Institution: Liverpool John Moores University

Unit of Assessment: 4

a. Overview

Research in UoA4 takes place within the School of Natural Sciences and Psychology, which is part of the Faculty of Science. Research activity is organised around three main groups: neuroscience (sensory processes, substance use, executive function), health psychology (pain, eating behaviour) and human factors psychology (safety, human-computer interaction). The unit has been strengthened by selective recruitment of staff during the current period and a move to a new £26m building in 2010. The resulting growth of psychological research culminated in the formal recognition of a Research Centre for Brain and Behaviour (RCBB) by the University. The RCBB is managed by an Executive of senior staff (three Professors, two Readers) and serves as a local hub to support all research activity within the unit, including: income generation, development of facilities to support research and dissemination. The goal of the RCBB is to support psychological research that combines academic quality with high impact, particularly in areas related to neuroscience and health psychology.

b. Research strategy

The current assessment period has seen a number of developments designed to establish an active and sustainable environment for psychology research. Our strategy has been to: (1) to build critical mass as evidenced by staff recruitment, particularly in neuroscience and health psychology, (2) enhance laboratory facilities to support those areas of research, and (3) develop specific projects capable of delivering quality academic output of high impact.

During the period 2008-2013, psychology staff obtained a total of £917,000 in research funding and published over 180 peer-reviewed articles. This activity was supported by a reorganisation of research activity into three main groupings: neuroscience, health psychology and human factors psychology. The first group has a common interest in cognitive neuroscience and has conducted research on the neuropsychology of affective touch, the impact of recreational drugs on executive functions, and the effects of aging and multitasking on executive function. Members of the neuroscience group have published in prestigious journals, such as *Nature* and established a microneurography facility to study a novel class of c-fibres that code for rewarding properties of touch (the only group in the UK with this specific expertise). This group has been strengthened by the recruitment of five neuroscientists since 2009. The health psychology group has active interests in pain perception, regulation of appetite and the development/evaluation of health-related interventions. This group developed a laboratory for the study of eating behaviour and obtained funding for health-related research from NHS sources (£72K), local government (£30K) and industry (£92K). Three new staff were recruited to the health psychology group in the last three years, including two chartered health psychologists. The human factors psychology group is active in two areas - the assessment of performance during safety-critical behaviour and the development of new modes of human-computer interaction (HCI). This research led to collaboration with industry on two EU-funded research projects (£390K in total) and an output that won an award for the most cited paper in the influential HCI journal *Interacting With Computers* over two consecutive years (2011 and 2012).

There has been an intensification of research activity in the unit during the current assessment period, underpinned by the promotion of three staff (one Professor, two Readers) by the institution, but the most significant development has been the formal opening of the Research Centre in Brain and Behaviour (RCBB) in March 2013. The Centre provides an organizational infrastructure to promote research excellence and a strong profile for the psychological research conducted within the unit. The RCBB will produce an annual report on research activities in psychology, the production of this report serves an important monitoring function to assess the number/quality of outputs and level of income generation from the unit.

The unit has identified several areas for development of our research portfolio over the coming five years, which have been selected in response to national/international funding priorities and to build upon existing skills; they include: mindfulness meditation and cognitive aging, wearable sensors and telemedicine applications, neuropsychology of affective touch in context of autistic spectrum disorder and the management of long-term health conditions. These priority areas have been selected to increase convergence between activities in the neuroscience and health psychology groups. Future research topics will be selected using the following criteria: (i) the proposed

research must advance knowledge and understanding on an international scale, and (ii) the topic must address challenges and innovations in industry and public sector organisations in order to ensure the impact of the research.
The University, Faculty and School believe that the long-term viability of the RCBB can only be assured if underpinned by world-class research and have therefore invested resources in staff and the physical infrastructure to support the activity of the unit (sections c and d). A five-year research plan has been developed underpinned by the University's Strategy Map 2012-17 that has research excellence and development of the research environment as core aims. The unit has identified four key objectives to be achieved within this timeframe:

1. Increase the level of research funding and diversify existing sources of income within the unit
2. Increase the number of PhD student completions as well as internal funding for PhD studentships, including equipment and funds for conference travel
3. Enhance our network of collaborators from academia and industry/public sector organisations, in order to maximise the impact of our research activity
4. Strengthen and promote the research culture within the unit

These four objectives represent a unified strategy to enhance the volume and quality of research within the unit. All four goals will be achieved via mechanisms set up within the RCBB (see section c for detail). The RCBB is responsible for organising regular seminars and the formation of special interest groups that cut across boundaries both within the unit and the Faculty (4). External speakers often present their work at the research seminars, who are selected based upon existing interest and the potential for collaboration with members of the unit (3). One purpose of the special interest groups formed within RCBB is a cross-fertilisation of ideas to generate funding applications of high quality and impact (1) to increase the number of PG students working in the unit (2).
Multi-disciplinary research and the creation of links with other academics both within and outside the University is an overarching theme of our research strategy and we intend to extend our existing network of collaborators. The RCBB includes staff members from other Research Centres within the University, e.g. Research Institute for Sport and Exercise Sciences, Research Centre in Evolutionary Anthropology & Paleoecology, Institute for Health Research. In addition, psychology staff are active in other research centres within the University, such as the Liverpool Logistics Offshore and Marine Research Institute (LOOM) and the Institute for Health Research (IHR). Staff also have active collaborations with University colleagues from Public Health, Computer Science, and Engineering. It should be noted that psychology staff were submitted in the RAE2008 alongside colleagues from the health area as part of the University's submission to UOA12 (Allied Health Professions & Studies) so many of these connections are already strong. Active interdisciplinary collaboration with external organisations includes: industry (Pfizer), NHS Trusts (The Walton Centre) and cultural institutions (Foundation for Art and Creative Technology). These links with external bodies often have strategic importance for funding purposes and the creation of impact, and we aim to reinforce these relations over the coming census period.

c. People, including:

I. Staffing strategy and staff development:

The unit remains committed to the strengthening of core research groups within the RCBB by recruiting research-active academics in key areas. This commitment is evidenced by the addition of eight new staff in the last four years, five with backgrounds in neuroscience and two chartered health psychologists. Two of the neuroscientists (McGlone and Walker) were recruited from industry (Unilever R&D) and both chartered health psychologists joined the university from industry and NHS respectively. The success of the RCBB is dependent on building critical mass in the areas of neuroscience and health psychology as well as ensuring coherence between research skills and our strategic goals as a unit.
There are several initiatives in place to support the development of researcher careers within the institution. LJMU is an active member of the UK Vitae North West Hub and has mapped the provision of training against the Researcher Development Framework (RDF). As well as supporting researchers to attend Vitae events, the University hosts Vitae workshops that are open to researchers from other institutions. LJMU was awarded the European Commission's HR Excellence in Research award in May 2012 and has as a robust action plan to continue to support researchers and researcher development, which is delivered through the Concordat Task Group and overseen by the University's Research and Scholarship Committee.
The University's overall research framework and strategy during the REF period have been

formulated and managed by the Director of Research (based in Research and Innovation Services) and implemented through Faculties. The Research and Innovation Services (RIS) provide leadership for staff within the University and quality assurance support for research and PGR programmes. In addition to its Code of Practice for Research, RIS operates formal protocols/procedures for research governance and the investigation of alleged misconduct in research. Additionally, core principles and expectations with regard to the curation of publicly funded research data and research outputs are explicit in the University's research data management policy. Research at the Faculty level is monitored and managed by the Faculty Research and Scholarship Committee, which is also in charge of the distribution of the Faculty Research Fund. The Executive Board of the RCBB develops and implements the research strategy of the unit, including the distribution of available research funds and management of postgraduate student admission.

Research is recognised and encouraged by the University's promotion policy through an annual call for conferment of Professorships and Readerships. In 2012, Fairclough and Montgomery earned respective promotions to Professorship and Readership. The University has also established the 'Early Career Fellowship Fund', operated on an annual basis via RIS through the Director of Research. New staff may apply to this fund to "buy out" time from teaching or to visit other institutions. Four staff from the unit successfully obtained awards from this fund in the current census period; these awards resulted in a number of high-quality publications, e.g. Ogden's (2010) paper in *The Quarterly Journal of Experimental Psychology*.

RIS run a series of informal induction events for new research active staff, including early career researchers (on average four times each semester). These events provide an opportunity for new starters to meet with existing research staff and present a broad overview of the professional services available to support research activity and those policies and procedural frameworks that underpin research at the University (e.g. research strategy, grant funding and support, research ethics, library resources, REF, Researcher Development Framework). The University also provides a range of career/skills development opportunities, targeted specifically at early career researchers, such as 'Being an Effective Researcher'. RIS provide a range of research-related training, skill development and networking opportunities for staff at all levels of experience and capability. It also disseminates information about internal and external training opportunities in a dedicated electronic research bulletin. Internal training events that run regularly include:

- Grant bid clinics (two-day events for principal investigators who are targeting competitive funding streams; attendees will generally have well-developed research proposals that would benefit from in-depth peer review to enhance quality prior to submission);
- Grant Incubator workshops (for researchers seeking guidance on how to develop their research ideas into more formal proposals);
- Research grant training (comprehensive training on all aspects of proposal development for those new to research and/or the University).

Ten members of the unit have attended these training courses over the last five years. The RCBB is also an important provider of quality assurance/peer review for funding applications prior to official submission.

The annual process of review and workload management permits line managers to tailor the balance between teaching and research activity in order to focus staff activities on tangible research outputs. The identification of research goals for each individual and necessary levels of support is an important component of the annual Personal Development and Performance Review (PDPR) process. Staff can identify training opportunities to progress research skills through the PDPR and to identify barriers to effective development of research work. One important outcome of the PDPR process is that managers are able to consider personalized solutions and plans for each individual staff member.

The unit operates a mentoring system for new academics. Senior staff members are assigned as mentors and their main duty is to facilitate integration of inexperienced academics into the existing research culture and to help them commence a successful research career. The development of Early Career Researchers (ECRs) is particularly important as we have welcomed a number of new staff to the unit in recent years. Upon joining the University staff are automatically awarded a high level of research allowance for the first three years of employment via the staff workload model. This provision is made to help new staff establish a research base during the transitional period to LJMU as their new institution. The role of the mentor is to advise on generic aspects of

professional activity (e.g. managing teaching/research balance) but mentors are also selected to match the research area of the ECR as far as possible, so they are able to offer specific advice on potential strategies for ECRs to establish themselves as researchers. This support may range from practical issues (induction with relevant laboratory apparatus) to creating links with potential collaborators both within and outside the unit. All ECRs are required to deliver a research seminar as part of the series organised by RCBB as a way of introducing themselves and their research to the staff body as a whole; the purpose of this exercise is to foster potential collaborations within the unit. Wider integration of new staff research interests are also promoted via institutional initiatives such as the Research Café series and seminar events at other Research Centres within the university.
The appointment of academics and promotions to Readership and Chairs are routinely monitored and reported with respect to equality and diversity. All research-related meetings and seminars are held during normal office hours to accommodate staff with childcare responsibilities. In addition, staff are managed in accordance with child-friendly HR policies with an emphasis on flexibility and support, particularly for those returning from a period of maternity leave. With respect to the latter, staff who return to work on a part-time basis after maternity leave have their teaching hours adjusted proportionately in order to protect their research activities. The University also holds membership of the Athena Swan Charter and is working towards the Athena Swan Bronze award by April 2014 in accordance with its Equality Objectives and Action Plan (2012-2017).

c. II. Research students

The development of postgraduate research student training is an important component of our research environment. The completion rate of research students in the unit was 84% (based on FTEs) during the current census period. The creation of new laboratory space in the current building is complimented by shared office space for research students designed to promote a sense of identity and peer support.
Postgraduate research student induction is a compulsory event provided by the University's Graduate School and progress of research students are closely monitored by the supervisory team (Director of Studies plus at least one co-supervisor), who report to the Faculty Research Degrees Subcommittee (FRDC) and upwards to the University Research Degree Committee. Annual reports on student progression are made in line with the University's Code of Good Practice for Annual Monitoring and assessed by the FRDC. The department has a Postgraduate Tutor acting as a contact point for potential PhD students who can also be consulted by individual Directors of Studies as required. Research students are required to submit a transfer report at the end of their first year and participate in a viva at that time (with an internal examiner from outside of the supervisory team) in order to ensure the future quality and viability of their research programme. In general, these institutional structures successfully support the needs of research students and the 2011 Postgraduate Research Experience Survey (PRES) indicated that 80% of PG students at LJMU felt that the research programme either met or exceeded their expectations. The perception of the quality of supervision within the Faculty of Science are generally good, PRES data indicated that students felt their supervisors provided helpful feedback (80%) and good guidance (78%).
Research students represent a group of individuals who often require training in all aspects of academic work, from public presentations to grant writing. The development of research student skills is promoted in the University via a mixture of specialised and generic training courses (offered by the Research and Graduate School). With respect to the former, research students from the unit have attended external workshops on software (MatLab, BESA), technical topics (neuroanatomy) and general courses on scientific writing during the current census period.
The unit and Faculty make every attempt to integrate research students into the research culture at LJMU. With respect to the activities of RCBB, students join as members of special interest groups and resent their work as part of the seminar series. The purpose of the latter is to develop student skills with respect to public presentation of their work prior to an appearance at a national or international conference. The Faculty of Science organise an annual Postgraduate Research Day where students across the Faculty deliver verbal presentations of their work or create poster presentations; research students also chair the sessions and are involved in the generation of the programme for the day. The Faculty offer cash prizes for the best presentations in each category, which may be converted into training opportunities or conference attendance for those individuals.

Research students from the unit have won prizes on two occasions in the current period. From 2011-12, RIS managed a conference travel budget specifically to enable research students to attend a conference in order to disseminate their work. One of our research students has been the recipient of this award and two other students presented their work at international conferences in the US and Europe with funding from external sources.

d. Income, infrastructure and facilities:

The physical infrastructure to support research in the unit was significantly enhanced by our move into a new £26m building in 2010. With respect to income generation, there was a significant increase from 2009/10 (£122K) to 2010/11 (£221K) that coincided with the arrival of the unit in the new building and large grants funded by the EU, such as ARTSENSE (£196K). Income generation has been sustained at a broadly equivalent level (£196K for 2012/13). Our portfolio of funding bodies has expanded in recent years to include consultancy and collaboration with industry (Kelloggs and Pfizer respectively), local government (Sefton Council), NHS bodies (Mersey Care) and charities (Bial Foundation) as well as traditional funders of national and international research. A number of laboratory facilities to support our research groupings in neuroscience, health psychology and human factors psychology were created in the new building and staff from the unit consulted with the architects prior to our move to design the laboratory spaces. The University funded the purchase of specialised apparatus for the laboratories in the new building which amounted to approximately £160K.

There are three dedicated laboratories to support research in the neurosciences. The multisensory laboratory houses apparatus for the study of sensory processes, specifically somatosensory and olfactory pathways. This space includes a Pathway Pain & Sensory Evaluation System (Medoc Advanced Medical Systems Ltd), an olfactometer, a purpose-built Robotic Tactile Stimulator (RTS: to deliver highly controlled touch stimuli for psychophysical experimentation) and iontophoresis system for delivery of polar molecules (e.g. histamine) through the skin to selectively activate nerve types, such as itch and pain. The microneurography system is also contained in the multisensory laboratory, this is a 16-channel high-performance data acquisition system with special electrodes and customised software to analyse nerve unit (spike) activity. This apparatus is used specifically to study c-tactile afferent nerve fibres as well as myelinated afferents, and this expertise is currently unique to the unit in the UK. The second laboratory is designed for EEG recording and analysis, this space contains three EEG systems capable of recording data from 32, 64 and 128 channels of EEG. The laboratory contains an electrically insulated booth for high-quality EEG recording and the unit holds specific software licenses for EEG analysis, e.g. BESA. The EEG laboratory is complimented by a reception room and shower facilities to allow participants to clean up after an EEG recording session. The fNIR200 (BIOPAC Inc.) is a functional near infrared spectography device designed for optical brain imaging from the rostral prefrontal area, which is contained in a third laboratory space. This room also contained a number of psychophysiological recording systems designed to measure cardiovascular impedance, facial electromyography and a range of autonomic responses.

The Appetite laboratory is designed for the study of eating behaviour and accessed by the health psychology group. This facility includes a kitchen area for food preparation and storage with three dedicated booths for experimental testing, which includes specialised apparatus for measuring eating behaviour, e.g. digital plate scale to capture rate of food consumption. The human factors psychology group use a driving simulator facility housed in another laboratory to study safety-critical behaviour. This apparatus is a fixed-based unit constructed around the STI SIM Driving Simulator software (STI Inc.), which powers the visual/audio properties of the simulator and data capture. The driving simulator facility is complimented by an eye-tracking system (FaceLAB) powered by two remote infrared video cameras. These dedicated laboratory spaces are complimented by eight testing rooms on the same floor with adjustable lighting and computers equipped with software for stimulus presentation (E-prime) during experimental psychology research. All laboratory facilities are maintained and supported by three technical staff based within the unit. In addition to these facilities, the unit also has access to a shared laboratory facility located in the School of Sport and Exercise Science designed to study sleeping behaviour and to manipulate the impact of circadian rhythms on behaviour; this sleep lab is an enclosed living space that can house four participants for a period of several days or weeks. Montgomery has access to clinical labs at University Hospital Aintree for urine analysis (linked to research on recreational

drugs) and McGlone receives an in-kind contribution with respect to access to the 7T fMRI scanner at the University of Nottingham as part of an active collaboration; in addition the RTS in the multisensory laboratory represents an in-kind contribution from the University of Gothenburg.
The external income generated by the unit in the current census period (£917K) was devoted mainly to staffing costs, however, income generated from two EU-funded projects (REFLECT & ARTSENSE) was used to acquire a range of ambulatory monitoring apparatus for data acquisition in the field. This equipment includes: portable EEG monitoring (1-channel and 4-channel), autonomic data capture (heart rate, respiration) and skin conductance. This apparatus is strategically important because it allowed the staff to measure real-world behaviour in the field.
External income is crucial to both create and sustain a pool of research assistants who represent an important repository of expert knowledge and a support network that can be utilized by staff and PhD students alike. There are a number of offices in the building for 2-3 persons that have been created to accommodate postgraduate researchers (PGRs). These individuals have priority access to laboratory facilities for externally funded projects. All research assistants are members of the RCBB and participate fully in the activities of the Centre, i.e. members of special interest groups, attendance at research seminars.
Research in the unit inevitably involves testing of human participants, which raises several issues in relation to research governance. In accordance with the University's Code of Practice for Research, research that involves human participants, human material and/or personal data must comply with all legal and ethical requirements and other applicable guidance. Where the University is the sole sponsor under the Research Governance Framework for Health and Social Care, responsibility for monitoring the research activity rests with the University's Research Ethics Committee (REC) through the Research and Innovation Services. Research studies that have been approved by the National Research Ethics Service must also be sanctioned by the University's REC whereby researchers submit an NHS Research Governance proforma. The University has formal protocols/procedures for the investigation of alleged misconduct in research. Additionally, core principles and expectations with regard to the curation of publicly-funded research data and research outputs are explicit in LJMUs research data management policy.

e. Collaboration or contribution to the discipline or research base:

Staff within the School have made a significant contribution to the peer review process for national and international grant applications during the current period. Six staff acted as reviewers for the following research councils: ESRC (10 grant reviews), BBSRC (2 reviews), MRC (2 reviews) and AHRC (1 review). Law is also a member of the ESRC Peer Review College. The expertise in health psychology that exists within the unit was accessed to provide peer review for the National Institute for Health Research (5 applications) and the National Institute for Medical Research (1 application). Staff also provided peer review for grant applications made to charitable bodies, such as Wellcome Trust (1 review), Leverhulme Trust (2 reviews) and Nuffield Foundations (3 reviews). There have also been a number of occasions when staff have provided reviews to international bodies such as the EU (1 review) and European Space Agency (1 review) as well as organisations from other countries: Australian Medical Council (1 review) and the Swiss National Science Foundation (2 reviews).
Staff from the School sit on editorial boards of several journals, these include: International Journal of Cognitive Performance Support, Complementary Therapies in Clinical Practice, Le Travail Humain and the Journal of Solid Tumours. Staff are also active within program committees for national and international conferences. Montgomery has acted as secretary for the Psychobiology Section of the British Psychological Society for the last five years and is a member of organising committee for their annual research meeting. Fairclough is currently a Conference Chair for the First International Conference on Physiological Computing (to be held in Lisbon in January 2014) and sits on the Programme Committee for the ACM CHI Conference on Human Factors in Computing Systems (to be held in Toronto in March 2014). With respect to personal research awards and fellowships, Law held an ESRC Fellowship from 2007-2009.
Collaboration with external bodies from industry and the public sector is an important aspect of our research activity. A grant awarded to Poole* by Pfizer is currently on the UKCRN portfolio and continuation of the research is supported via NHS R&D. Poole also has an honorary contract as Health Psychologist at The Walton Centre (the only specialist neurosciences NHS Trust in the UK) and holds the position of Research Fellow at the Pain Research Institute, which is part of the Division of Neurological Sciences at the University of Liverpool. Other staff have successfully

collaborated with Liverpool and Sefton Eating Disorders Unit to secure grant funding from the NHS and obtained funding from Sefton Council to investigate wellbeing and energy consumption. Fairclough has collaborated extensively with Philips Research Laboratories in Eindhoven, which led to a 2-month placement (of Philips staff at LJMU) in 2010 and a number of joint publications. Fairclough has also collaborated with a number of external organisations via EU-funded research projects from 2008-2013 (e.g. Ferrari S.p.A in Maranello, Fraunhofer-Gesellschaft, Foundation for Art and Creative Technology) and was funded by the UK Government via the Health and Safety Executive (2008).
With respect to formal academic collaboration, Malinowski* has worked with the Institute of Psychology at the University of Osnabrück, which led to two successful grant applications and a peer-reviewed journal publication; he has also produced a successful grant application with the Department of Neurophysiology and Pathophysiology at the University of Hamburg. Gilleade* has extensively collaborated with Murdoch University in Australia leading to two published papers, two research visits and was Local Chair for an international conference in 2012 (3rd IEEE Network Embedded Systems for Every Application). Montgomery has collaborated extensively with the University of Central Lancashire, co-producing 21 peer-reviewed journal outputs in the last five years. Law has collaborated with colleagues at the University of Edinburgh leading to a co-investigator position on a research grant awarded by the Leverhulme Trust and four journal publications; she has also worked with the University of Stirling and produced two co-authored journal publications. McGlone holds an honorary position at the University of Liverpool and has been an "Eminent Visiting Professor" at the University of Western Australia from 2011. In addition, McGlone has collaborated extensively with the University of Gothenburg & Sahlgranska Hospital (4 outputs) and University of North Carolina (7 outputs); he also has joint-authored outputs with a number of academics in the UK, including: University of Nottingham (2 outputs), University of Oxford (3 outputs), University of Cardiff (2 outputs) and Leeds University (1 output).

*members of psychology staff whose outputs do not appear in REF1a