UNIVERSITY OF BIRMINGHAM | CHBH CENTRE FOR HUMAN BRAIN HEALTH

CENTRE FOR HUMAN BRAIN HEALTH

ANNUAL REPORT 2022

FOREWORD

No doubt that the COVID-19 pandemic has been challenging for us all. Big thanks to the Operations Teams and the Laboratory Leads for navigating us through the multiple lockdowns and bringing our operations back to normal. I think we all enjoy being back in person at the CHBH to conduct our research, and importantly, to discuss research and exchange ideas. Beyond the existing imaging laboratories, we have been busy establishing a new laboratory for Optically Pumped Magnetometers (OPM) research. A shielded room is now installed in the OPM laboratory in the Gisbert Kapp building. We expect to have a working facility towards the end of 2022 with a whole-head OPM-MEG system that can be used for lifespan research including brain imaging in children. Furthermore, we have been busy organising the international Biomag2022 conference which was held in August on campus. It was a great pleasure to welcome fellow researchers from across the globe to the University to discuss the latest developments on MEG research. We now have an exciting year ahead. We have been so lucky to hire a number of new Principal Investigators and the aim is to integrate them into the CHBH and develop new collaborations.

Professor Ole Jensen
CHBH Co-Director

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The past year has had many positives compared to the year before, with the renewed ability to have face-to-face contact and tone down the Zoom meetings, high on my own list. Dagmar's haircut is also up there. We've had several new colleagues join the Centre community, with more to come over the next few months. Hopefully we can help them to settle in quickly and feel part of the CHBH, and we look forward to the new ideas they bring about how we can develop and grow the Centre in the future. While COVID-19 remains with us, we've been able to get back to data collection relatively as normal, which has been a relief to everyone. Behind the scenes, the Operations Team and Lab Leads have put in a huge amount of effort to get us to where we are now, and many thanks to everyone for the work they've put in. Figuring out how and when to update procedures as government guidance has changed and changed again may not be the most glamorous work, but without it we wouldn't be running as smoothly as we have been. A special mention to Alberto Guglielmi, whose calm presence and efficiency as our Operations Manager over the past year has been very much appreciated. Here's to a productive year with a minimum of global catastrophes!

Professor Andrew Bagshaw
CHBH Co-Director

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The Centre for Human Brain Health (CHBH) has world-leading expertise in attention, action, decision-making, social behaviour, sleep, neuronal oscillations, and multi-modal research.

The Centre works with industry partners on uncovering the fundamental mechanisms of the human brain as well as understanding how brain health contributes to wellbeing.

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Participate in brain research at the CHBH

birmingham.ac.uk/chbhvolunteer

CENTRE FOR HUMAN BRAIN HEALTH

The Centre for Human Brain Health (CHBH) is a leading interdisciplinary brain research facility established with the mission of understanding the fundamental mechanisms of the human brain as well as understanding what makes a brain healthy, how to maintain it, and how to prevent and reverse damage.

Our vision is to cross the boundaries of traditional academic and clinical disciplines to transform our understanding of the human brain. We recognise that to achieve the goal of personalised brain health we must first identify what constitutes a healthy brain and how lifestyle, developmental and societal factors interact and contribute to this endeavour.

The CHBH is a vibrant neuroscientific community, which currently comprises 59 principal investigators; including 13 professors, 3 readers, 21 associate professors/senior research fellows, and is supported by groups of dedicated post-doctoral researchers and PhD students.

Since its inception, CHBH has generated funding from a wide range of sources, including:

- The Academy of Medical Sciences
- Action Medical Research
- Alzheimer's Research UK
- Baily Thomas Charitable Fund
- Biotechnology and Biological Sciences Research Council (BBSRC)
- BRIDGE – Birmingham-Illinois Partnership
- The British Academy
- British Council
- Cancer Research UK
- Early Postdoc Mobility
- Education Endowment Foundation (EEF)
- Empower Therapeutics
- European Research Council (ERC)
- Economic and Social Research Council (ESRC)
- European Commission Marie Curie Fellowships
- Experimental Psychology Society
- Engineering & Physical Science Research Council (EPSRC)
- European Commission
- Facebook Technologies
- Greater Birmingham Enterprise Partnership
- Guangzhou First People's Hospital
- Horizon Europe
- HSBC
- The Humane Research Trust
- Jacobs Foundation
- James S. McDonnell Foundation
- Leverhulme Trust
- Marie Curie Fellowships
- Medical Research Council (MRC)
- Midland Neuroscience Teaching & Research Fund
- Ministry of Science and ICT
- Ministry of Defence (MoD)
- National Institute of Neurological Disorders and Stroke (NIH-NINDS)
- Oculus
- Proctor & Gamble Ltd
- National Institutes of Health (NIH)
- National Institute for Health and Care
- Research (NIHR)
- Research Council of Norway
- The Royal Society
- Siemens PLC
- Templeton World Charity Foundation
- The Waterloo Foundation
- The Wellcome Trust
- The Wellington Hospital – HCA Healthcare
- Wolfram Syndrome UK
- The Wolfson Foundation
- UK Quantum Technology Hub

Areas of specialism

The Centre is home to state-of-the-art brain imaging facilities, which are used to uncover the mechanisms supporting cognition 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)**, a high-performance EEG laboratory for accurate timing and application of auditory and visual stimulation (concurrently or separately)
- **Sleep laboratories**, equipped with 64-channel EEG amplifiers and peripheral equipment for experimental testing and stimulus delivery

Magnetic Resonance Imaging (MRI)

- **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.
- **Non-Invasive Brain Stimulation**, housing all the equipment required for both transcranial magnetic (TMS) and electrical (TES) non-invasive brain-stimulation experiments

We have strong links with many hospitals, including: Queen Elizabeth Hospital Birmingham, The Barberry National Centre for Mental Health, Birmingham Women's and Children's, Moseley Hall Hospital, Royal Leamington Spa Rehabilitation Hospital, Wellington Hospital (HCA Healthcare UK) and Heartlands Hospital.

Over the past year we've welcomed several new colleagues who bring exciting new approaches to the CHBH. We've also cemented our relationships with other Centres and Institutes within and external to the University, to develop a vibrant community of brain researchers.

Prof Andrew Bagshaw
CHBH Co-Director

A potential audience of 1 billion readers

Academics at the Centre for Human Brain Health strive to communicate their research to the wider public. During the last 12 months academics in the Centre have contributed to 296 articles.

The stories that received the most extensive coverage were from the lab groups of Dr Matthew Apps on the connection between motivation and how the brain processes fatigue, Prof Ole Jensen and Dr Steven Frisson on how our eyes and brain work together, and from Dr Patricia Lockwood on why older adults are most likely to make the effort to help others.

Functional Near-Infrared Spectroscopy (fNIRS)

RESEARCH HIGHLIGHTS

PAST, PRESENT AND FUTURE RESEARCH IN THE CHBH

Dr Tara Ghafari
Postdoctoral Researcher,
mTBI PREDICT consortium

Improving the outlook of mild traumatic brain injury

Mild traumatic brain injury (mTBI), or concussion, accounts for 1.4 million UK hospital visits annually. The consequences of mTBI are profound, with many patients suffering from persistent headaches, imbalance, memory disturbance, and poor mental health.

The CHBH, along with regional institutions Aston University and the University of Nottingham, is a key partner in the mTBI PREDICT consortium, which is funded by the Ministry of Defence and spearheaded by Professor Alexandra Sinclair at Birmingham's Queen Elizabeth Hospital. The consortium aims to identify mTBI patients at risk of long-term problems, such as those listed above, ultimately enabling a clearer, more accurate indication of required patient care and long-term medical prognoses.

This will be achieved through a programme of detailed clinical recording and evaluation of up to 800 patients, using a variety of medical techniques including: magnetoencephalography (MEG), magnetic resonance imaging (MRI), electroencephalography (EEG), functional near infrared spectroscopy (fNIRS), fluid biomarking, steroid hormones, visual, vestibular, and cerebral physiology.

A number of CHBH brain imaging techniques will be utilised in the study, results from which will capture the full range of features that characterise neural dysfunction after mTBI, and assess how injury might alter the brain:

- MEG – identifies the source(s) of post-injury disrupted brain activity, as well as the changes to brain signals and connectivity caused by the injury itself.
- MRI – provides information on different features within the brain and can demonstrate the impact of mTBI on brain function.
- fNIRS & EEG – combining these two techniques measures neural and vascular dysfunction in the brain.

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Dr Oscar Ferrante
Postdoctoral Researcher,
The Neuronal Oscillations Research Group

Unravelling the mystery of consciousness through conflicting theories

One of the biggest unresolved questions in neuroscience is the so-called "hard problem" of consciousness: How does a conscious experience, such as the pleasant feeling of the sun on the skin, arise from signals processed by billions of neurons in the brain? Many theories have been proposed to unravel this mystery, but the lack of dialogue between the differing theoretical frameworks have produced incompatible models and predictions. How can we determine which theory better explains consciousness?

The idea behind the Cogitate consortium, funded by the Templeton World Charity Foundation, is to compare two leading theories of consciousness by identifying their outright differences and design experiments that directly test the contracting predictions. By embracing this adversarial collaborative framework, experiments have been developed with, and endorsed by, the theories' supporters. These experiments are now being tested in six laboratories around the world, using three brain imaging methods: fMRI, MEG and intracranial EEG. At the CHBH we are in charge of the MEG segment of the project. This work is spearheaded by CHBH Postdoctoral Researcher, Dr Oscar Ferrante.

Relying on adversarial collaborations, multimodal brain imaging, open science practices as well as international team science, this initiative aims to accelerate research on consciousness.

COGITATE

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RESEARCH HIGHLIGHTS

PAST, PRESENT AND FUTURE RESEARCH IN THE CHBH

Dr Joseph Galea

Reader in Motor Neuroscience,
Galea Lab Lead

Virtual reality gaming helps stroke patients overcome hand impairments

After stroke, most survivors experience significant hand impairments and a decreased use of the paretic hand in daily life. Despite this, there are a lack of interventions that focus on improving hand impairment (i.e., open/closing the hand) in stroke patients. One of the key restrictions to developing these interventions has been inability to measure/track the movement of individual fingers without the use of extremely expensive equipment. To clear this hurdle, this European Research Council-funded project turned to off-the-shelf virtual reality (VR) technology.

The first thing the project did was demonstrate that this affordable hand-tracking software found in most new commercial VR headsets was accurate enough for use in a rehabilitation setting. Next, researchers developed two cost-effective immersive games which focused on improving hand function in stroke patients. These tasks were able to improve hand function (range of movement) in patients and showed that the user's level of engagement correlated to the rewards being offered. Most importantly, the researchers found that having played the games for a prolonged period of time, the improved hand performance would persist even when the VR headset was removed. Funding routes are now being explored to test the intervention with stroke patients within clinical settings.

More information on the study can be found here:
bit.ly/VRhand

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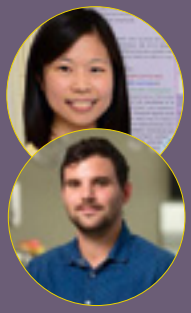


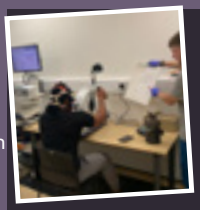
Dr Shin-Yi Chloe Chiou

Assistant Professor in Motor Control and Rehabilitation,
SportExRSpinal Cord Injury Research Group

Dr Tom Nightingale

Assistant Professor in Exercise Physiology,
SportExR Spinal Cord Injury Research Group

Arm exercise to improve stability and balance in spinal cord injury



An injury to the spinal cord can cause paralysis of the body and depending on its exact location, can disrupt involuntary control of the heart and blood vessels, limiting one's ability to perform exercise. Low levels of physical activity can reduce overall fitness and increases the risk of developing vascular and metabolic problems, such as arterial stiffness and type 2 diabetes. The SCI (Spinal Cord Injury Group) are a research group studying how accessible exercise technologies can benefit the health and fitness of people living with a spinal cord injury. Our recent review recommends individuals with a chronic (> 1-year) spinal cord injury should perform 30-40 minutes of arm-crank exercise at a moderate-to-vigorous-intensity 3-5 times per week to improve health and fitness. Our review also identified important areas for future research, which we are actively pursuing at the University of Birmingham, such as whether arm-crank exercise can improve core strength and stability for individuals living with a spinal cord injury. In addition to this, we are testing whether non-invasive spinal cord stimulation can 'normalise' cardiovascular responses to exercise in this population, thereby possibly augmenting the beneficial effects of exercise across a range of health outcomes.

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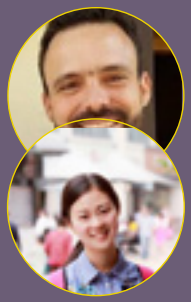
Chiou SY, Clarke E, Lam C, Harvey T and Nightingale TE. Effects of Arm-Crank Exercise on Fitness and Health in Adults With Chronic Spinal Cord Injury: A Systematic Review. Front. Physiol. 13:831372 (2022).

RESEARCH HIGHLIGHTS

PAST, PRESENT AND FUTURE RESEARCH IN THE CHBH



Dr Stephane De Brito

Associate Professor in Psychology, Social, Cognitive, Affective and Neuroscience (SCAN) Lab Lead

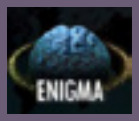
Dr Yidian Gao

Postdoctoral Research Fellow, Social, Cognitive, Affective and Neuroscience (SCAN) Lab

Collaborating globally to understand the connection between brain structure and conduct disorder in children and adolescents

The ENIGMA (Enhancing NeuroImaging Genetics Through Meta-Analysis) consortium is an international network of researchers who collaborate by sharing data to study brain structure and function in health and disease as well as their genetic basis.

As part of the ENIGMA-Antisocial Behaviour (ASB) working group, Dr Stephane De Brito and Dr Yidian Gao, together with colleagues from the University of Bath, have brought together over 27 research groups and 93 scientists based in 14 countries across Europe, Asia, North and South America to study the association between brain structure and conduct disorder/problems (e.g., physical aggression towards other humans or animals, theft and rule-breaking behaviours) in children and adolescents.



Since the beginning of 2020, this first project of the ENIGMA-ASB working group has produced the largest neuroimaging dataset (over 3,700 participants) in the world on conduct disorder/problems to compare different measures of brain architecture (cortical surface area, cortical thickness and subcortical volume) between typically-developing youths and those diagnosed with conduct disorder or severe conduct problems.

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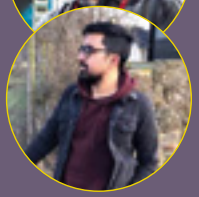
Thompson, P.M., Jahanshad, N., Ching, C.R.K. et al. ENIGMA and global neuroscience: A decade of large-scale studies of the brain in health and disease across more than 40 countries. Transl Psychiatry 10, 100 (2020)

Dr Katrien Segaert

Associate Professor in Psychology, The FAB Study

Dr Sam Lucas

Associate Professor in Exercise and Environmental Physiology, The FAB Study



Dr Foyzul Rahman

Postdoctoral Research Fellow, The FAB Study

Fitness, Ageing and Bilingualism

A lot has happened in the year or so since our previous item in the CHBH Annual Report 2021. Our project, Fitness, Ageing, and Bilingualism (FAB), which investigates how physical exercise might bestow protection against age-related decline in cognition, has well surpassed its half-way point.

We have performed 342 online pre-screens, 140 in-person screens, 243 cognitive testing sessions, 107 fMRI acquisition sessions, and 106 physical function tests; put another way, that's 53,634 minutes or 894 hours of data collection!

COVID restrictions, sickness, and the Commonwealth Games have thrown up many challenges. Nonetheless, due to the unceasing hard work of our research assistants, placement students, and PhD student, we have now concluded recruitment of new participants for the study but will continue to collect the remainder of our data until Spring 2023.

Excitingly, we are currently analysing the first iteration of our fMRI, VO2 max, and tip-of-the-tongue datasets which will form the basis of an upcoming paper. Here, we will look to establish a link between brain activity, grey matter density, cardio-respiratory fitness, and word-finding abilities in our older adult participants. We hope this is the first of many exciting outputs from this project and thank all the participants who volunteered to take part in the study.

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RESEARCH HIGHLIGHTS

PAST, PRESENT AND FUTURE RESEARCH IN THE CHBH

Dr Patricia Lockwood

Senior Research Fellow in Cognitive Neuroscience, Social Decision Neuroscience Lab Lead

Dr Jo Cutler

Postdoctoral Research Fellow, Social Decision Neuroscienece Lab

Older adults across the globe are more willing to help others, but mostly those in the same country

2022 marks the second year of the UN Decade of Healthy Ageing, a global collaboration to "improve the lives of older people, their families, and the communities in which they live." Maximising health and well-being as we age is a particularly pressing issue. Between 2015 and 2050, the proportion of the world's population over 60 years old will nearly double, from 12 percent to 22 percent. Prosocial behaviours—actions that help others—are vital for health and well-being throughout life. These behaviours strengthen social relationships and improve mental and physical health. It is therefore essential to understand whether our willingness to help others changes with age.

In a recent study we measured prosocial behaviours in over 46,500 people from 67 countries. People were asked how much of their income they would be willing to donate to charities helping victims of COVID-19 in their own country, victims abroad, or to keep money for themselves. In a second example, we asked people to report how much they were willing to socially distance to protect others.

We found that older adults around the world were more prosocial. They were willing to donate more money to charity overall and reported higher levels of social distancing to protect others during the pandemic. However, although older people were more generous overall, they were also more biased. Younger people gave more equal amounts to the national and the international charities, whereas older people gave less internationally.

Older adults also had stronger preferences for people in the same country. They were more likely to identify with their country and agreed more strongly with statements such as "my country deserves special treatment".

As the challenges of the 21st century become increasingly global in nature and rely on people helping others, it is vital we understand how different age groups might respond. With countries implementing cuts to foreign aid budgets, there will be an increasing reliance on global charities. Understanding giving preferences and inclinations of different age groups could therefore be extremely important in addressing these challenges.

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Cutler, J., Nitschke, J.P., Lamm, C. et al. Older adults across the globe exhibit increased prosocial behavior but also greater in-group preferences. Nat Aging 1, 880–888 (2021)

QUANTUM NEUROSCIENCE

DEVELOPING QUANTUM BRAIN SENSORS TO IMAGE, STIMULATE AND DIAGNOSE

Dr Anna Kowalczyk

Assistant Professor and EPSRC Fellow

When something goes wrong in the brain, due to injury or a disorder, we need to address the source of the issue as quickly and as accurately as possible. However, because of the brain's inherent complexity, achieving sufficiently detailed accuracy to image, stimulate and diagnose is extremely challenging.

Electrophysiological brain activity can be measured by magnetoencephalography (MEG), where highly-sensitive magnetic field sensors are used to detect changes in the magnetic field outside the head. In our multidisciplinary lab, we are developing a new type of ultra-sensitive magnetometer based on interactions of atoms with laser light. Such quantum sensors, called Optically Pumped Magnetometers (OPMs), employ polarised light to detect changes in the spin of atoms when they are exposed to a magnetic field. OPM sensors are so sensitive that they can measure and localise magnetic fields induced by activity in the brain.

The quantum sensor we have developed and tested with human subjects is robust in detecting brain signals, and can be also combined with other neuroscience techniques such as functional Near Infrared Spectroscopy (fNIRS), where harmless light is transmitted into the brain and reflected back, containing information about blood flow in underlying tissue. All of that can be combined in a single hybrid sensor that will simultaneously provide two contrast-rich signals: those of neural and vascular response, creating a sensor that will be richer than either alone. Finally, our quantum sensors can be built to be resilient to the high magnetic field pulses of Transcranial Magnetic Stimulation (TMS), a type of brain stimulation technique. We are currently developing OPM gradiometers and hybridised quantum optical sensors that can be used in conjunction with TMS.

Our overall objective is to develop compact, easy-to-use, scalable, novel technology to access, acquire, view and diagnose brain signals for neuroimaging. Such non-invasive optical quantum sensors will enable new capabilities in basic and translational cognitive neuroscience for understanding brain connectivity and for the diagnosis and treatment of debilitating brain disorders such as mild traumatic brain injury (mTBI).

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Dr Anna Kowalcyzk and Yulia Bezsudnova working on the OPM

Dr Kyung-Min An,
Assistant Professor in Psychology

A PAEDIATRIC OPM SYSTEM: FROM DEVELOPMENT TO CLINICAL APPLICATIONS

Children grow and develop incredibly fast. During development, the child's brain changes not only structurally but also functionally. However, due to their smaller head sizes, conventional brain imaging methods are less suitable for recordings of brain activity in children.

At the CHBH, optically pumped magnetometers (OPMs) will be used to develop a new type of brain imaging system optimised for paediatric recordings. OPM sensors can be placed in any position, so they can be adapted to different head sizes and measure the brain activity from children at any age. For these reasons, researchers at the CHBH are developing a paediatric OPM-MEG system.

The development of the system and the improvement of the sensors is part of a collaboration between the University of Birmingham's School of Psychology, School of Physics and Astronomy, and the UK Quantum Technology Hub for Sensors and Timing. As an academic with expertise in paediatric research, I, amongst others situated within the CHBH and the University of Birmingham's Institute for Mental Health (IMH) and Centre for Developmental Science (CDS), will apply the system to investigate neurodevelopmental disorders such as autism spectrum disorder (ASD).

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Dr Anna Kowalczyk and Dr Kyung-Min An stand within the newly-installed, magnetically-shielded room which houses the OPM

Yulia Bezsudnova
PhD Researcher

OPTIMISING OPM SENSORS FOR MEG APPLICATIONS

The main goal of the OPM lab is to develop novel quantum technology for brain imaging. The field of optical magnetometry is rich and many types of optically pumped magnetometers exist, however, employing OPMs for brain imaging sets several requirements on the physical aspects of the sensor.

Every OPM sensor consists of a laser light that propagates through a glass cell filled with atoms, and a detector that measures how the properties of light change with the magnetic field. Usually, in physics lab settings, the bigger the atomic cell, the more the atoms contribute to the measurement, resulting in better sensitivity of the sensor. However, one might wonder: what size of the cell is best for brain imaging applications? To tackle this question, we have developed a computational model that can be used to guide the design of the OPM sensor or sensor arrays for the other type of brain imaging technique, magnetoencephalography (MEG).

Our model takes into account the physical aspects of the sensor (e.g. size of the cell), characteristics of the external environment (noise level), and parameters specific to the MEG experiment (the origin of the brain activity). The output of our model gives the optimal cell dimensions that result in the best possible signal-to-noise ratio. We can also check how well an array formed by such sensors performs by estimating its localisation accuracy and spatial resolution.

My current focus is to set up the new OPM-MEG system suitable for subject testing in our new magnetically shielded room (pictured). We expect to prove that an OPM-MEG system with a small number of sensors (<10) is suitable for using Multivariate Pattern Analysis. Furthermore, we want to see how multivariate decoding of neural activity patterns benefits from the increase in signal-to-noise ratio provided by an array of OPMs.

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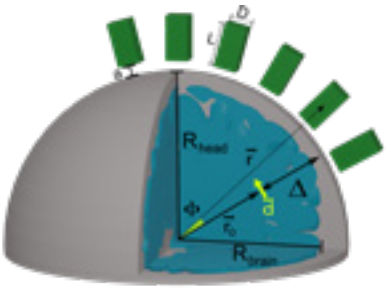

CELEBRATING OUR EARLY CAREER RESEARCHERS

CHBH PHD PAPER OF THE YEAR 2021

WINNER

Awarded a £100 voucher of choice

LIZZIE FARROW

SLC25A24 gene methylation and gray matter volume in females with and without conduct disorder: an exploratory epigenetic neuroimaging study *Translational Psychiatry*, September 2021

Lizzie's comments on winning:

'I was a bit surprised but very excited when I found out that I'd won the CHBH PhD paper prize! The paper was my first publication and a lot of work went into it, so having that recognised was really rewarding and validating. I'm so grateful to my PhD supervisors, Stephane De Brito and Magdalena Chechlacz, for all the hard work they put into the paper too, for encouraging me through the process of submitting and revising it. Thanks also go to Andreas Geburtig-Chiocchetti, our collaborator in Germany, who hosted me for a placement in Frankfurt in 2019 where I learnt the key methylation analysis techniques used in the paper.'

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CHBH POSTDOCTORAL PAPER OF THE YEAR 2021

WINNER

Awarded a £100 voucher of choice

DR YALI PAN

Neural evidence for lexical parafoveal processing *Nature Communications*, September 2021

Yali's comments on winning:

'It is an honour to win the CHBH Postdoctoral Paper Prize. It has been a long journey to my first postdoctoral paper at the University of Birmingham, and it means a lot to receive such positive feedback. I really want to thank everyone in the Neuronal Oscillations Group, especially Ole Jensen and my collaborator Steven Frisson for their insightful discussions. I want to also send thanks to all the participants who contributed during the development of this study. I hope that the publication of this study can help us to understand the neural mechanisms underlying natural reading, as well as giving us insight into reading disorders like dyslexia.'

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CHBH PHD PAPER OF THE YEAR 2021

RUNNER-UP

Awarded a £25 voucher of choice

KATHARINA DUECKER

No Evidence for Entrainment: Endogenous Gamma Oscillations and Rhythmic Flicker Responses Coexist in Visual Cortex *The Journal of Neuroscience*, August 2021

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CHBH POSTDOCTORAL PAPER OF THE YEAR 2021

RUNNER-UP

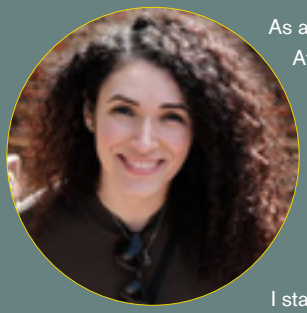
Awarded a £25 voucher of choice

DR JO CUTLER

Older adults across the globe exhibit increased prosocial behavior but also greater in-group preferences Nature Aging, October 2021

@DrJoCutler **j.l.cutler@bham.ac.uk**

BIANCA DIACONU: CHAMPIONING AND IMPROVING WELLBEING SUPPORT FOR UNIVERSITY OF BIRMINGHAM STUDENTS



As a PhD student in the Social, Cognitive, Affective and Neuroscience (SCAN) lab, I am investigating resilient functioning (emotion processing, psychophysiology, and structural brain differences) in youth with experiences of childhood maltreatment.

I started my PhD in September 2019, which meant that I only had approximately 6 months of normality before the pandemic kicked in. I knew a PhD was going to be hard work but adapting to a cognitively demanding environment in light of the new circumstances...well, it didn't make it a breeze. I started a PhD representative role for my cohort, and it wasn't long before I learned that many of us were struggling for various reasons. This motivated me to hear from more postgraduate students across the University and find out ways to increase support for early career researchers (ECRs). After collecting feedback from postgraduate students across the university and presenting it to the Graduate School and Wellbeing Services, support started to improve. The University is now providing instant online counselling to all students regardless of age and without waiting lists. Moreover, with the help of the CHBH operational team, we have started a new mentoring scheme, where on a voluntary basis, PhD students get paired with a more experienced academic to guide them alongside their supervisory team. Finally, together with my PhD colleagues Lydia Hickman, Brandon Ingram, and Mike Winstanley we have put together a series of seminars aimed at providing ECRs with advice about navigating academia.

If you would like to hear more about these opportunities or to share your views on what support should look like for postgraduate researchers, please get in touch. You'd be surprised how far a little collective effort can go.

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BRAIN AWARENESS WEEK 2021 AND 2022

The CHBH has a history of celebrating the annual Brain Awareness Week, and 2021 and 2022 were no exception. The COVID-19 pandemic did not stop 2021's efforts to celebrate the landmark occasion, with colleagues from departments across the University coming together, including: the CHBH, School of Psychology, School of Sport, Exercise and Rehabilitation Sciences, Institute of Cancer and Genomic Sciences, Institute of Inflammation and Ageing, and the School of Biosciences. The collective efforts of this collaborative event produced a wide-range of informational videos and resources encompassing the broad-spectrum of brain-related research taking place across the University, and all features from the event can be found online: bit.ly/uobbaw21

2022's Brain Awareness Week presented the long-awaited opportunity to directly re-engage with the public on brain science, following the chaos of the pandemic. Academic representatives from the CHBH, School of Psychology, School of Biosciences and the Medical School again came together to bring a taste of their research to the likes of Birmingham's ThinkTank Museum and the Midlands Art Centre, to engage with the next generation of scientists and their families.Topics and engagement included:

- Can you make your memory better?
- Medical neuroscience: Neurodegeneration, brain trauma, tumours and trials
- Animal Brain Matching Game
- 'Guess the Fruit' from the MRI scan image
- 'True or False?' Brain Facts Challenge
- BRAINZ - A Smartphone Game for Emotion Control
- Looking into the brain of a fly
- Using Fruit-flies for Brain Discovery

EVENTS SPOTLIGHT

THE 22ND INTERNATIONAL CONFERENCE ON BIOMAGNETISM, AUGUST 2022

The Centre for Human Brain Health hosted the biannual 22nd International Conference on Biomagnetism (Biomag2022) at the University of Birmingham. The conference was a great success with 500 people attending in person and 150 people attending online. The attendees were researchers from around the globe. The talks and posters covered MEG brain imaging applied to address cognitive and clinical neuroscience questions as well as developments on sensors and data analysis. Beyond the neuroscience research, there was exciting new work presented on OPM-MEG. This refers to a new type of brain imaging where neuronal activity is measured using so-called Optically Pumped Magnetometers (OPMs). These sensors are more versatile and can be used for – amongst others – brain imaging in children. The conference was held in the Great Hall and the Bramall Music Building allowing us to show off the campus. Beyond the scientific programme, the attendees enjoyed the social activities including a running club, a music night with bands composed of the researchers, and dinner in the Custard Factory.

@biomag2020 **#Biomag2022**

ANNUAL MEETING FOR THE BRITISH ASSOCIATION FOR COGNITIVE NEUROSCIENCE (BACN), MAY 2022

Numerous CHBH academics and students presented fresh-off-the-press research findings and methodologies as the University welcomed delegates to this year's Annual BACN conference, hosted by CHBH Reader Dr Joe Galea. Hundreds converged upon Edgbaston Park Hotel, as stimulating scientific dialogue was had through prize lectures, symposia and poster sessions, covering an abundance of topics including: perception, language, memory, attention, and decision-making. CHBH Senior Research Fellow Dr Matthew Apps scooped the 2021 Early-Career Prize for his lecture 'Can I be bothered? Neural and computational mechanisms underlying the dynamics of effort processing'.

@bacn_uk
#BACN22

IMPACT ON EDUCATION

Dr Wieske Van Zoest
Assistant Professor in Psychology,
Director of Postgraduate Programmes

The Brain Imaging and Cognitive Neuroscience (BICN) MSc is the flagship programme affiliated with the CHBH and is delivered by in-house staff and postgraduate students.

The BICN MSc degree is integrated with other MSc programmes in the University of Birmingham's School of Psychology and has been designed to promote development of advanced neuroscientific skills in experimental design and analysis, research skills, critical thinking and reading, oral presentation, and scientific writing. Students learn the main techniques of brain mapping that are used in the Centre and learn how neuroscience expands the understanding of human cognition in different fields.

The MSc project is the most significant part of the degree. Supervised by in-house staff, students plan and carry out a substantial empirical inquiry. This work is presented at a Postgraduate Research event and forms the backbone for the MSc dissertation. Examples of the MSc project from 2021/2022 include:

- "Functional Architecture in Resting - State Associated with Fluid Intelligence Among Older Adults"
- "Regional hemispheric alpha power fluctuation correlates with congruency during complex audiovisual stimuli"
- "Examining the Relationship Between Poor Sleep, Frontoparietal White Matter, and Sustained Attention in Older Adults using Diffusion Tractography"

After two years of primarily on-line learning, in 2022 we were very happy to have students from the MSc Brain Imaging and Cognitive Neuroscience (as well as collaborating students from the MSc Computational Neuroscience & Cognitive Robotics) back in person at the Centre.

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MEG, THE COMMONWEALTH GAMES, AND ME

Gabriel Byczynski
MSc Brain Imaging and Cognitive Neuroscience Student 2021/2022

Under the supervision of Dr. Hyojin Park, I have spent my degree using magnetoencephalography (MEG) to understand audiovisual integration. As someone with a background in music and a passion for languages, this project is exciting, and has given me an improved understanding of the complexity of auditory and visual perception, and their overlap. The knowledge and skills I obtained during my MSc have been excellent, and were instrumental in my acceptance to Trinity College Dublin, where I will be pursuing my PhD. During my time at the University of Birmingham, I was fortunate to be able to augment my time with some public engagement activities, too! I participated in Brain Awareness Week by creating informational videos about my research. I was also interviewed by ITV News about my research, the Commonwealth Games, and what it's like being Canadian and studying in Birmingham. Towards the end of my year at Birmingham, I also had the chance to guide a local youth group around the CHBH MEG laboratory, demonstrating how I used the equipment in my MSc research and studies.

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A MEDIC'S TIME STUDYING AND **RESEARCHING IN THE CHBH**

MEDICAL STUDENT KISAL MUNASINGHE ELABORATES ON HIS EXPERIENCES STUDYING ON THE HUMAN NEUROSCIENCE INTERCALATED DEGREE

Kisal Munasinghe
BSc Intercalated Human Neuroscience Student 2021/2022

From September 2021 to May 2022, I had the privilege of augmenting my Medical studies with an intercalated BSc degree in Human Neuroscience at the University of Birmingham. With this degree, I had the pleasure of spending a lot of time at the CHBH working on an EEG project on selective visual attention under the guidance of world expert in the field, Dr Clayton Hickey, and some other truly exceptional researchers, Dr David Acunzo and PhD researcher Damiano Grignolio. Together, we carried out over 25 EEG recordings from volunteers from the University whilst they undertook a visual search task and a repetition detection task. With this method, we managed to show visual targets that capture our attention are registered in our brainwaves. Armed with this evidence, our research team presented our novel work at both the International Conference of Neuroscience, the 2022 edition of which was held in Helsinki, and the British Association of Cognitive Neuroscience, held in our very own backyard at the University's Edgbaston Park Hotel. My time working at the CHBH was not only greatly enjoyable on a day-to-day basis, but truly eye-opening to a medical student who had previously had very little exposure to the research world. My time within the CHBH has given me a much greater appreciation for the graft, intuition and inventiveness commonplace in the life of a researcher, and has opened up my mind to future research opportunities.

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INTERCALATED BSC HUMAN NEUROSCIENCE

In partnership with the University of Birmingham Medical School, each year the CHBH hosts medical students completing an intercalated BSc in Human Neuroscience. These students pause completion of their medical degree for one year, commonly after the third year of their five-year programme, to complete the 1-year BSc. They choose a set of academic modules offered by the Schools of Sport, Exercise, and Rehabilitation; Psychology; Biosciences; and Philosophy and complete a dissertation project under direct supervision of a CHBH faculty member. This interdisciplinary programme is highly competitive, attracting academically strong medics with a view to future specialisation in fields like psychiatry and neurosurgery.

Dr Clayton Hickey
Associate Professor in Psychology, BSc Neuroscience Programme Lead

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