

Research Methods for Brain and Behaviour

Overview:

How do we study the human brain and behaviour? This badge introduces participants to the fundamental methods used in neuroscience research, from experimental design to brain imaging. Participants will explore a range of research techniques, including neuroimaging, electrophysiology, genetic manipulation, and tissue analysis. Participants will also explore the exciting world of computational neuroscience and use data science to analyze brain research findings.

Learning Outcomes:

- Understand the scientific method and its application in neuroscience and psychology
- Identify strengths and limitations of key research methods
- Critically evaluate psychological and neuroscience studies
- Electrophysiology & neuroimaging – Recording the Brain in Action
- EEG, MEG, and fMRI – how we measure brain activity
- Understanding brain waves and cognitive states

Module 1: Introduction to Research

- The scientific method in research
- The evolution of neuroscience research (from lesion studies to AI)
- Ethical considerations in human and animal brain research

Module 2: Designing Research – Experiments & Observational Studies

- Independent vs. dependent variables, control groups
- Designing a simple memory or reaction time experiment

Module 3: Neuroscience at the Cellular & Molecular Level

- Cell culture, tissue dissection, and histology – How we study brain cells in the lab
- Techniques for molecular analysis: PCR, western blotting, and gene expression studies

Module 4: Electrophysiology – Recording Brain Activity in Real-Time

- EEG, MEG, and patch-clamp techniques to study brain electrical activity

Module 5: Neuroimaging Techniques – Seeing the Brain in Action

- Understanding fMRI, PET, and MRI – Measuring brain activity in vivo
- Brain regions and their functions: Exploring the brain map with neuroimaging

Module 6: Behavioural Research Methods – How Do We Measure Behaviour?

- Surveys, case studies, and observational techniques
- Personality & cognitive tests

Module 7: Computational Neuroscience & Data Analysis – Modeling the Brain

- Introduction to computational neuroscience: using Python and neural network models
- How AI and machine learning can help us understand complex brain functions