centre for Applied Behavioural Science will pursue this research rigorously. Industrial sponsorship by *Otsuka* and *GW Pharma* has been critical in the development of anti-epileptic cannabinoid drugs at Reading. Behavioural work by **Williams (C)** is a key component of this development. Funding for Phase II clinical trials has been awarded with further investment likely. CINN is collaborating with the pharmaceutical firm *Servier* as part of a clinical trial. Food manufacturers collaborate with members of the School

to encourage healthy eating and investigate the possibility of food-induced cognitive improvements including *Danone*, *Britvic*, *Ella's Kitchen* (**Houston-Price, Butler, Field, Ellis**). A CINN project studying decision-making in CEOs has led to a new collaboration with *British Airways*. *Microsoft Research* have invested in **Glennerster**'s laboratory with the long-term goal of informing novel computer vision approaches to localisation and mapping.

National and International peer review*: The School encourages staff to act as members on grant panels and peer review bodies and to influence the international research agenda*.
Saddy serves on the ERC Panel "The human brain and its complexity" which establishes the direction of research funding within the EU in this field. Other international grant panels on which members of the School serve or have served include the Bernstein Centres for Neurotechnology and Computational Neuroscience panel (German Government) (**Glennerster**); Leading Edge and New Initiatives Fund panel (Canadian Foundation for Innovation) (**Glennerster**); Portuguese Foundation for Science and Technology (**Riddell**), Commonwealth Fellowship Board (**Cooper**). Members of the School are on steering committees dictating clinical practice, including the American Neurological Institute of Neurological Disorders and Stroke (NINDS) Working Group for Huntington's Disease (**Ho**); act as journal editor (**Rothman**, *Linguistic Approaches to Bilingualism*); are on journal review boards, including *Frontiers in Neuroscience* (**Feredoes**), *Phil Trans B* (**Glennerster**), *PLoS ONE* (**Holmes**), *Frontiers in Developmental Psychology, Child Development* (**Houston-Price**), *Applied Psycholinguistics* (**Marinis**), *Linguistic Approaches to Bilingualism* (**Marinis**), *Memory and Cognition, Frontiers in Cognitive Science* (**Beaman**), *Molecular Autism* (**Chakrabarti**), *British & Irish Orthoptic Journal* (**Horwood**), *Cognition and Emotion* (**van Reekum**), *EuroSLA Yearbook* (**Rothman, Marinis**), *Frontiers in Cultural Psychology* (**Athanasopolous**). **Saddy** advises the Spanish Government on its neuroscience agenda. At a **national level**, School staff serve on grant panels including: ESRC First grant and Fellowships (**Beaman**), Parkinson's UK Research (**Ho**), Chair of BPS Research Board (**Ellis**), NIHR RfPB (**Cooper**) and advisory boards, including: Home Office Science Advisory Council, ESRC Training and Skills committee and Chair of ESRC International Benchmarking Review (**Ellis**).

Promotion of research collaboration*: The School's research strategy depends, as described above, on an international network of collaborations and the School has a policy of actively supporting projects that promote research collaboration within the discipline.* A good example is the joint meeting of the *BPS Developmental and Cognitive Sections* (**Schafer, Houston-Price**, **Riddell, Beaman, Stojanovik, Chakrabarti, Marinis, Ellis, Horwood, Butler**). The School's critical mass of researchers in child development and cognition attracted a large audience (500 attendees) and a renowned set of invited speakers (e.g. Gathercole, Seidenberg, Tomasello, Vargha-Khadem). Disseminating the School's research internationally is a key component of its research strategy and the School plans to hold at least one similar large-scale meeting at the University of Reading annually. Many smaller scale meetings promote international collaboration: workshops have been held, especially through CINN and the WRU, with high-profile international speakers and others are planned, e.g. *European Science Foundation* on speaking, thinking and gesturing in two languages (**Athanasopoulos**)**.** The contribution that members of the School make to the discipline at an international level has been recognised through a number of awards, including **Horwood**, named as a future (2016) Burian Lecturer by the International Orthoptics Association, **Creswell**, winner of British Psychological Association May Davidson Award (2010) and **Murayama,** Distinguished International Researcher Award for Young Psychologist (Japanese Psychological Association, 2013) and Richard E. Snow Award for Early Contributions (American Psychological Association, 2013).

Responsiveness to national and international research priorities*: The School is ideally placed to respond to calls for research within the area of Lifelong Health and Wellbeing which will remain a key priority of RCUK; Health and Wellbeing are key priorities for the EU Horizon 2020 programme; and, for the Wellcome Trust, understanding neural networks and integrating basic and clinical neuroscience are key components of understanding the brain. The increasing clinical impact of research within the School will enhance this fit further.*