

# Edinburgh Imaging

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## Applications in Disease

**Semester 1 / Autumn**

**10 Credits**

**Each Course is composed of Modules & Activities.**

**Modules:**

Ageing White Matter and Cognition	IMSc	NI4R
Applied MR in Stroke	IMSc	NI4R
MR Health and Safety		NI4R
Lacunar Stroke	IMSc	NI4R
Dementia	IMSc	NI4R
Imaging in Depression		NI4R
Cardiothoracic	IMSc	
Ageing Brain Volume and Spectroscopy		NI4R
Abdominal Aortic Aneurysm Surgery	IMSc	
MND		NI4R
The Zebrafish	IMSc	
fMRI Practicalities		NI4R
Schizophrenia		NI4R
Neurosurgery		NI4R
Veterinary Applications	IMSc	

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

The summary table above shows whether the modules are available in the Neuroimaging for Research (NI4R) programme or the Imaging (IMSc) programme or indeed both.

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## **Applications in Disease - Modules include:**

### **Ageing White Matter and Cognition:**

Ageing, white matter & cognition

### **Applied MR in Stroke:**

Imaging in cerebrovascular disease

### **MR Health and Safety:**

MR Health and Safety  
Safe running of an MR unit

### **Lacunar Stroke:**

Lacunar stroke – part A  
Lacunar stroke – part B

### **Dementia:**

Introduction and Alzheimer's disease  
Vascular and other dementias  
SPECT and PET imaging in the dementias

### **Imaging in Depression:**

Background, advances and limitations  
Example of a study of depression after stroke

### **Cardiothoracic:**

Overview

### **Ageing Brain Volume and Spectroscopy:**

Ageing, brain volumes & spectroscopy

### **Abdominal Aortic Aneurysm Surgery:**

Patient selection for AAA surgery

### **MND:**

The neuropsychology of motor neurone disease

### **The Zebrafish:**

Zebrafish basics

### **fMRI Practicalities:**

fMRI Practicalities

### **Schizophrenia:**

Functional neuroimaging in schizophrenia

Edinburgh Imaging Academy – online distance learning courses

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**Modules include:**

**Neurosurgery:**

Imaging in surgery for glioblastoma, a type of brain tumour

**Veterinary Applications:**

CT for all creatures – great and small 1

CT for all creatures – great and small 2

**We can also provide a more detailed syllabus showing what lectures will be given for each module, and the learning outcomes for each module.**

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**Further details of modules that may be within your  
Applications in Disease course.**

## **Ageing White Matter and Cognition (both NI4R and IMSc)**

Lecture 1

**Title: Ageing, white matter & cognition**

Description: The appearance and associated features of age-related white matter lesions as determined through imaging research.

Author(s): Dr. Susan Shenkin

### **Learning Objectives**

- Outline the changes in the brain and cognition with age
- Explain what we know of the appearances in MR imaging, risk factors, associated features, and prognostic implications of age-related white matter lesions.
- Discuss new areas for future research

## **Applied MR in Stroke (both NI4R and IMSc)**

Lecture 1

**Title: Imaging in cerebrovascular disease**

Description: This lecture illustrates ways in which imaging has improved our understanding of how blood vessel diseases affect the brain, and how imaging is used in research.

Author(s): Prof. Joanna Wardlaw

### **Learning Objectives**

Explain what a stroke is and why stroke is a big health care problem

- Explain how imaging techniques have improved understanding of causes and pathophysiology of stroke
- Illustrate new avenues of stroke research that will lead to future improvements in stroke care

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## MR Health and Safety (NI4R only)

### Lecture 1

#### **Title: MR Health and Safety**

Description: Health and safety aspects of working within high magnetic fields and other aspects of MR safety

Author(s): Mrs. Iona Hamilton, Mrs. Elaine Sandeman

#### **Learning Objectives**

- Explain how to work in a high magnetic field safely
- Describe differences in safety aspects of different types of MR scanner
- List items which may cause hazard in a magnetic field
- Discuss subject-specific factors that may affect safety

### Lecture 2

#### **Title: Safe running of an MR unit**

Description: Key factors in running a safe and effective human MR scanning facility

Author(s): Prof. Joanna Wardlaw

#### **Learning Objectives**

- Outline the key factors involved in setting up and running an MR scanning facility for research in people
- Describe how to ensure safety of staff and subjects or patients being scanned
- Discuss current areas of debate concerning safety of magnetic fields and contrast agents

## Lacunar Stroke (both NI4R and IMSc)

### Lecture 1

#### **Title: Lacunar stroke, part A**

Description: Introduction to and imaging of lacunar stroke

Author(s): Prof. Joanna Wardlaw

#### **Learning Objectives**

- Compare lacunar stroke with large artery stroke in terms of their importance and epidemiology
- Describe small vessel pathology associated with lacunar stroke
- Identify lacunar stroke and associated pathologies on imaging
- Discuss any considerations in imaging lacunar stroke and associated pathologies

### Lecture 2

#### **Title: Lacunar stroke – part B**

Description: Current theories regarding causes of lacunar stroke

Author(s): Prof. Joanna Wardlaw

#### **Learning Objectives**

- Elaborate on current theories of its causes, focussing on evidence from imaging studies

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## Dementia (both NI4R and IMSc)

### Lecture 1

#### **Title: Introduction and Alzheimer's disease**

Description: Public health burden, diagnosis, use of imaging, Alzheimer's disease

Author(s): Dr. Nadine Dougall, Prof. Joanna Wardlaw

#### **Learning Objectives**

- Outline the public health burden of dementia
- Describe the diagnosis of dementia in general
- Explain the variation in diagnosis introduced by use of different criteria
- Outline the diagnosis of Alzheimer's disease specifically
- Outline the pathology of Alzheimer's disease
- Describe the use of imaging in routine practice
- Describe the use of structural imaging in research
- Identify key features associated with dementia on imaging
- Discuss the current limitations of dementia research

### Lecture 2

#### **Title: Vascular and other dementias**

Description: Neuroimaging in Vascular and other dementias

Author(s): Dr. Nadine Dougall, Prof. Joanna Wardlaw

#### **Learning Objectives**

- Define
  - Vascular dementia
  - Lewy body dementia
  - Fronto-temporal (semantic) dementia
- Outline the diagnosis of vascular dementia in general
- Explain the variation in diagnosis introduced by use of different criteria
- Describe the use of structural imaging in research
- Discuss the current limitations of dementia research

### Lecture 3

#### **Title: SPECT and PET imaging in the dementias**

Description: To outline the role of SPECT and PET imaging in dementia and compare with structural imaging techniques

Author(s): Dr. Nadine Dougall, Prof. Joanna Wardlaw

#### **Learning Objectives**

- Describe the role of SPECT in the diagnosis of dementia
- Describe the role of PET in the diagnosis of dementia
- Explain opportunities for improved understanding of dementia through radioisotope imaging
  
- Discuss limitations and practical difficulties of functional imaging in dementias

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## Imaging in Depression (NI4R only)

### Lecture 1

**Title: Background, advances and limitations**

Description: Current theories about what causes depression and how imaging techniques have helped elucidate these mechanisms

Author(s): Dr. Kristin Haga

**Learning Objectives**

- Outline depression as a disease,
- Outline some of the possible mechanisms that lead to depressive illness
- Describe how imaging techniques have helped to understand those mechanisms
- Discuss how different imaging techniques can be used together to provide complementary information in exploring disease mechanisms
- Explain the application of these imaging methods to study one aspect of depression, i.e. post-stroke depression

### Lecture 2

**Title: Example of a study of depression after stroke**

Description: An example of a study of depression after stroke and use of imaging techniques illustrating difficulties, results and opportunities for future work.

Author(s): Dr. Kristin Haga

**Learning Objectives**

- Explain how imaging can be used in a study of depression following stroke
- Discuss some of the practical difficulties in using imaging to study a complex disease like depression in the elderly
- Discuss how different imaging techniques can be used together to provide complementary information in exploring disease mechanisms

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## Cardiothoracic (IMSc only)

Lecture 1

**Title: Overview**

Description: Relating lung and cardiac imaging

Author(s): Prof. Edwin J.R. van Beek

**Learning Objectives**

- Historical review of Cardiothoracic Radiology over past 100+ years, with a focus on the last 20 years
- Describe pulmonary embolism imaging in clinical context
- Discuss the imaging of lung cancer
- Relate imaging findings of COPD to other pathologies
- Describe coronary artery disease CT imaging

## Ageing Brain Volume and Spectroscopy (NI4R only)

Lecture 1

**Title: Ageing, brain volumes & spectroscopy**

Description: This tutorial describes the use of imaging techniques to determine some of the changes that occur in the brain with ageing

Author(s): Dr. Karen Ferguson

**Learning Objectives**

- Discuss some of the imaging and image analysis techniques that can be used to investigate brain ageing
- Describe some of the changes that occur with ageing in terms of regional brain volumes, cerebrovascular disease, brain metabolites and cortisol endocrinology
- Explain how these changes relate to cognition in healthy ageing
- Outline what factors the changes in cognition in healthy ageing may be due to

## Abdominal Aortic Aneurysm Surgery (IMSc only)

Lecture 1

**Title: Patient selection for AAA surgery**

Description: Review of research which currently informs AAA surgery

Author(s): Prof. Peter Hoskins

**Learning Objectives**

- Describe conventional prediction of AAA rupture
- Define elastic modulus for rupture prediction
- Discuss asymmetry for rupture prediction
- Describe peak wall stress for rupture prediction

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## MND (NI4R only)

Lecture 1

**Title: The neuropsychology of motor neurone disease**

Description: Imaging and the cognitive consequences of motor neurone disease

Author(s): Dr. Sharon Abrahams

### Learning Objectives

- Define:
  - Motor Neuron Disease (MND)
  - MND-Dementia
- Outline the role that imaging has played in improving the knowledge of how MND affects regions of the brain other than the motor system
- Using the example of Classical MND studies, discuss how imaging can be used in conjunction with other approaches, in particular neuropsychology, in research and clinical practice

## The Zebrafish (IMSc only)

Lecture 1

**Title: Zebrafish basics**

Description: Advantages and disadvantages in biomedical research

Author(s): Dr. Carl Tucker

### Learning Objectives

- Describe zebrafish significance in biomedical research
- Outline the natural history of the zebrafish
- Recognise key anatomical features of zebrafish
- State advantages and disadvantages of the zebrafish as a biomedical research model
- Compare genetic, cellular and physiological processes between zebra fish and mammals

## fMRI Practicalities (NI4R only)

Lecture 1

**Title: fMRI Practicalities**

Description: A practical overview of how fMRI experiments are prepared, conducted and analysed

Author(s): Liana Romaniuk

### Learning Objectives

- Describe the initial administrative steps of fMRI
- Compare the various hardware/software options
- Describe scanning parameters for fMRI
- Explain the procedure of a normal experiment

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## Schizophrenia (NI4R only)

Lecture 1

**Title: Functional neuroimaging in schizophrenia**

Description: The role of functional neuroimaging as a research tool in schizophrenia

Author(s): Prof. Stephen Lawrie

### Learning Objectives

- Briefly describe basic background information about schizophrenia including:
  - epidemiology
  - symptoms
  - risk factors
- Outline current theories of what brain abnormalities underlie schizophrenia
- Explain how different imaging techniques have been used in studies of schizophrenia, including some examples of studies
- Discuss the difficulties and limitations, as well as the advantages, of using imaging as a research tool to study a complex disease like schizophrenia

## Neurosurgery (NI4R only)

Lecture 1

**Title: Imaging in surgery for glioblastoma, a type of brain tumour**

Description: This lecture describes how imaging has improved management of glioblastoma in particular the surgical approaches

Author(s): Prof. Ian Whittle

### Learning Objectives

- Describe how imaging is used to investigate, guide treatment of, and follow-up brain tumours
- Give an overview of advances in surgical neuro-oncology made possible with imaging
- Give an overview of the impact of technology on management of malignant gliomas

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## Veterinary Applications (IMSc only)

### Lecture 1

**Title: CT for all creatures - great and small 1**

Description: Veterinary CT of the brain, skull, head & neck

Author(s): Dr. Tobias Schwarz

**Learning Objectives**

- Discuss restraint methods for scanning animals
- Summarize uses of CT in veterinary imaging of the brain, skull, head & neck
- List common indications and findings

### Lecture 2

**Title: CT for all creatures - great and small 2**

Description: Veterinary CT of the chest, abdomen & pelvis

Author(s): Dr. Tobias Schwarz

**Learning Objectives**

- Summarize uses of CT in veterinary imaging of the chest, abdomen and pelvis
- List common indications and findings