Applications in Disease

Semester 1 / Autumn 10 Credits

Each Course is composed of Modules & Activities.

Modules:

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

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:
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
We can also provide a more detailed syllabus showing what lectures will be given for each module, and the learning outcomes for each module.
Further details of modules that may be within your Applications in Disease course.

**Systematic review methodology**

Lecture 1  
Title: How to do a systematic review  
Description: The practicalities of conducting a systematic review  
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
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
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
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
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
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
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
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