



UNIVERSITY OF  
BIRMINGHAM



# ENABLING TECHNOLOGIES

Enabling technologies at Birmingham combine state of the art equipment with expert staff.

An enabling technology is defined as 'Equipment and/or methodology that, alone or in combination with associated technologies, provides the means to generate giant leaps in performance and capabilities of the user.' [Business Dictionary]

Enabling technologies at the University of Birmingham serve to support and strengthen our research in key areas such as:

- Sequencing
- Mass spectrometry
- Human brain imaging: MRI/MEG
- Flow Cytometry/Cell sorting
- Fluorescent imaging
- NMR

Enabling Technologies at Birmingham are underpinned by outstanding expertise in computational biology.

We continually invest in resources, and improve research facilities to ensure that our academic staff and doctoral researchers are able to pursue their ideas, undertake research and transfer their knowledge to create global impact and excellence in teaching.

## SEQUENCING

Genomic sequencing is an indispensable tool for modern biological research, and is increasingly vital in clinical practice. We manage the latest high-throughput sequencing equipment including Illumina instruments (MiSeq, NextSeq and HiSeq) and the Oxford Nanopore GridION. We also support single-cell RNA sequencing using the 10X Genomics Chromium. All of these instruments are available for easy and rapid access to customers via an innovative 'walk-in' service. For more specialised applications, three academic-led sequencing facilities are on campus. MicrobesNG is the only dedicated

microbial genome sequencing facility in the UK and has sequenced almost 15,000 isolates so far. Genomics Birmingham is dedicated to human and cancer genetics research and has a wealth of experience with clinical samples from humans. The Environmental 'Omics facility specialises in genomic research on environmental eukaryotes such as *Daphnia*. Our genomics services integrate with and reflect our core research strengths on campus. environmental safety.

## MASS SPECTROMETRY

The world-class mass spectrometry facilities at Birmingham offer unique capabilities for biomolecular analysis. The mass spectrometry platform is arranged around four nodes: Metabolite Mass Spectrometry, Advanced Mass Spectrometry & Proteomics, Geochemistry Mass Spectrometry and Environmental Health Mass Spectrometry. The Metabolite Mass Spectrometry node supports research into metabolism in human health and disease, and includes the Phenome Centre – Birmingham, the Steroid Metabolome Analysis Core, and the Metabolic Tracer Analysis Core. The Advanced Mass Spectrometry Facility plays two roles: it supports research in the physical science of mass spectrometry, ie, emerging technology research, and provides support to researchers in proteomics. The Geochemistry Mass Spectrometry node provides state-of-the-art continuous-flow isotope-ratio mass spectrometry for the investigation of environmental, biological and geological samples. The Environmental Health Mass Spectrometry node supports research in air and water pollution, and nanoparticles.

**WE WELCOME  
ENQUIRIES FROM  
EXTERNAL  
ORGANISATIONS  
SEEKING TO ACCESS  
OUR FACILITIES  
AND EQUIPMENT.**



## HUMAN BRAIN IMAGING LABORATORIES

The Centre for Human Brain Health (CHBH) is an interdisciplinary brain research facility established with the mission of understanding what makes a brain healthy, how to maintain it, and how to prevent and reverse damage. The Centre is home to state-of-the-art brain imaging facilities, which are used to uncover the mechanisms supporting human cognition in both the healthy and the dysfunctional brain. The facilities include:

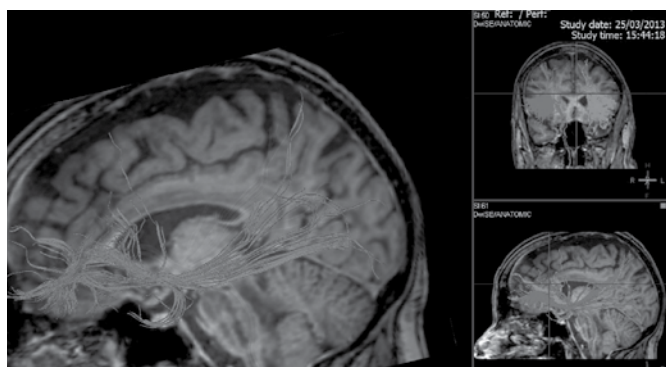
- A 3T magnetic resonance imaging (MRI) scanner
- Elekta Neuromag TRIUX magnetoencephalography (MEG) system
- High density EEG laboratories
- Sleep laboratories
- Exercise laboratory
- Functional near-infrared spectroscopy (fNIRS) system
- Brain stimulation facilities including transcranial magnetic and electrical brain stimulation

We use our multidisciplinary expertise and state-of-the-art technology to identify the key factors for maintaining a healthy brain. To do this, we are developing and applying advanced neuroimaging techniques, including the development of new sensor technology, to characterise brain structure and function, combined with experimental and lifestyle interventions to enhance brain health across the lifespan.

## FLOW CYTOMETRY/CELL SORTING

Flow cytometry measures expression of proteins and other cellular components on vast numbers of individual cells. Cell suspensions are stained with fluorescence labelled antibodies or fluorochromes to specifically stain cellular components. Up to 14 different parameters can be quantified on individual cells. Sensitivity down to 20 fluorochrome molecules per cell and analysis speeds up to 30,000 cells/second are possible. Cells are characterised and clustered according to protein expression patterns.

Flow cytometric cell sorters sort cell populations with speeds up to 20,000 cell/second into up to four different populations, or separate them into small isolates down to single cells into 384-well microtitre plates for downstream applications such as cloning or gene expression analysis. Latest technologies can microphotograph individual cells during flow analyse to determine the location of proteins within cells on individual cell or population level. Mass cytometry combines flow cytometry and mass spectrometry to measure up to 100 parameters per cell.



## FLUORESCENT IMAGING

The Imaging Suite within Enabling Technologies consists of Microscopy Hubs (including the Birmingham University Light Microscopy [BALM] Unit) and the Centre of Membrane Proteins and Receptors (COMPARE). The Microscopy Hub and COMPARE provide researchers with access to state-of-the-art fluorescent imaging systems in order to address fundamental questions in biology and disease. Our systems comprise a diverse range of super-resolution, light-sheet, wide-field and confocal microscopes suitable for imaging live and fixed samples, ranging from single cells to small embryos. A dedicated cell culture lab allows researchers to prepare their samples nearby prior to live imaging experiments. In addition to full training on all of our optical systems, we also offer expertise and assistance in experimental design and image analysis. The Imaging Suite welcomes researchers from a range of disciplines and institutes.

## NMR

Nuclear magnetic resonance spectroscopy is a versatile technique to investigate the structure and behaviour of biomolecules in solution. Among the unique strengths of NMR is its ability to capture the dynamic behaviour of proteins – reflecting how they act in the cell; to measure weak interactions between protein and their binding partners in a site-specific fashion – thus identifying molecular groups that are critical for the interaction; to probe metabolic pathways in live cells through metabolic flux analysis – providing molecular insight in what way tumour cells differ from healthy ones. The Henry Wellcome Building for Biomolecular NMR (HWB-NMR) at the University of Birmingham is the National Facility for Biomolecular NMR. HWB-NMR features several 600 MHz spectrometers, an 800 MHz and an ultra-high field 900 MHz spectrometer, all equipped with a range of probes. Use of the 800 and 900 MHz spectrometers is financially supported by the Wellcome Trust, allowing users access without charges.



TO FIND OUT MORE  
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TECHNOLOGIES AT  
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