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# Applications in Disease

**Semester 1 / Autumn** **10 Credits**

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

**Modules:**

| | | |
|---|---|---|
| Systematic review methodology | IMSc | NI4R |
| Neurosurgery | IMSc | NI4R |
| Stroke | | NI4R |
| • Applied MR in Stroke | | |
| • Lacunar Stroke | | |
| Dementia | NI4R | |
| Schizophrenia | | NI4R |
| MND | | NI4R |
| Imaging in Depression | | NI4R |
| Ageing | IMSc | NI4R |
| • Ageing Brain Volume and white matter | | |
| • Ageing Brain Volume and Spectroscopy | | |
| Veterinary Applications | IMSc | |
| Cardiothoracic | IMSc | |
| Abdominal Aortic Aneurysm Surgery | IMSc | |
| The Zebrafish | 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:

- NI4R - Neuroimaging for Research programme
- IMSc - Imaging programme

## Applications in Disease - Modules include:

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**Systematic review methodology**
How to do a systematic review

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

**Stroke**
**Applied MR in Stroke:**
Imaging in cerebrovascular disease
**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

**Schizophrenia:**
Functional neuroimaging in schizophrenia

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

**Imaging in Depression:**
Background, advances and limitations
Example of a study of depression after stroke

**Ageing**
Ageing, white matter & cognition
Ageing, brain volumes & spectroscopy

**Veterinary Applications:**
CT for all creatures – great and small 1
CT for all creatures – great and small 2

**Cardiothoracic:**
Overview

**Abdominal Aortic Aneurysm Surgery:**
Patient selection for AAA surgery

**The Zebrafish:**
Zebrafish basics

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## Systematic review methodology

Lecture 1
**Title: How to do a systematic review**
Description: The practicalities of conducting a systematic revie
Author(s): Dr Francesca Chappell
**Learning Objectives**

- Describe the stages of a systematic review
- Explain how to carry out & document each stage
- Highlight publication requirements of PRISMA & other relevant guidelines

## Neurosurgery

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

## Applied MR in Stroke

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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# Lacunar stroke

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

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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# Schizophrenia

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

# MND

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

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# Imaging in Depression

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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## Ageing White Matter and Cognition

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

## Ageing Brain Volume and Spectroscopy

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

## Veterinary Applications

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**

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

## Cardiothoracic

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

## Abdominal Aortic Aneurysm Surgery

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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# The Zebrafish

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