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Preclinical Imaging

Semester 1 / Autumn **10 Credits**

Each Course is composed of Modules & Activities.

Modules:

Introduction to Preclinical Imaging	IMSc
Legislation and ethics governing the use of animals in research in the UK	IMSc
Practical considerations of preclinical MR imaging	IMSc
Preclinical MR case studies	IMSc
Practical considerations of Preclinical Ultrasound	IMSc
Preclinical US case study	IMSc
Practical considerations of Preclinical optical techniques	IMSc
Practical considerations of Preclinical PET imaging	IMSc
Experimental imaging	IMSc
Zebrafish as an animal model	IMSc

Each Module is composed of Lectures, Reading Lists, MCQ self-assessments, & Discussion Boards.

These Modules are taught on the following Programmes, or are incorporated into blended Courses which teach students enrolled outwith the Edinburgh Imaging Academy:

- IMSc - Imaging programme

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Modules are:

Introduction to Preclinical Imaging:
Preclinical imaging - introduction

Legislation and ethics governing the use of animals in research in the UK:
Animals in Research – Moral and ethical considerations
Animals in Research – UK legislation

Practical considerations of preclinical MR imaging:
Practicalities of Preclinical MRI
Preclinical cardiac MRI

Preclinical MR case studies:
Assessment of myocardial viability using 23Na MRI
Conscious rodent fMRI
Imaging the healing murine myocardial infarction: ultrasound, MRI and near-infrared fluorescence

Practical considerations of Preclinical Ultrasound:
Introduction to preclinical ultrasound imaging

Preclinical US case study:
Preclinical US (embryonic heart)

Practical considerations of Preclinical optical techniques:
Pre-clinical optical in vivo imaging

Practical considerations of Preclinical PET imaging:
microPET and microSPECT imaging

Experimental imaging:
Overview
Applications

Zebrafish as an animal model:
The anatomy and natural history of zebrafish
The application of Zebrafish: Imaging in Biodmedical Research

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Introduction to Preclinical Imaging

Lecture 1
Title: Preclinical imaging - introduction
Description: Introduction
Author(s): Dr. Maurits Jansen
Learning Objectives
- Explain different preclinical imaging modalities
- Compare these imaging modalities and highlight advantages and disadvantages of each of them
- Give examples of applications

Legislation and ethics governing the use of animals in research in the UK

Lecture 1
Title: Animals in Research - Moral and ethical considerations
Description: Moral and ethical considerations of animal in research
Author(s): Dr Carmel Moran
Learning Objectives
- Discuss the moral and ethical dilemmas associated with animal research
- Describe the use of animals in research from a statistical and historical perspective

Lecture 2
Title: Animals in Research – UK legislation
Description: Overview of UK legislation governing the use of animals in research
Author(s): Dr Carmel Moran
Learning Objectives
- Highlight the key features of the UK's Animal Scientific Procedure Act 1986
- Explain terminology used in this legislation
- Explain the concept of 3Rs
- Highlight the 2012 amendments to bring UK national legislation into full compliance with the European directive

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Practical considerations of preclinical MR imaging

Lecture 1
Title: Practicalities of Preclinical MRI
Description: Example of a preclinical MRI study; Preclinical MRI vs. clinical MRI
Author(s): Dr. Maurits Jansen
Learning Objectives
- Explain the example of a preclinical MRI study
- Highlight issues specific to preclinical MRI as compared to clinical MRI
- Discuss solutions to common problems

Lecture 2
Title: Preclinical cardiac MRI
Description: Translational medicine; Non-invasive MRI; Cardiac MRI in rodents
Author(s): Dr. Maurits Jansen
Learning Objectives
- Interpret cardiac MRI use & application of in rodents
- Highlight some issues concerned with rodent cardiac MR

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Preclinical MR case studies

Lecture 1
Title: Assessment of myocardial viability using 23Na MRI
Description: Case study
Author(s): Dr Maurits Jansen
Learning Objectives
- Give an overview of the techniques used for assessment of myocardial viability
- Explain the usage and usefulness of 23Na MRI for the assessment of myocardial viability
- Describe the advantages and disadvantages of 23Na MRI

Lecture 2
Title: Conscious rodent fMRI
Description: Pre-clinical animal research, translational utility, techniques
Author(s): Dr. Nichola Brydges
Learning Objectives
- Describe functional magnetic resonance imaging (fMRI)
- Evaluate conscious fMRI in pre-clinical animal research
- Give an overview of the development of
    - conscious rodent fMRI procedures
    - rodent fMRI analysis

Lecture 3
Title: Imaging the healing murine myocardial infarction: ultrasound, MRI and near-infrared fluorescence
Description: Possibilities and limitations with in vivo imaging for studying myocardial infarctions.
Author(s): Dr. Gillian A Gray
Learning Objectives
- Explain basic pathology of myocardial repair & remodelling after myocardial infarction (MI)
- Explain the usefulness of in vivo imaging as a research tool in experimental models
- Describe murine coronary artery ligation as an experimental model for investigating MI
- Describe possibilities & limitations of in vivo imaging for investigation of murine myocardial repair & remodelling
- Explain practically how to image myocardial infarct & its potential for translation to clinical studies

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Practical considerations of Preclinical Ultrasound

Lecture 1
Title: Introduction to preclinical ultrasound imaging
Description: Practical preclinical ultrasound imaging
Author(s): Dr Carmel Moran
Learning Objectives
- Describe equipment used in preclinical ultrasound
- Explain terminology used in ultrasound imaging
- Highlight advantages & disadvantages of ultrasound imaging over other preclinical imaging techniques
- Describe examples of preclinical ultrasound imaging studies

Pre-clinical US case study

Lecture 1
Title: Preclinical US (embryonic heart)
Description: The importance of glucocorticoid action in foetal heart development
Author(s): Dr. Eva Rog-Zielinska, Prof Karen Chapman
Learning Objectives
- Describe the importance of glucocorticoid action in fetal heart development
- Interpret the cardiac phenotyping of glucocorticoid receptor knock-out (GR-/-) fetal mice by non-invasive in utero ultrasonography

Practical considerations of Pre-clinical optical techniques

Lecture 1
Title: Pre-clinical optical in vivo imaging
Description: Optical imaging, reagents & applications
Author(s): Dr Paul M Fitch, Dr Marc Vendrell & Adrian Thomson
Learning Objectives
- Define the two methods of optical in vivo imaging
- Describe some of the reagents currently available for bioluminescence imaging and their application
- Describe some of the reagents currently available for fluorescence imaging and their application
- Highlight the key advantages and limitations of optical in vivo imaging

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Practical considerations of Preclinical PET imaging

Lecture 1
Title: microPET and microSPECT imaging
Description: Preclinical PET, SPECT imaging, and examples of applications in preclinical research
Author(s): Dr. Adriana Tavares, Dr. Alison Fletcher
Learning Objectives
- Define molecular imaging - PET and SPECT
- Describe physics principles associated with molecular imaging
- State main applications of PET and SPECT imaging
- Explain the radiotracer principle
- Identify & describe key aspects associated with preclinical PET and SPECT imaging

Experimental imaging

Lecture 1
Title: Overview
Description: Overview of preclinical imaging
Author(s): Dr. Maurits Jansen
Learning Objectives
- Understand differences between small animal and human imaging
- Know how MR experiments are performed in animals
- Understand applications of cardiac cine MR in animals

Lecture 2
Title: Applications
Description: Recent applications & techniques
Author(s): Dr. Maurits Jansen
Learning Objectives
- Know what is meant by cell tracking
- Describe examples of experimental imaging
- Describe the term molecular imaging
- Describe manganese enhanced MR

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Zebrafish as an animal model

Lecture 1
Title: The anatomy and natural history of zebrafish
Description: The fundamental anatomy of zebrafish and the advantages of this model organism in biomedical research
Author(s): Dr. Carl Tucker
Learning Objectives
- Describe the anatomy and natural history zebrafish in biomedical research
- Explain the significance of the natural history of the zebrafish and its importance in biomedical research
- Interpret the comparative genetic, cellular and physiological processes that exist between zebrafish and mammals

Lecture 2
Title: The Application of Zebrafish: Imaging in Biomedical Research
Description: Methodologies employed with zebrafish in biomedical pre-clinical research
Author(s): Dr. Carl Tucker
Learning Objectives
- Explain the benefits of Genetically-Modified zebrafish in biomedical research
- Give an overview of the applications of Genetically-Modified zebrafish in biomedical research
- Describe observable morphological changes, as well as assessments of organ function