UNIVERSITY OF BIRMINGHAM | Centre for Human Brain Health

Centre for Human Brain Health

Annual Report 2025

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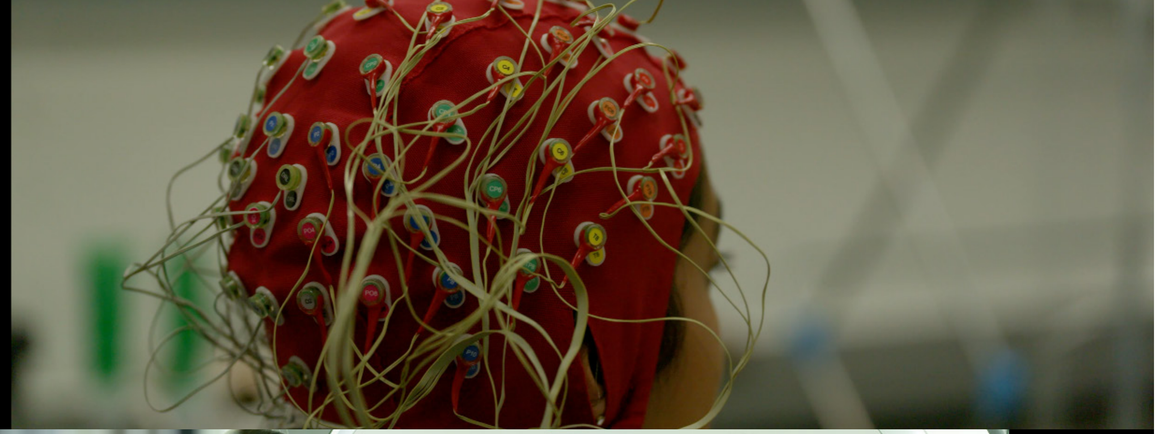
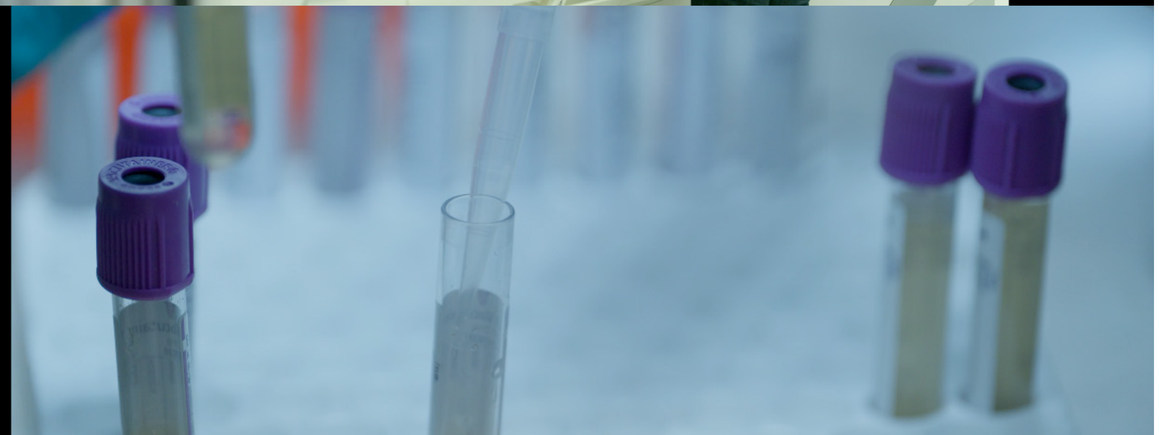




Foreword from the Co-Directors

We are delighted to present the 2025 Annual Report for the Centre for Human Brain Health (CHBH). This has been a particularly important year for the Centre, marked by the completion of our triennial Centre Review. The review provided a valuable opportunity to reflect on the progress made over the past three years and to reaffirm the strength of our research environment. We were pleased that it highlighted CHBH's international reputation, interdisciplinary ethos, and continued scientific excellence. Our sincere thanks go to all members of the CHBH community whose collective efforts underpin these achievements.

This year also saw a transition within the leadership team. Dr Katja Kornysheva stepped down as Co-Director after three years of dedicated service. We thank Katja warmly for her thoughtful leadership and the many contributions she has made to the Centre's strategic development, and we are pleased that she has remained actively engaged in CHBH activities and as a member of the Strategy Committee. We were equally pleased that Professor Stephane De Brito joined as Interim Co-Director for 2025/26. Having been involved in CHBH since its inception, Stephane brings valuable experience and insight to the role.

The past year has seen significant developments across our research and facilities. A key highlight was the award of a major BBSRC ALERT24 grant to expand our OPM capability. This investment will support pioneering work in next-generation brain imaging and open new avenues for developmental, computational, and translational neuroscience. We are also delighted to report the launch of the newly refurbished CHBH Sleep Laboratory and the establishment of a Bioprocessing Facility. These facilities provide state-of-the-art platforms for sleep and circadian rhythm research and broader investigation of the links between fluid biomarkers and brain structure and function.

CHBH researchers have continued to secure substantial external funding from UKRI, Wellcome, ARIA, and international partners, and produced high-impact work across our six research themes—from cognitive and computational neuroscience to lifespan and brain health, social interaction, learning and memory, sleep and consciousness, and neuroimaging methods and AI. Our interdisciplinary environment remains one of the Centre's greatest strengths, bringing together colleagues from across the University and our clinical partners to tackle key questions in human neuroscience.

We also continued to strengthen our global profile through a series of 5 high-impact international conferences and workshops hosted or co-organised by CHBH in 2025. These events brought leading experts from across the world to the University of Birmingham to discuss advances in computational social cognition, curiosity and exploration, foraging mechanisms, and motor learning, and included a collaborative visit from the University of Illinois at Urbana–Champaign. These activities reinforced CHBH's role as a hub for international knowledge exchange and interdisciplinary dialogue.

We are equally proud of our contributions to education and training. The MSc in Cognitive Neuroimaging and Data Science continues to attract outstanding students from around the world, providing hands-on experience with cutting-edge imaging technologies and computational tools. Early career researchers are at the core of the intellectual and social fabric of CHBH, supported through dedicated training opportunities, representation on our committees, and involvement in major funded projects.

Looking ahead, the CHBH is exceptionally well positioned for continued success. With our expanding facilities, strong collaborative networks and an internationally connected research community, we are well placed to produce cutting-edge work in human brain research over the coming period.

We invite you to read on and explore some of the highlights from another productive and inspiring year at the CHBH.

Professor Andrew Bagshaw

Professor Stephane De Brito

Dr Katja Kornysheva

Centre for Human Brain Health

The Centre for Human Brain Health (CHBH) is recognised for its work in cognitive and translational neuroscience, offering world-class facilities for studying the human brain and dedicated to pioneering research spanning the full spectrum from basic neuroscience to clinical translation. By fostering an inclusive, internationally collaborative and interdisciplinary environment, we bring together world-class researchers from diverse fields to tackle the most pressing challenges in human neuroscience. The Centre has 51 Core and 22 Affiliated Principal Investigators from across the University and local hospitals, a dedicated Operations team, and houses seven major facilities: magnetic resonance imaging (MRI); magnetoencephalography (MEG); electroencephalography (EEG); several types of brain stimulation; sleep laboratories; functional near-infrared spectroscopy (fNIRS); and an expanding facility for optically pumped magnetometer (OPM) research and sensor development.

Interested in using CHBH facilities to support your research?
Please see birmingham.ac.uk/chbh for further details or email chbh@contacts.bham.ac.uk.

Since its inception in 2019, core CHBH Principal Investigators have secured £65M in research funding from a wide variety of sources. Our top funders are:

UKRI Biotechnology and Biological Sciences Research Council

UKRI Engineering and Physical Sciences Research Council

UKRI Economic and Social Research Council

UKRI Medical Research Council

Wellcome

leap

Advanced Research + Invention Agency ARIA

LEVERHULME TRUST

The Academy of Medical Sciences

NIHR | National Institute for Health and Care Research

CHBH Themes

The Centre focuses its research around six core themes:

Learning,Memory and Performance

We study how the structure, physiology and function of the human central nervous system contribute to enhancing human learning, memory, and control – from encoding new knowledge about our environment to producing skilled actions for essential everyday tasks such as reading and handwriting.

Awareness, consciousness and sleep

Researchers in this theme aim to reveal the intricate workings of our inner world. By studying the neural processes underlying attention and awareness, we unravel how our brain constructs our perception of reality.

Neuroimaging methods and AI

The Centre is at the forefront of developing methods to analyse neuroimaging data and techniques to record brain activity. We create analysis pipelines such as FLUX pipeline for analysing magnetoencephalography data.

Lifespan and brain health

Our Centre connects several research groups that aim to understand basic principles of brain structure and function. We are interested in how these principles are similar or different across the lifespan from infancy to old age.

Cognitive computational neuroscience

In this theme, we bring together interdisciplinary researchers across cognitive psychology, neuroscience, and computer science to unravel the intricate workings of the human mind. We aim to understand the mechanisms underlying cognitive and behavioural processes by employing advanced computational models and analytical techniques.

Social interaction and communication

Social interactions are crucial for our health and well-being across our lifespan. Positive social behaviours will also be fundamental for solving several global challenges such as climate change, infectious disease and ageing populations. Researchers in this theme therefore study social cognition and behaviour, as well as the individual differences between people.

Research facilities within the CHBH

The Centre is home to state-of-the-art brain imaging facilities, which are used to uncover the mechanisms supporting cognition and behaviour in both the healthy and the dysfunctional brain. These include:

- **Magnetic Resonance Imaging (MRI),** providing a range of options for stimulus delivery and physiological and behavioural recordings
- **Magnetoencephalography (MEG),** which allows for continuous recordings of ongoing brain activity with a millisecond time resolution and advanced analysis tools to identify where in the brain the measured electrophysiological activity is generated
- **Electroencephalography (EEG),** three high-performance EEG laboratories for accurate timing and application of auditory and visual stimulation (concurrently or separately)
- **Sleep laboratories,** equipped with 32-channel EEG amplifiers and peripheral equipment for experimental testing and stimulus delivery. Biological sampling capability includes single assessment urine, saliva and blood or continuous sampling of blood via an in-dwelling intravenous line
- **Functional Near-Infrared Spectroscopy (fNIRS),** housing the Imagent (v2) system that allows non-invasive functional imaging of the brain
- **Optically Pumped Magnetometer (OPM) laboratory,** where we are developing new sensors to be used for magnetoencephalography (MEG) using quantum technology, as well as installing a whole-head system using commercial sensors for adult and paediatric neuroimaging.
- **Non-Invasive Brain Stimulation,** housing the equipment required for both transcranial magnetic (TMS) and electrical (TES) non-invasive brain stimulation experiments as well as new Focused Ultrasound Stimulation (FUS) equipment, which has the capability to combine ultrasound brain stimulation with fMRI

Access our facilities

The CHBH is a university facility and all of these modalities and collaborative expertise are available for the university community, so get in touch if you're interested.

Contact us

chbh@contacts.bham.ac.uk

bsky.app/profile/thechbh.bsky.social

linkedin.com/company/thechbh

Participate in brain research at the CHBH: birmingham.ac.uk/research/centres-institutes/human-brain-health/participate

Find out more at : birmingham.ac.uk/chbh

CHBH to Launch the UK's First Naturalistic Lifespan Brain Imaging Facility with £1.5M BBSRC Investment

The CHBH is entering an exciting new chapter with the launch of the Naturalistic Lifespan Electrophysiology (NatLife) project, a breakthrough research facility funded through a prestigious £1.5 million BBSRC ALERT award. NatLife will be the first platform in the UK designed specifically to study how the brain functions during real-life activity, and how it develops and changes across the entire human lifespan, from the first days of life through to old age.

Traditional brain imaging technologies require people to sit or lie still inside large, enclosed scanners, which limits how well researchers can study natural movement, social interaction or very young children. NatLife overcomes this barrier by using a new generation of sensors that sit inside a lightweight helmet and can be placed directly on the head. Because the equipment is comfortable, silent and non-invasive, people can move around freely while researchers record their brain activity. This means that, for the first time, scientists at the CHBH will be able to observe how the brain works during everyday behaviour such as playing, reading, resting, sleeping or interacting with others.

The technology behind NatLife, known as magnetoencephalography with optically pumped magnetometers (OPM-MEG), measures with extraordinary precision tiny magnetic fields generated by the brain, capturing brain activity in less than a thousandth of a second and mapping it to locations in the brain with millimetre accuracy. Crucially, OPM-MEG can be used with people of all ages, including babies and older adults, who have been difficult or impossible to study using conventional scanners.

The NatLife platform will also allow simultaneous recordings from two people at once, for example, a parent interacting with a baby or guiding a child through a learning task. This capability opens a new window into how brains interact during communication, learning and social connection.

NatLife will be accessible to researchers at CHBH, across the University of Birmingham and the wider scientific community. Training, open collaboration and public engagement will form core pillars of the programme, ensuring that skills, knowledge and research benefits are widely shared. By enabling naturalistic, lifespan brain imaging at a scale not previously possible, NatLife will accelerate discovery research, drive innovation in neuroscience and support the development of future clinical and educational technologies. It positions Birmingham and the UK at the forefront of global brain science.

NatLife is a team effort of 14 Co-Investigators led by Dr Anna Kowalczyk and Dr Barbara Pomiechowska. Thank you to the whole team for making it possible: Professor Andy Bremner, Dr Giulia Orioli, Dr Andrew Quinn, Professor Andy Bagshaw, Dr Charlotte Marshall, Professor Joe Galea, Professor Matthew Apps, Dagmar Fraser, Dr Romy Froemer, Professor Patricia Lockwood, Dr Hyojin Park, Dr Lei Zhang

Dr Anna Kowalczyk

Dr Barbara Pomiechowska, Assistant Professor

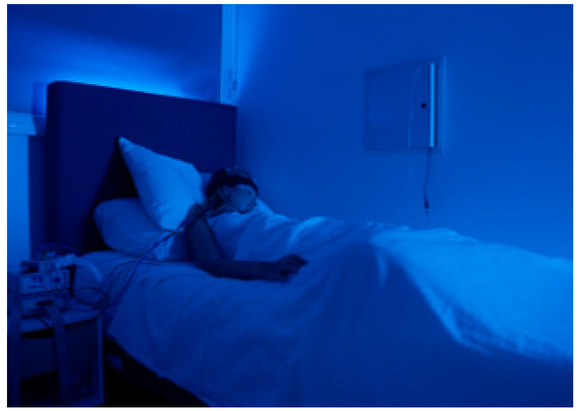
CHBH Sleep Lab and Bioprocessing Facility

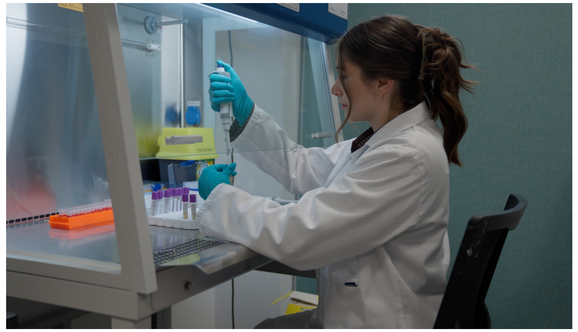
The CHBH Sleep Laboratory launched in 2025 after major refurbishment creating a state-of-the-art facility for sleep and circadian rhythm research. The upgraded space now accommodates the full range of sleep study designs, including nap paradigms, overnight polysomnography, sleep deprivation and constant-routine protocols, and multi-day monitoring. Each suite is fully time- and temperature-controlled and equipped with Dreams Sleepmotion beds, 32-channel EEG systems, eye-tracking technology and PC-based neurocognitive assessments. The facility also enables urine, saliva and blood sampling for comprehensive biomarker measurement.

The Sleep Lab is complemented by the new CHBH Bioprocessing Facility, a highly controlled Biosafety Level 2 laboratory for processing and storing biofluids, including melatonin assays, inflammatory markers, 'omics' research and other biological endpoints. This is essential for the Sleep Programme and is available for other researchers within the CHBH. Together, these facilities provide an integrated platform for cutting-edge biological, neurophysiological and behavioural sleep and circadian research.

PI Clare Anderson launched both laboratories with a new research programme focused on identifying neural and biological biomarkers of Alzheimer's disease risk and vulnerability to sleep deprivation, supported by UKRI and Takeda Pharmaceutical. In 2025, an Interdisciplinary Network+ Research grant established the Birmingham Sleep Network, uniting researchers from Psychology and Neuroscience, Sport, Exercise and Rehabilitation Science, Medicine and Metabolism, Computer Science and Mathematics to advance interdisciplinary sleep and circadian science at Birmingham.

The CHBH Sleep Programme and the wider Birmingham Sleep Network collaborate with industry partners across business sectors to drive innovation in sleep and circadian science. Together, we co-develop evidence-based sleep solutions to promote health and wellbeing, performance and productivity. Our current activities include working with UK Policing and forensic investigators on the detection of fall asleep crashes and advisory roles in the development of new UN regulations relating to in-vehicle drowsiness detection systems.





Professor Clare Anderson
Professor of Sleep and Circadian Science

Transcranial Focused Ultrasound (FUS) for Neuromodulation

This year, the CHBH added a new research methodology to its toolkit: Transcranial Focused Ultrasound (FUS). Ultrasound is the application of high-frequency pressure waves to the body, and many of you will be familiar with it in an imaging context (e.g. foetal imaging). However, ultrasound can also be used to modulate brain activity; transiently changing the way neural circuits operate.

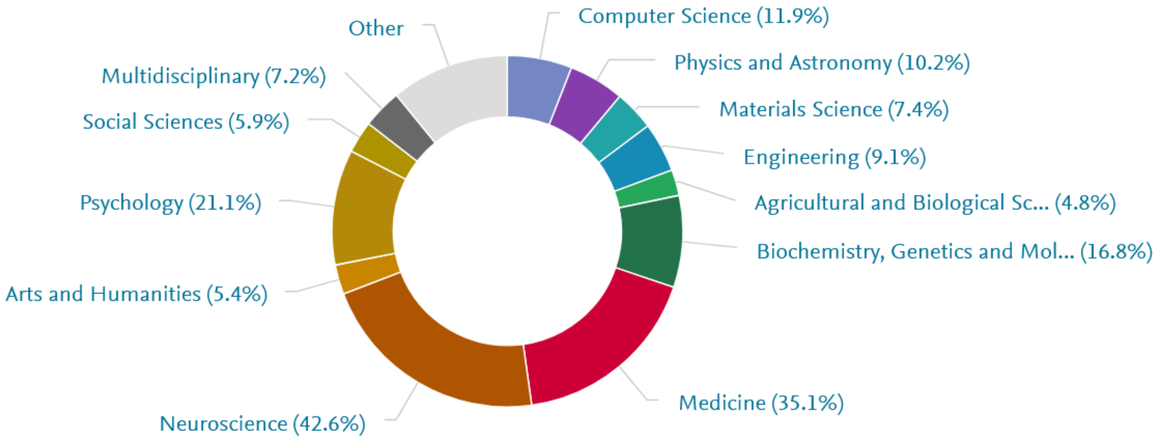
The first research project at the CHBH utilising the FUS system is currently being conducted by the Fernández-Espejo lab, and aims to investigate and refine its use as a therapeutic modality in disorders of consciousness (DOCs). This will focus on whether FUS can be used to selectively modulate specific thalamic nuclei, particularly the mediodorsal and ventrolateral nuclei, which are thought to play key roles in DOC pathology. Using nucleus-specific behavioural tasks, the project aims to demonstrate targeted and dissociable effects of stimulation, with the long-term goal of developing clinically translatable and individualised neuromodulation interventions for DOC.

Dr Charlotte Reese Marshall – Assistant Professor and CHBH Lead for Neurostimulation

Research highlights

Between 2022 and 2025, the CHBH produced 674 scholarly outputs. The Centre maintained a strong Field-Weighted Citation Impact (FWCI) of 1.40, indicating that its publications were cited 40% more than the global average for similar research. The CHBH's research is highly interdisciplinary, with leading contributions in Neuroscience (42.6%), Psychology (21.1%), and Medicine (35.1%), alongside notable outputs in Computer Science, Engineering, Biochemistry, and Physics.
The Centre's publications received 4,967 citations, averaging 7.4 citations per publication. Notably, 15.1% of outputs were among the top 10% most cited globally, and 48.1% appeared in the top 10% of journals by CiteScore.

Collaboration is a key strength:
International collaborations accounted for 66.8% of outputs, with a higher FWCI of 1.51.



Research highlights

Why are Parkinson's diagnoses more common in the autistic community?

CHBH Research Theme: Social interaction and communication

Parkinson's diagnoses seem to be much more common in autistic adults than in non-autistic adults, but we still don't know exactly why. One possibility is that autistic people may genuinely be more likely to develop Parkinson's. If that's true, it would be important for autistic adults and healthcare professionals to look out for early signs. Another possibility is that some common autistic movement differences can look similar to the movement features used to diagnose Parkinson's. This could mean that autistic adults sometimes score highly on Parkinson's tests even when they don't have the condition. If this is happening, the way Parkinson's is diagnosed may need adjusting to reduce the risk of misdiagnosis.

Our recent article reviewed what is currently known about the high rates of Parkinson's in the autistic community. We found that, although Parkinson's diagnoses are indeed more common, there is little evidence for a shared genetic cause. However, several studies suggest that some autistic movement patterns may resemble parkinsonian movement.

To move forward, we need studies that directly compare autistic adults and people with Parkinson's matched for age, IQ, and gender, particularly focusing on the key features used in diagnosis. This would help reveal whether autistic traits affect Parkinson's assessments and, in turn, help improve diagnostic accuracy and healthcare for autistic adults as they age.

Artwork by Catherine Fleming, Cook Lab Artist in Residence. The artwork depicts the interwoven nature of autism and Parkinson's. The strings represent autism and Parkinson's being interwoven and how the research is working to unravel them so they can discern the key differences between them.

Hickman, L.J. and Cook, J.L. (2025). High rates of Parkinson's disease diagnosis in the autistic population: True co-occurrence or a product of overlapping traits? Neuroscience & Biobehavioral Reviews, [online] 176, p.106261. doi:https://doi.org/10.1016/j.neubiorev.2025.106261.

Lydia Hickman
PhD Researcher

Professor Jennifer Cook
Professor of Cognitive Neuroscience

Research highlights

Explaining tip-of-the-tongue experiences in older adults: The role of brain-based and cardiorespiratory fitness factors

CHBH Research Theme: Lifespan and brain health

You meet a friend and tell her about a great book you're reading:

"It's by a famous author, her name is, um …"

But the name just won't come to you. That's what we call a tip-of-the-tongue moment—those times when we can't quite retrieve a word or name we know we know.

Speaking involves many complex processes, and tip-of-the-tongue moments happen when there's a brief disruption in our ability to access the word's sound. We haven't forgotten the word, we still know its meaning, but in that moment, we can't produce it.

These moments are common throughout life, but they occur more often as we age. This is partly because brain health declines over time, and partly because we know more words when we're older, creating greater competition from similar-sounding words.

Our research shows that being physically fit may help. In a study with adults over 60, we combined fitness testing with measures of brain structure, function, and perfusion. We found that older adults with higher fitness levels showed different patterns of brain activity when searching for the right word, and experienced fewer tip-of-the-tongue problems. These effects occurred over and above the influence of brain structure and blood flow on word-finding.

While we've long known that regular exercise benefits brain health, our findings reveal that fitness also specifically affects how the brain operates during speech.

Dr Foyzul Rahman
Postdoctoral Research Fellow

Dr Katrien Segaert
Associate Professor

Professor Sam Lucas
Professor of Cerebrovascular Exercise & Environmental Physiology

Jack Feron
PhD Researcher

Rahman, F., Tsvetanov, K.A., Feron, J., Mullinger, K., Joyce, K., Gilani, A., Fernandes, E.G., Wetterlin, A., Wheeldon, L., Lucas, S.J.E. and Segaert, K. (2025). Explaining tip-of-the-tongue experiences in older adults: The role of brain-based and cardiorespiratory fitness factors. Neurobiology of Aging, [online] 154, pp.25–36. doi:https://doi.org/10.1016/j.neurobiolaging.2025.06.008.

Research highlights

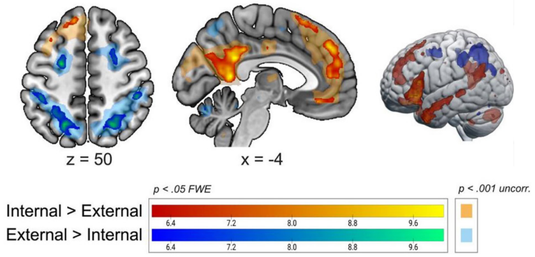
Neural Correlates of Goal-Directed Preparation to Switching Across External and Internal Domains

CHBH Research Theme: Awareness, consciousness and sleep, Neuroimaging methods and AI

Most everyday tasks require us to regularly switch our focus between monitoring internal signals (e.g., thoughts, feelings, physical sensations) and those coming from our external environment (e.g. the traffic light switching to green). This ability to seamlessly switch between internal and external domains is crucial to allow us to flexibly engage and interact with the world.

This paper reports the last of a series of studies conducted by Sara Calzolari as part of her PhD at CHBH (supervised by Prof Fernández-Espejo and Prof Bagshaw, and funded by MIBTP). Sara's PhD aimed to characterise the neural and behavioural correlates of cognitive shifts between external and internal cognition.

In this study participants performed a series of tasks that sometimes required an external focus and sometimes an internal one, while their brain responses were recorded in the MRI scanner. The order of each question was manipulated so that on most occasions questions from the same task followed each other, but sometimes there was a switch from one task to another or from one domain (internal / external) to another. Behaviourally, the study confirmed that switching between tasks and between domains comes at a cognitive cost (evidenced by slower responses). While the brain activity associated with the tasks for each domain was different, the switch itself was accompanied by anticipatory activation of specific frontoparietal regions in the brain in all cases. The study revealed for the first time that similar networks are involved in switches regardless of their domain, suggesting the presence of a domain-general neural network that facilitates the flexible shift between task demands.



Sara Calzolari
PhD Researcher

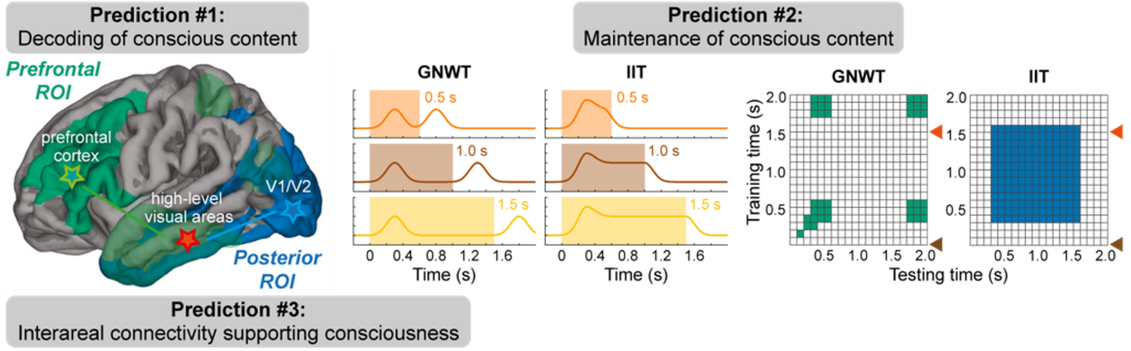
Dr Davinia Fernández-Espejo,
Professor of Neuropsychology and Clinical Neuroscience

Calzolari, S., Ingram, B.T., Bagshaw, A.P. and Fernández-Espejo, D. (2025). Neural Correlates of Goal-Directed Preparation to Switching Across External and Internal Domains. Human brain mapping, [online] 46(15), p.e70376. doi:https://doi.org/10.1002/hbm.70376.

Research highlights

Adversarial testing of global neuronal workspace and integrated information theories of consciousness

CHBH Research Theme: Awareness, consciousness and sleep



Understanding how consciousness emerges from brain activity remains one of the most compelling questions in neuroscience. Two influential frameworks – Global Neuronal Workspace Theory and Integrated Information Theory – offer distinct explanations for how the brain supports awareness. To examine these specific predictions, the international consortium COGITATE conducted one of the most ambitious, theory-driven studies of consciousness to date, combining large-scale data collection with preregistered hypotheses and state-of-the-art neuroimaging including MEG, fMRI, and iEEG.

Published in Nature in 2025, the study involved more than 250 participants who completed a visual perception task while their brain activity was measured across multiple modalities. Rather than evaluating each theory separately, the project used an "adversarial collaboration" approach, rigorously testing contrasting predictions within the same framework. The CHBH contributed to this effort, with Dr Oscar Ferrante playing a key role.

The results revealed a complex pattern of neural evidence: some predictions from both theories were supported, while several critical predictions were not fully supported. These findings provide the first large-scale, direct comparison of the two frameworks and clarify the conditions under which each accounts for observed neural activity. The project demonstrates the value of coordinated, transparent scientific collaboration, an approach that strongly reflects the research ethos of the CHBH.

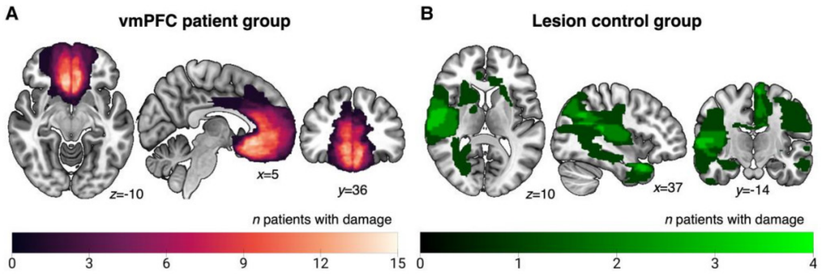
Dr Oscar Ferrante
Postdoctoral Research Fellow (now Lecturer in Cognitive Neuroscience at the University of Surrey)

Ferrante, O., Gorska-Klimowska, U., Henin, S., Hirschhorn, R., Khalaf, A., Lepauvre, A., Liu, L., Richter, D., Vidal, Y., Bonacchi, N., Brown, T., Sripad, P., Armendariz, M., Bendtz, K., Ghafari, T., Hetenyi, D., Jeschke, J., Kozma, C., Mazumder, D.R. and Montenegro, S. (2025). Adversarial testing of global neuronal workspace and integrated information theories of consciousness. Nature, [online] pp.1–10. doi:https://doi.org/10.1038/s41586-025-08888-1.

Research highlights

How specific brain injuries disrupt learning to help others

CHBH Research Theme: Cognitive computational neuroscience and social interaction and communication



Prosocial acts such as holding a door for someone or donating money to charity are fundamental to everyday life and societal well-being. To help others, we must learn to adjust our behaviour based on how it affects them. Yet how and where in the brain this learning takes place is unclear.

Previous research suggests that a region at the front of the brain called the ventromedial prefrontal cortex (vmPFC) is active during learning to help others, but brain scans cannot reveal whether a region is essential for learning. In this study, 28 adults with rare, well-defined injuries to vmPFC played a computer game in which they learned how to win points for a real other participant, themselves, or nobody. Two control groups also played the game to establish whether vmPFC specifically is important: a group of healthy adults and a group with injuries to other brain regions. We found that patients with vmPFC damage were worse at learning to win points for another person as well as for themselves, compared to the control groups. Mathematical models of learning showed that when rewards were for somebody else, vmPFC patients learned less from good outcomes and overreacted to bad outcomes. These impairments were linked to specific subregions of vmPFC, suggesting these are necessary for prosocial learning.

Overall, we identified brain areas that are crucial for helping other people. This may help explain changes in social behaviour after certain brain injuries and inform treatments for conditions like psychopathy which are characterised by reduced prosocial behaviours.

Margot Gueguen
PhD Researcher

Dr Jo Cutler
Postdoctoral Research Fellow

Professor Patricia Lockwood
Professor of
Decision Neuroscience

Gueguen, M., Cutler, J., Drew, D., Apps, M.A.J., Jeyaretna, D.S., Husain, M., Manohar, S.G. and Lockwood, P.L. (2025). Ventromedial prefrontal cortex lesions disrupt learning to reward others. Brain. [online] doi:https://doi.org/10.1093/brain/awaf056.

Event and engagement spotlight

This year, CHBH strengthened its standing as an international centre for excellence through a vibrant programme of high-profile seminars and conference contributions. These events reflect the Centre's commitment to fostering global collaborations and advancing cutting-edge brain research.

2025 CHBH Seminar Series Speakers:

- **Dr Livia Tomova (CUBRIC, Cardiff)** presented "The Effects of Isolation and Loneliness on Adolescent Cognition", hosted by Dr Lei Zhang.
- **Professor Christian Olivers (University of Amsterdam)** presented "The Prospective Use of Visual Working Memory", hosted by Dr Clayton Hickey.
- **Professor Barbara Franke (Donders Institute)** presented "Big-Data Approaches to Uncovering Biological Mechanisms in Psychiatric Neurodevelopmental Disorders", hosted by Professor Stephane De Brito.
- **Professor Sören Krach (University of Lübeck)** then delivered "Neurocomputational Mechanisms of Affected Beliefs", hosted by Dr Lei Zhang.
- **Professor Tomoki Arichi (King's College London)** shared advances in "Imaging Emerging Brain Function in Infants", hosted by Dr Barbara Pomiechowska.
- **Dr Yin Wang (Beijing Normal University)** presented "A Neurocomputational Framework for Understanding Human Relationship Perception", hosted by Professor Stephane De Brito.
- **Professor Tamara Swaab (UC Davis)** delivered "Meaning in Mind: Neurocognitive Perspectives on Context Sensitivity, Prediction, and Individual Variation in Language Processing", hosted by Dr Katrien Segaert.
- **Dr Daniel Yon (Birkbeck, University of London)** presented "Learning About Uncertainty from Ourselves and Others", hosted by Professor Jennifer Cook.
- **Professor Esther Walton (University of Bath)** delivered "Genetic Architecture of Brain Age and Its Health Correlates Across the Lifespan", hosted by Dr Felix Chan.
- **Dr Nadine Dijkstra (University College London)** presented "Distinguishing Visual Imagination and Perception of Reality in the Human Brain", hosted by Dr Charlotte Marshall.
- **Professor Jeffrey Bowers (University of Bristol)** delivered "Deep Problems with Neural Network Models of Human Vision and Language", hosted by Dr Dietmar Heinke.

Collectively, these events illustrate CHBH's broad international reach and its ongoing mission to strengthen ties with neuroscientists beyond Birmingham. By hosting seminars across diverse disciplines and methodologies, the Centre continues to advance understanding of the human brain while fostering global collaborations aligned with its core research themes.

Birmingham-Leiden Summer School on Computational Social Cognition, 2025

International Conferences and Workshops

CHBH has a long-standing record of hosting and co-organising high-profile international conferences and workshops, reinforcing its reputation as a global centre for excellence in brain research. In 2025, the Centre continued this tradition with a series of influential events that brought together leading experts from around the world to discuss cutting-edge topics across neuroscience and related disciplines.

Key events co-organised or hosted by CHBH in 2025 included:

- Leiden Computational Social Cognition Summer School: An intensive programme advancing training and dialogue in computational social cognition, designed to bring together early-career researchers and established leaders in the field.
- Curiosity, Information Seeking and Exploration: A conference exploring the cognitive, neural, and computational bases of curiosity and exploratory behaviours across species.
- The Mechanistic Basis of Foraging: A multidisciplinary workshop examining the behavioural, computational, and neural mechanisms that underlie foraging and decision-making in humans and animals.
- Advances in Motor Learning II: An international forum focusing on the latest experimental, computational, and applied research on motor learning and adaptation.
- Drawing the year to a close, thanks to the Birmingham-Illinois Partnership for Discovery, Engagement & Education (known as "BRIDGE "), CHBH hosted a delegation from the University of Illinois at Urbana-Champaign (UIUC, USA). The visit included a workshop to identify areas for future collaboration, initially focused on brain networks and their applications, while primarily seeking to stimulate broad conversations between the University of Birmingham and UIUC.

Through these events and collaborations, CHBH strengthened its global partnerships, provided platforms for sharing pioneering research, and continued to advance understanding of the human brain while fostering international knowledge exchange.

Looking ahead, CHBH's programme of international engagement will continue into 2026, with the Emerging Techniques and Technologies to Understand the Thalamus conference taking place in early 2026, focussing on advances in recording and stimulating the thalamus, both invasively and non-invasively, with applications to pathology and clinical translation. We also look forward to involvement in the EEG Cutting Gardens event later in the year, a collective for cutting-edge EEG/MEG research, supporting learning and networking through conferences, workshops, and community-driven events, with a commitment to good scientific practices, diversity, accessibility, and sustainability.

Global Knowledge Exchange and Capacity Building

CHBH strengthened its international collaborations this year with our Chief Radiographer Nina Salman hosting Jacky Thairu, an MR Radiographer from Nairobi, Kenya. Her visit was supported through the Gates Foundation Knowledge Exchange Fellowships, an initiative designed to promote bilateral sharing of expertise between MRI sites in Africa and high-resource centres.

During her time at CHBH, Jacky undertook structured training in MRI safety, incident reporting, the development and implementation of local operating rules, scanning protocols, project set-up and general operational oversight. The Fellowship enabled a rich professional exchange, enhancing technical and operational skills while fostering meaningful two-way learning between participating teams.
The knowledge exchange was further strengthened through the involvement of additional international radiography colleagues, Christian Emery, a Radiographer from Ghana, Africa, broadening the reach and impact of the programme.

This initiative reflects CHBH's ongoing commitment to global capacity building and the principle that knowledge is a shared resource. By connecting MRI professionals across diverse healthcare settings, these collaborations are helping to establish sustainable partnerships, elevate MRI standards and contribute to the advancement of magnetic resonance imaging worldwide.

Open Science at CHBH

Open science is thriving at the CHBH. Research activities at the Centre prioritise accessibility, reproducibility and transparency across the board, and this is reflected in the training and events organised across the year.

We are developing our own research methods handbook to support neuroimaging research at the Centre. This is an accessible approach for research groups to share tips and best practices across all of our neuroimaging methods. The intention is to develop documentation so that new members of the CHBH can quickly get up to speed on some of the more technical aspects of our work, and so that expertise is not lost when people move on to new opportunities. The pages are growing quickly with 20 contributors adding content at the last count and we expect this number to grow quickly in the next year.

The pinnacle of open science and collaborative research culture this year was the Hackathon event in May. Lead by organisers Dr Selma Lugtmeijer, Dagmar Fraser and myself, groups of students and researchers self-organised into projects and spent two days collaborating to learn and achieve their goals. A broad range of projects were proposed covering all aspects of neuroimaging and cognitive neuroscience. Feedback after the event was highly positive with participants emphasising teamwork opportunities, open atmosphere and the safe environment for learning. 100% of participants said they were keen to come back next year, and we hope to make this an annual fixture in the CHBH calendar.

Dr Andrew Quinn
Assistant Professor in Psychology

Early Career Researcher Highlights

Early career researchers (ECRs) are at the heart of CHBH success. As well as their own research, CHBH ECRs have been involved with a variety of events throughout the year, together with representing the Centre's ECRs at the School's management committee.

The first CHBH Hackathon was delivered on 28 May 2025. The event brought together researchers from across the Centre for collaborative problem-solving, coding sessions, and skills exchange, thereby strengthening interdisciplinary connections and supporting a culture of methodological innovation within CHBH.

During Brain Awareness Week 2025, ECR representatives lead CHBH's public engagement activities at the Midlands Arts Centre. The programme included hands-on demonstrations and interactive discussions designed to enhance public understanding of neuroscience and to further develop CHBH's outreach profile within the local community.

In 2025, ECR representatives initiated the development of a School-wide neurodiversity workshop and prepared an application for £500 to host Dr Robert Chapman (Durham University). The planned event will feature a keynote address, ECR-led presentations, and a panel discussion, with the aim of promoting inclusive and reflective research practices across the CHBH and School of Psychology.

Preparations are also underway for an ECR poster presentation session and an accompanying "Coffee Thinking" discussion event scheduled. This initiative is intended to provide ECRs with an informal but constructive forum for sharing ongoing work, receiving feedback, and fostering collaboration between research groups within CHBH.

Dr Selma Lugtmeijer
Postdoctoral Research Fellow

Dr Alicia Rybicki
Postdoctoral Research Fellow

Dr Yessica Martinez-Serrato
Postdoctoral Research Fellow

Spotlight on education: MSc Cognitive Neuroimaging and Data Science

In September 2024 CHBH welcomed the second cohort of students on its flagship Masters programme, Cognitive Neuroimaging and Data Science (CNDS).

The programme offers students hands-on opportunities to learn about and use the various neuroimaging tools which are housed at the Centre. MSc CNDS offers students an opportunity to create their own bespoke learning pathway by taking either a more cognitive or computational focus on neuroscience. Thus, the programme is well suited for students joining us with diverse prior backgrounds (psychology, neuroscience, biology, medicine, engineering, mathematics, computer science).

While all students have an opportunity to develop data science skills, students choosing a more computational focus are encouraged to apply programming skills to analyse secondary, large-scale multimodal (neuroscientific/neuroimaging) data, while those on the cognitive pathway tend to focus on collecting data in one of our neuroimaging facilities.

Dr Magda Chechlacz
Cognitive Neuroimaging and Data Science MSc Lead

Spotlight on education: MSc Cognitive Neuroimaging and Data Science

In December 2025 graduation ceremony, we celebrated the successes of our 2024/2025 cohort of MSc CNDS students. Here we share experiences and successes of some of these students.

Samuel Hannon
CNDS MSc Student

My time on the CNDS programme gave me a breadth and depth of experience across multiple neuroimaging tools including TMS, EEG, and MRI. The programme gives you a great opportunity to experience all of these (and more!) under one roof at the CHBH. My master's project with Dr Magda Chechlacz was focused on the use of a novel MRI method for measuring brain waste clearance during sleep. Through the cognitive neuroscience pathway, I felt well prepared and supported by the modules offered on research methods and MRI analysis.

While the modules tailored towards completing your project are immensely helpful, I felt the real strength of the programme was the transferrable skills you gain throughout. The foundational data science and translational neuroscience modules offered training in coding and clinical trials that can be applied outside of the scope of your assessments and research project. This gave me the confidence to apply to my current role as a senior research technician on the ACORN project under Dr Ali Mazaheri, which involves using an EEG biomarker to predict pain and painkiller usage in surgical patients. Others in my cohort have gone on to various roles including in PhDs, industry, and the public sector. I would say to any potential applicants that the programme caters both to those who have a clear career path in mind, and those who are still wondering!

Jamie Cooper
CNDS MSc Student

I entered the Cognitive Neuroimaging and Data Science (CNDS) programme with a BSc in Psychology and a desire to develop my understanding of the latest research related to brain health and cognitive function as we age. From multiple exciting research projects available, I chose to research the role of physical activity and sleep in the clearance of waste products in the brain using MRI. The modules I completed during the programme provided me with the necessary skills to complete my project, namely, the Data Science for Brain and Behaviour and Magnetic Resonance Imaging in Cognitive Neuroscience modules provided the fundamental skills for me to complete my project. Other modules broadened my scope of understanding of how various modalities can be applied to investigate the brain and cognition from different perspectives. The engaging teaching and opportunities to engage in research provided by the programme fed my curiosity and allowed me to develop a passion for research.
Since completing the CNDS MSc I have started a PhD at the CHBH, working with Dr Magda Chechlacz. The focus of my research is to investigate brain and cognitive changes associated with obstructive sleep apnea in older adults using MRI.

Krishna Bhavaraju
CNDS MSc Student

This year, MSc student Krishna Bhavaraju completed a research project within the Amico Lab, culminating in a manuscript currently under review titled "Unmixing the Psychedelic Connectome: Brain Network Traits of Psilocybin". Using a novel connectome-decomposition framework, Krishna helped identify two fundamental brain connectivity patterns underlying the acute psilocybin state (with effects indexed by plasma psilocin, the active metabolite of psilocybin): a Psilocin-Associated Functional Trait, whose expression scaled with plasma psilocin concentration, and a separate Visual Divergent Thinking Trait, which was linked to creative task performance and was significantly suppressed under psilocybin. Together, these traits formed a compact neural signature that allowed accurate classification of participants into psilocybin vs. placebo groups with 80% accuracy using logistic regression. Krishna's contributions to the stability analysis, trait extraction, and interpretation were central to this work, which highlights the high level of CHBH's students. The preprint of this work is available at: https://www.biorxiv.org/content/10.1101/2025.11.17.688834v1.full

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