

PG7914-: Neural Engineering

Lecture Based Module

Credit weighting: 5 ECTS Co-ordinator: Prof. R. Reilly

This module will introduce students to neural engineering from a neuroscience perspective. Students will learn how to apply engineering principles to understand the excitation of nerve and muscle, the generation of bioelectric signals and the artificial stimulation of biological tissues. Methods of stimulating, recording and analysing neural systems will be examined in detail. The basic principles and methods studied will then be applied to examine specific neuroscience applications of neural engineering, such as biomarkers for neurological disorders and neuroprostheses.

This module will be delivered in a 2-3 week block in November 2025

Details of the module

Introduction to Neural Engineering

Implantable microelectrodes

Extracellular Activity: Neural Spike Trains and Analysis

Electroencephalography: Genesis and Recording

Electroencephalography: Signal Analysis

Event Related Potentials: Design of Experiments

Event Related Potentials: Signal Analysis

EEG & ERP Analysis: Neurological Disorders

EEG & ERP Analysis: Ageing

Non-Invasive Brain Machine Interfaces

Invasive Brain Machine Interfaces

Magnetic stimulation of biological tissues

Electric stimulation of biological tissues

Deep brain stimulation

Retinal and Visual Prostheses

Cochlear Implants and Auditory Prostheses

Reading/Learning Resources

- Reading material is available for each lecture and is available on the module website/blackboard.

Learning Outcomes

On successful completion of this module students should be able to:

- Describe quantitative methods for the monitoring of neural activity
- Select materials for their properties in order to acquire neural activity
- Design paradigms to elicit & select appropriate methods to analyse neural activity for clinical and research applications
- Analyse the effects of electrical stimuli applied to biological tissues
- Design paradigms for selective electrical stimulation of biological tissues for clinical and research applications
- Describe & discuss applications of neural engineering to restore function & interface with human nervous system

Assessment (100%): Exam