PRIFYSGOL BANGOR UNIVERSITY

BANGOR IMAGING UNIT

Bangor Imaging Unit

Annual Report 2025

bangor.ac.uk

Foreword from our Director

I am delighted to present the Annual Report for the Bangor Imaging Unit (BIU). Our vibrant community of scientists, students, and technicians continues to grow, strengthening our mission to conduct world-leading research that advances foundational science while making a real-world impact.

This public report serves to broaden the reach of our research, keep colleagues and students informed about ongoing activities and opportunities, and foster engagement with the wider local community. For those encountering the BIU for the first time, we've included a brief history of the unit, an overview of our core research themes, and a showcase of our facilities. To explore further, I encourage you to visit our newly redesigned website by scanning the QR code or clicking the provided link.

Over the past year, our researchers have published numerous articles in leading international journals, reporting groundbreaking discoveries and methodological advancements. I am proud to highlight a selection of these papers in the "Highlights" section of this report. Additionally, we have expanded our research team with two new principal investigators, who bring fresh expertise and exciting research programs to the BIU. I would like to take this opportunity to formally welcome Tirso and Geoff—readers can find their bios on Page 12. We are also thrilled to welcome the 2024 cohort of doctoral students; a strong postgraduate research program is essential to securing the long-term future and global influence of our unit. This report features two recent graduates, illustrating the kinds of successes our students achieve.

Following the merger of our parent schools, Psychology and Sport and Exercise Science, we have integrated and strengthened our technical support teams, significantly enhancing the services available to BIU users. I extend my sincere thanks to Kev Williams, Andrew Fischer, and the entire team for their invaluable contributions.

Looking ahead, I am eager to develop new partnerships with local businesses and organisations. If you are interested in collaborating or accessing BIU facilities, please don't hesitate to reach out. The same invitation extends to our colleagues at Bangor—we are keen to explore new research collaborations and expand our teaching portfolio.

As I write this report, I am witnessing the launch of several exciting new projects, reinforcing my confidence in another outstanding year ahead. I have no doubt that the BIU will continue to thrive as we move into the second quarter of the 21st century.

Learn more about the BIU

Visit our website at
www.bangor.ac.uk/bangorimagingunit

Richard | BIU Director 2024

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Image credit: Katerina Vazacova

Bangor Imaging Unit

The Bangor Imaging Unit (BIU) is a leading research facility equipped with a state-of-the-art 3.0T magnetic resonance imaging (MRI) scanner and a neuro-navigated non-invasive brain stimulation laboratory. These advanced technologies support both fundamental and applied research into the human brain and body.

The BIU is closely affiliated with Bangor University's Cognitive Neuroscience Institute and the Institute for Applied Human Physiology. Located at the heart of campus within the **College of Medicine and Health**, it plays a vital role in research and education across the **School of Psychology and Sport Science** and the **North Wales Medical School**. The unit fosters a dynamic, interdisciplinary community of neuroscientists, physiologists, physicists, and clinicians.

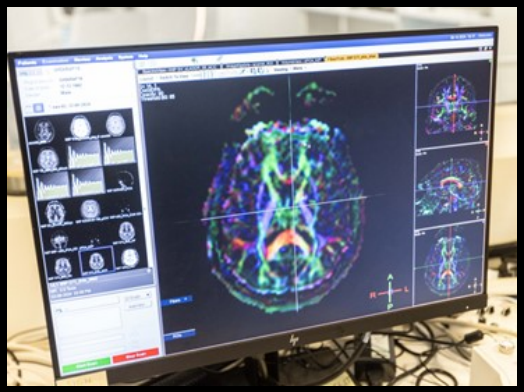
Our research focuses on unraveling the structural, chemical, and functional composition of human organs to better understand the distinctions between healthy and diseased states. By identifying mechanisms of dysfunction and potential avenues for prevention or repair, we aim to advance medical science and improve human health.

Through our exploration of the full spectrum of health, we strive to make a lasting impact—empowering individuals to live longer, healthier lives.

Discovery and Innovation

Core Research Themes

Physiology and Health



Imaging Methods

Perception and Action

Social Interaction

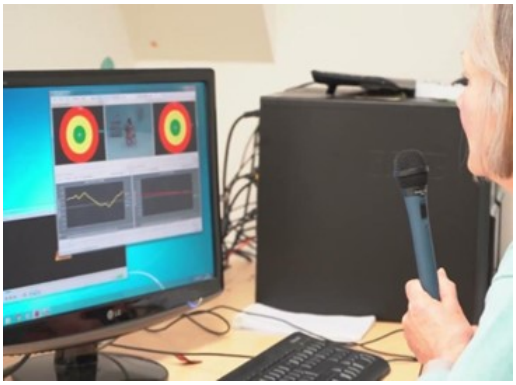
Funding

Since its inception, BIU researchers have attracted funding from a variety of external agencies, including UKRI (ESRC, BBSRC), the Wellcome Trust, the Leverhulme Trust, Ministry of Defence, and the European Research Council.

State-of-the-Art

Facilities

Magnetic Resonance Imaging



Behavioural laboratories

Near-Infrared Spectroscopy

Non-invasive Brain Stimulation

Research Output

BIU researchers frequently publish in top international, peer-reviewed journals. See pages 7-11 for selected highlights from 2024, or follow this link for a comprehensive list of publications from the past five years.

History of MRI at Bangor

In the late 1990s, Bangor University contributed financially to the local Health Board to support the purchase of a Philips 1.5T MRI scanner—the first fixed installation of its kind at the hospital. In return, university researchers were granted ‘out-of-hours’ access, and by the early 2000s, they had established a strong track record of funding and publications using MRI. This success strengthened the strategic case for further investment, leading to support from the Welsh Government and the Wolfson Foundation for a research-dedicated 3.0T system on campus in the Brigantia Building. Installed in 2007, this facility provided unparalleled regional access to advanced basic-science and clinical research.

The original installation in 2006

New system installed in 2019

The associated building work also enabled the co-location of the MRI suite with other neuroscience labs, such as those for brain stimulation, fostering synergy between research methods. These world-class facilities, in turn, helped attract leading experts in biomedical imaging and cognitive neuroscience.

In 2019, a state-of-the-art Philips 3.0T system replaced the previous scanner, significantly enhancing sensitivity, resolution, and imaging capabilities while improving energy efficiency and reducing liquid helium consumption for cooling the superconducting magnet.

Research Highlights 2024

Metronomes help stabilise speech movements in people who stutter

People who stutter often show more variability in their speech movements, even when their speech sounds are fluent. We can use MRI to record images of the vocal tract at over 30 frames per second – about as fast as a smart-phone camera. This enables us to see the entire vocal tract in motion during speech, providing new insights into speech motor control.

This study analysed speech movements when participants spoke with and without a metronome. Results showed that people who stutter had greater movement variability when speaking naturally, but this reduced to the same level as non-stuttering speakers when using a metronome. Variability was similar throughout the vocal tract – from the lips to the larynx.

These findings demonstrate that metronome-timed speech not only improves fluency in people who stutter but also stabilises speech movements. This highlights how rhythmic cues can enhance motor control in people who stutter, offering valuable insights into the mechanics of speech production.

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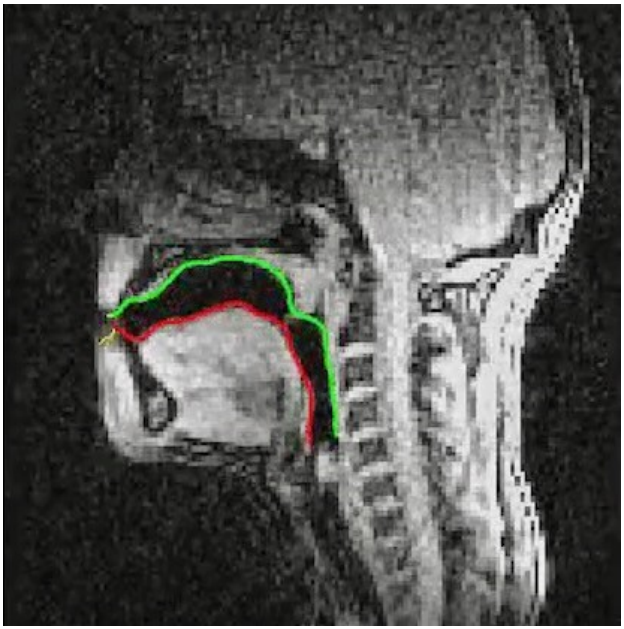

OPEN DATA

This research report is Open Access: Scan the QR code, or Click Here to access the publication

Wiltshire, C. E., Cler, G. J., Chiew, M., Freudenberger, J., Chesters, J., Healy, M. P., ... & Watkins, K. E. (2024). Speaking to a metronome reduces kinematic variability in typical speakers and people who stutter. *Plos one*, *19*(10), e0309612.

Research Highlights 2024

Brain basis of tool perception lateralises with handedness and language dominance independent of handedness

Dr David Carey
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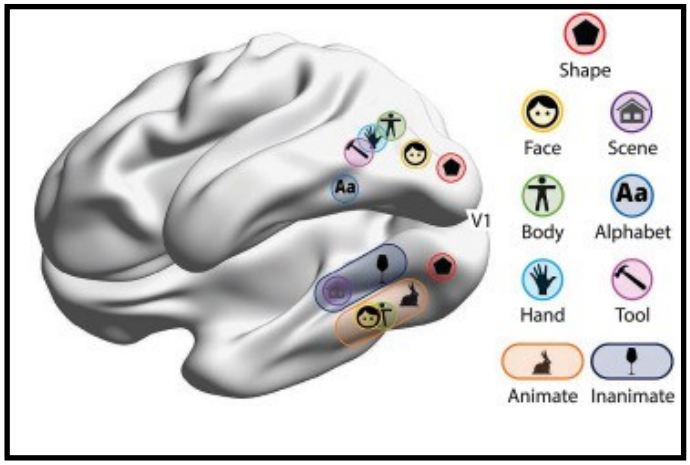
The two hemispheres of the human brain are specialised for different tasks, and one of these functions is the skilled use of tools with our highly dexterous hands. Regions in the brain that are selective for images of hands and tools have been suggested to be more specialised in the left hemisphere of the brain. This arrangement makes sense, as that is the hemisphere that controls the right-hander's tool-using hand. It is also the hemisphere best at speech and language functions. One would think, given their use of their left hand, that these functions would be lateralised to the right hemisphere in left-handers. In fact, in left-handers, many functions related to tool use or tool pantomime may also depend more on the left hemisphere. One hypothesis about this odd arrangement is that the left hemisphere is dominant for speech and language in the majority of left-handers, suggesting a control system for controlling complex movements needed for skilled tool use, as well as for the muscles that control speech. BIU researchers examined if this left hemispheric specialisation extends to the posterior brain regions crucial for the visual perception of hands and tools (see Figure) in left- and right-handed individuals. They specifically included a large group of left-handed individuals with right hemisphere language dominance, identified via a longstanding recruitment effort by Dr David Carey. The results suggest a complex picture regarding hemispheric overlap of hands and tool representations, and that visual appearance of tools may be driven in part by both language dominance as well as the hemisphere which controls the motor-dominant hand.



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Scan the QR code, or Click Here to link to the publication

Karlsson, E & Carey, D. (2024). Hemispheric asymmetry of hand and tool perception in left- and right-handers with known language dominance. *Neuropsychologia, 196*.

Research Highlights 2024

Brain region helps us quickly detect social interactions from sight

Understanding social interactions requires rapid visual processing. Research from the BIU reveals that a region of left hemisphere posterior cortex (the extrastriate body area; EBA) plays a crucial role in this ability. Previously, this area was mainly thought to be involved in perceiving individual people.

Our researchers used a large fMRI dataset to show that the left EBA responds more to facing than non-facing human figures. Behaviourally, people struggle to recognise facing dyads when they are inverted, and more so than when non-facing ones are inverted. Using transcranial magnetic stimulation, our researchers temporarily disrupted left EBA activity, which eliminated this inversion effect—proving a causal role of this region in social perception. These findings highlight how our brain efficiently decodes social interactions from visual stimuli.

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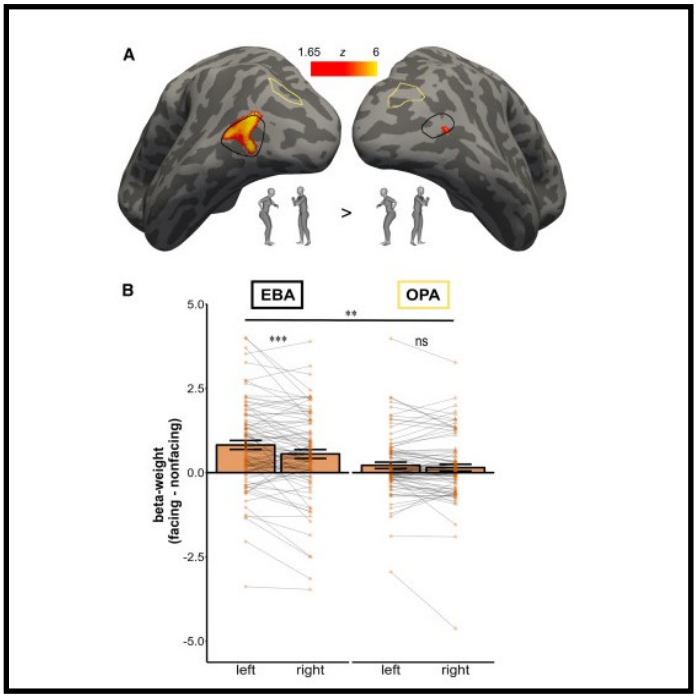

Gandolfo, M., Abassi, E., Balgova, E., Downing, P. E., Papeo, L., & Koldewyn, K. (2024). Converging evidence that left extrastriate body area supports visual sensitivity to social interactions. *Current Biology, 34*(2), 343-351.

Research Highlights 2024

The brain's social network: semantics influence our understanding of others

Understanding how our brains process social interactions is a major challenge in cognitive neuroscience. This study investigates whether social cognition relies on dedicated brain regions or shares neural systems with broader cognitive functions, particularly semantic cognition (how we understand meaning). Using a meta-analysis of neuroimaging studies, BIU researchers examined brain activity related to theory of mind (ToM) — our ability to attribute thoughts and intentions to others — and compared it to semantic processing. They found significant overlap in the anterior temporal lobe (ATL) and temporoparietal junction (TPJ), suggesting that ToM involves general semantic retrieval processes. However, distinct ToM-related activity was also found in areas like the right TPJ and medial prefrontal cortex, indicating specialized social-processing circuits. These findings suggest that while social cognition is intertwined with general meaning-making processes, it also has dedicated neural mechanisms. This hybrid model advances our understanding of how the brain navigates complex social interactions.

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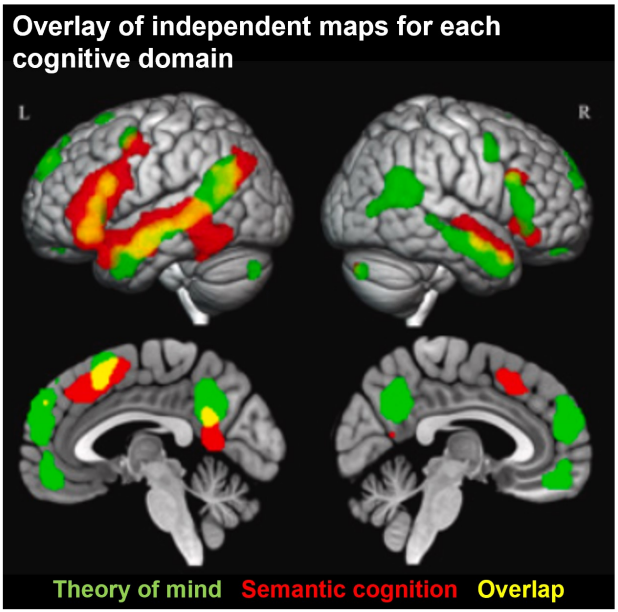


OPEN DATA

This research report is Open Access: Scan the QR code, or Click Here to access the publication

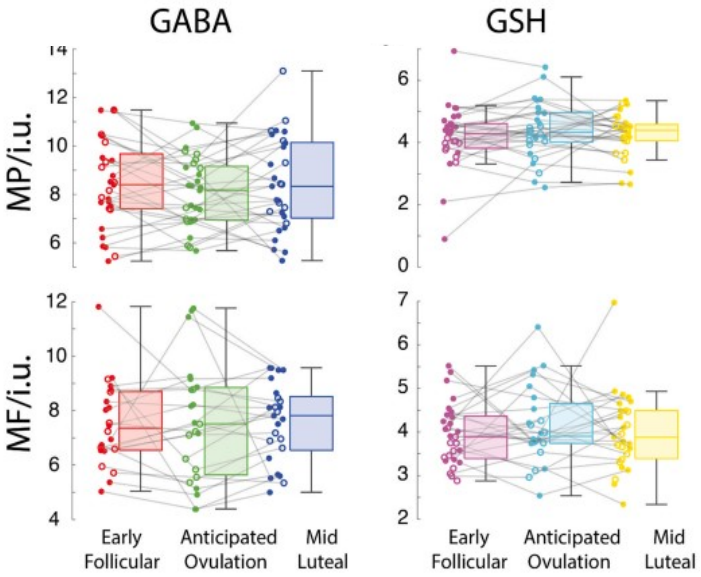
Balgova E., Diveica, V., Jackson, R.L. & Binney R.J. (2024). Overlapping neural correlates underpin theory of mind and semantic cognition: Evidence from a meta-analysis of 344 functional neuroimaging studies. *Neuropsychologia*, 200.

Methods Showcase 2024

Tracking neurotransmitters in the brain

Magnetic resonance spectroscopy and the menstrual cycle

Gamma-aminobutyric acid (GABA) and glutathione (GSH) play a significant role in the functioning of a healthy brain and can both be quantified using magnetic resonance spectroscopy (MRS). Previous research has suggested GABA may fluctuate with the menstrual cycle, suggesting that GSH may as well. As a result, some past MRS studies have excluded women over concerns of variability in measures during the menstrual cycle. Utilising an advanced MRS technique, across 12 different research groups, this study explored possible changes in GABA and GSH across the menstrual cycle in 4 distinctive brain regions. With a larger sample size and the inclusion of more brain regions, it failed to replicate previous findings of GABA change due to phases of the menstrual cycle. It also shows for the first time that MRS measures of GSH do not significantly alter across the cycle. These findings suggest that the menstrual cycle has minimal impact on MRS measures of GABA and GSH, and as such, should not be used as a justification for exclusion of women in MRS studies.



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This research report is Open Access: Scan the QR code, or Click Here to access the publication

Song Y et al. (2025). Magnetic resonance spectroscopy and the menstrual cycle: A multi-centre assessment of menstrual cycle effects on GABA & GSH. J Neurosci Methods.

Welcoming new principal investigators to the BIU team

In 2024, we welcomed two new colleagues whose expertise and research programs bring fresh energy and innovation to the BIU.

Dr Tirso Gonzalez Alam
Lecturer in Psychology

Tirso is a member of the Cognitive Neuroscience Institute and a Mexican national. He joined the institute after completing postgraduate and postdoctoral training in neuroscience at the University of York. His research focuses on the large-scale network organization of the brain, exploring how these patterns vary between the hemispheres and contribute to cognitive processes. Additionally, he employs functional imaging and naturalistic tasks to investigate how we comprehend complex language, including double entendre, humor, irony, and sarcasm.

In a recent study, Tirso used task-based, resting-state, and structural MRI to examine the relationship between visual and memory networks. His findings revealed that functional subdivisions of the visual and memory cortices are positioned at opposite ends of two parallel processing streams. These pathways independently support semantic and spatial cognition, suggesting that our memory system may be organized in a domain-specific manner, shaped by distinct visual inputs.

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Dr Geoff Coombs
Lecturer in Sport and Exercise Science

Geoff is a member of the Institute for Applied Human Physiology. A Canadian national, he joined Bangor University after completing postgraduate training in environmental physiology and two postdoctoral fellowships studying the regulation of cerebral blood flow. Geoff has had the opportunity to practice these areas of expertise around the world (e.g., Peru, Croatia) working with unique populations in various extreme environments (indigenous high altitude populations, free divers). Geoff employs a diverse array of physiological research techniques (transcranial Doppler ultrasound, MRI, thermometry, etc.).

Geoff's research program examines the integrative cardiorespiratory aspects of human health and performance. His specific research interests include human health throughout the lifespan and how the environment influences that process – specifically, the human health impacts of climate change as well as the benefits of physical activity on cardiovascular health during the aging process.

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Researcher Alumni

Meet two of our former graduate students who combined their training and talent to launch successful careers, showcasing the research excellence nurtured in our unit.

Dr Veronica Diveica
Postdoctoral Fellow, McGill University, Montreal

Veronica completed our MSc in Neuroimaging before continuing on to a UKRI-funded PhD under the supervision of Dr. Richard Binney. She successfully defended her doctoral thesis in 2023 and has since published ten peer-reviewed empirical studies in internationally renowned journals.

In 2022, Veronica was awarded a competitive UKRI grant to conduct a research visit at the University of Calgary, where she established valuable collaborative ties in Canada. Building on this experience, she has since worked as a postdoctoral researcher at McGill University, one of Canada's top institutions, and is currently supported by funding from the Quebec government.

linktr.ee/veronicadiveica

Dr Gabs Rossetti
Lecturer, Manchester Metropolitan University

Dr Rossetti did their PhD within the BIU, under the supervision of Professors Jamie Macdonald, Sam Oliver and Paul Mullins, graduating in 2019. They completed postdoctoral fellowships at Bangor in the School of Sport and Exercise Science and then Reading University, before becoming a Lecturer in Human Neuroscience at Manchester Metropolitan.

Gabs' research focuses on the interaction between physiology and brain function, with 15 publications in peer reviewed journals. They have a particular interest in neurovascular coupling and region-specific responses to systemic physiological stressors.

mmu.ac.uk/staff/

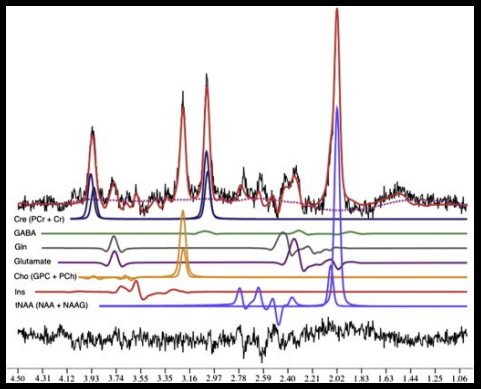
Events Spotlight

Functional Magnetic Resonance Spectroscopy Symposium II

1-2 September 2025

We invite all interested neuroscientists and spectroscopists to come join us and discuss the latest research using magnetic resonance spectroscopy to probe brain function and metabolism.

The symposium aims to cultivate a core community within the field of functional MRS by fostering the exchange of novel insights, discussing and establishing current best practices, and identifying key research priorities. It seeks to provide valuable opportunities for networking and collaboration while enhancing access and relevance to other related fields. Additionally, the symposium strives to elevate the international profile of the fMRS field and support early career researchers by offering education, skills training, and networking opportunities to help them establish themselves in the discipline.



Learn more and Register:

pgmm03.uk/

Visceral Mind: Neuroanatomy Summer School 1-5 September 2025

Visceral Mind is an immersive, 5-day residential summer school dedicated to functional neuroanatomy. It is geared toward postgraduate and postdoctoral researchers in cognitive neuroscience and related fields, as well as clinical, medical, and allied health professionals. Participants engage in a blend of lectures, patient case conferences, hands-on practical sessions, and dissection laboratories using human brain tissue. Our esteemed faculty includes distinguished scientists from Bangor and across Europe (a sample of whom can be seen below), while delegates from around the world join each year to expand their knowledge and expertise.

Prof. Oliver Turnbull
Bangor University

Dr. Stephanie Forkel
Radboud University

Dr. Michel Thiebaut de Schotten
Bordeaux University

Prof. Paul Downing
Bangor University

Learn more and Register:

www.bangor.ac.uk/courses/other-courses/functional-neuroanatomy-course-visceral-mind-summer-school

Empowering future professionals

MSc Neuroimaging

Our MSc in Neuroimaging was one of the first programmes of its kind in the UK and remains a leader in modern applied imaging science. Renowned for its emphasis on practical learning and skill development, it offers unparalleled hands-on access to cutting-edge scanner technology. Additionally, students benefit from exclusive access to a dedicated image analysis suite equipped with high-specification workstations.

This MSc is designed to:

- Equip students with the expertise to design experiments and acquire, analyse, and interpret imaging data.
- Focus on Magnetic Resonance Imaging (MRI), covering key techniques such as volumetry/morphometry, functional MRI, diffusion-weighted imaging, and spectroscopy.
- Develop a comprehensive understanding of neuroimaging applications in both research and clinical practice.

The course culminates in a research project, where students collect and analyse data using our state-of-the-art 3.0T MRI system under the expert supervision of our research-active faculty.

Learn more:

www.bangor.ac.uk/courses/postgraduate-taught/neuroimaging-msc

Contact the Course Director:

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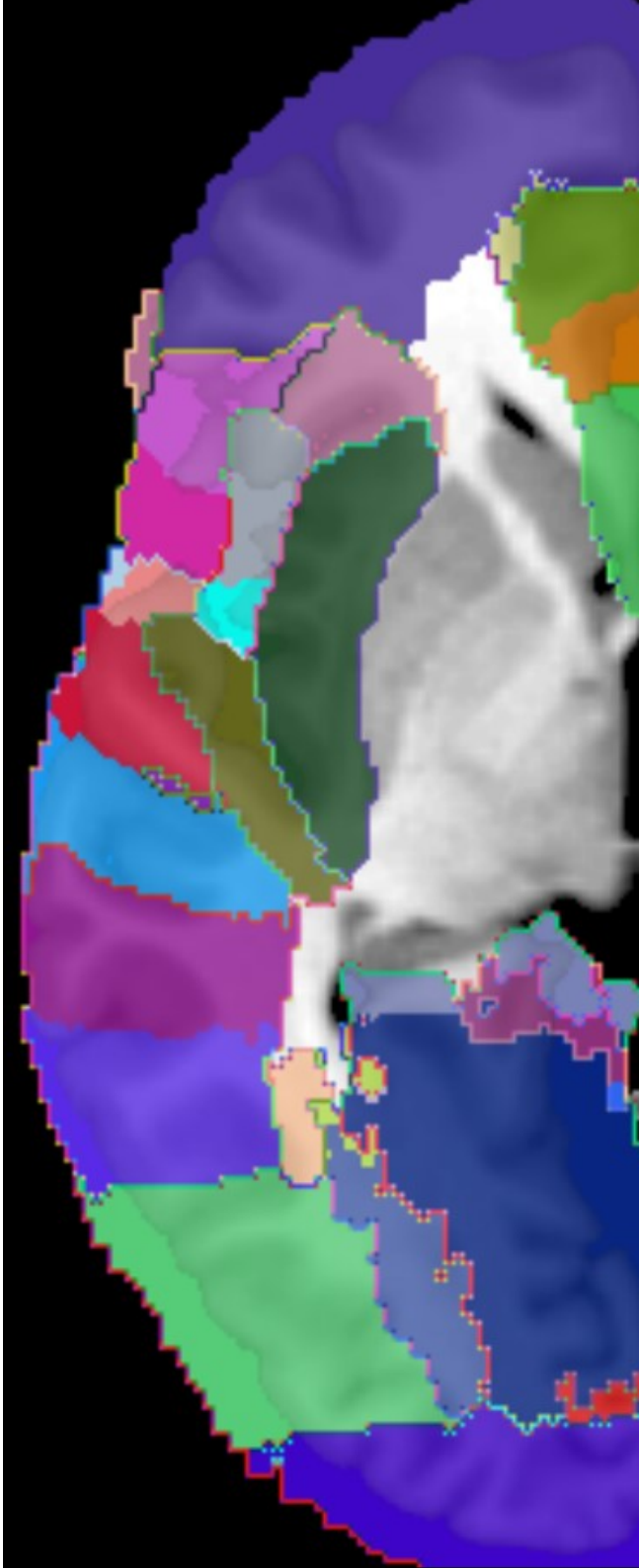

BANGOR IMAGING UNIT

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