BM3804

Neuroscience Research Topics

Course Handbook 2022-2023

School of Medicine, Medical Sciences & Nutrition

Contents

Course Summary

This course builds on the basics of nervous system function covered in level 2 and in BM3502. The major focus of the course relates to topical research on the structural and functional alterations that occur in neuronal tissues during development, how they function in the adult and how disease states affect function.

Course Aims & Learning Outcomes

The purpose of this course is to build upon aspects of Neuroscience and Neuropharmacology covered in BM3502. This course is a prerequisite for the Developmental Neuroscience Course (PY4302) which runs in the final year. The detailed course objectives are:

1. To describe the genetic pathways controlling the specification of neurones and the compartmentalisation of the CNS
2. To describe CNS development, the role of cell surface molecules and cell-cell interactions.
3. To describe the physiological consequences of pain at the spinal level and novel pharmacological approaches to the treatment of pain.
4. To describe plastic changes in the visual cortex, and in the hippocampus, which is associated with learning and memory.
5. To describe mechanisms involved in nervous system disorders such as, Alzheimer's Disease, Parkinson's Disease, Huntington's Disease, central/peripheral neuromuscular disorders and stroke.
6. To describe the enteric nervous system and disorders of the enteric nervous system.

Course Teaching Staff

Course Co-ordinator:
Dr Ann M Rajnicek (ext. 7514) **a.m.rajnicek@abdn.ac.uk**

Other Staff:

- Dr Derek Garden (DG), Biomedical Sciences
- Dr Antonio Gonzalez Sanchez (AGS), Biomedical Sciences
- Dr Wenlong Huang (WH), Biomedical Sciences
- Dr Mary MacLeod (MM), Biomedical Sciences
- Prof Simon Parson (SP), Biomedical Science
- Prof Bettina Platt (BP), Biomedical Sciences
- Prof Derek Scott (DS), Biomedical Sciences

Assessments & Examinations

1. Attendance: At the first lecture important information regarding course assessment and practical work will be given. Students will be expected to attend all lectures, attend the practical session, and to submit the Lt case study and Lt practical assignments. Students should inform the Course Co-ordinator (**a.m.rajnicek@abdn.ac.uk**) if they are unable to attend a class or if they encounter difficulty with managing course work. The minimum performance acceptable for the granting of a class certificate is attendance at 75% of the teaching sessions, and presentation of all set course work, written and oral.

2. Continuous Assessment (CA): includes an online Case Study and an online Practical assignment. CA accounts for 30% (Lt case study 15%, Lt online Practical 15%) of the total assessment. The deadlines for submission are indicated in the course timetable.

3. Written Examination: the examination will involve answering 2 essay-type questions from a choice of 4. The examination lasts for 1 hour 30 minutes. The examination comprises 70% of the total assessment.

4. The degree examination is held in April/May, with the re-sit examination in June/July.

Class Representatives

We value students' opinions in regard to enhancing the quality of teaching and its delivery; therefore, in conjunction with the Students' Association we support the Class Representative system.

In the School of Medicine, Medical Sciences & Nutrition we operate a system of course representatives, who are elected from within each course. Any student registered within a course that wishes to represent a given group of students can stand for election as a class representative. You will be informed when the elections for class representative will take place.

What will it involve?

It will involve speaking to your fellow students about the course you represent. This can include any comments that they may have. You will attend a Staff-Student Liaison Committee and you should represent the views and concerns of the students within this meeting. As a representative, you will also be able to contribute to the agenda. You will then feedback to the students after this meeting with any actions that are being taken.

Training

Training for class representatives will be run by the Students Association. Training will take place within each half-session. For more information about the Class representative system visit www.ausa.org.uk or email the VP Education & Employability vped@abdn.ac.uk . Class representatives are also eligible to undertake the STAR (Students Taking Active Roles) Award with further information about this co-curricular award being available at: www.abdn.ac.uk/careers.

Problems with Coursework

If students have difficulties with any part of the course that they cannot cope with alone they should notify the course coordinator immediately. If the problem relates to the subject matter, general advice would be to contact the member of staff who is teaching that part of the course. Students with registered disabilities should contact the medical sciences office, (medsci@abdn.ac.uk) (based in the Polwarth Building, Foresterhill) to ensure that the appropriate facilities have been made available. Otherwise, you are strongly encouraged to contact any of the following as you see appropriate:

- Course student representatives
- Course co-ordinator
- Convenor of the Medical Sciences Staff/Student Liaison Committee (Professor Gordon McEwan)
- Personal Tutor
- Medical Sciences Disabilities Co-ordinator (Dr Derryck Shewan)

All staff are based at Foresterhill and we strongly encourage the use of email or telephone the Medical Sciences Office. You may have a wasted journey travelling to Foresterhill only to find staff unavailable.

If a course has been completed and students are no longer on campus (i.e. work from second half session during the summer vacation), coursework will be kept until the end of Fresher's Week, during the new academic year. After that point, unclaimed student work will be securely destroyed.

Submission of Coursework

All students should submit coursework as directed in the assignment, usually online via MyAberdeen or to the Lt Kuracloud system.

Course Reading List

Suggested textbooks:

- Rang, H.P., Dale, M., Ritter, J.M. & Moore P. (2011) Pharmacology. 7th Edition, Churchill Livingstone, Edinburgh.
- Bear, M.F., Connors, B.W., Paradiso M. (2015) Neuroscience: Exploring the Brain. 4th Edition. Lippincott Williams and Wilkins, Baltimore.

A first Introduction to neuroscience: http://www.brainfacts.org/

In depth literature:

- Siegel, G.J., Albers, R.W., Brady, S., Price, D.R. (2005) Basic Neurochemistry: Molecular, Cellular and Medical Aspects. 7th Edition, Academic Press Inc. (London) Ltd, London

Individual lecturers will provide references for further reading on specific topics.
Also see the Leganto reading list on MyAberdeen.

Lecture Synopsis

Lecture 1. Early CNS Development 1: The differential adhesion hypothesis – Dr W Huang

How do cells from different tissues separate during development and then stay separate afterwards. Cell surface adhesion properties are fundamental, and the theory and practical evidence for the basis of cell mixing and segregation are explored.

Lecture 2. Early CNS Development 2: Anterior-posterior patterning – Dr W Huang

Starting with the classic experiments that showed the genetic basis of compartment formation and anterior-posterior patterning in Drosophila, we move onto the experimental evidence for similar mechanisms in vertebrates. We look at how Hox genes drive patterning of the vertebrate hindbrain. (Lecture shared with DB3804 Development of Organ Systems)

Lecture 3. Early CNS Development 3: Dorso-ventral patterning – Dr W Huang

In the CNS, motor output is via the mid-ventral neurones in the neural tube and sensory input comes in dorsally where it must be picked up and transmitted by many types of interneuron. This lecture looks at how dorsalising signals including BMPs tussle with ventralising signals such as Shh to pattern the vertebrate neural tube in the dorso-ventral axis. (Lecture shared with DB3804)

Lecture 4. Central Motor Pathways – Prof S Parson

The lecture will provide an overview of the motor pathways in the central nervous system from brain to spinal cord, including motor nuclei and descending tracts.

Lecture 5. Parkinson's disease – Prof Derek Scott

Parkinson's disease is a common neurodegenerative disease characterized by disabling motor abnormalities, such as tremor, muscle stiffness, paucity of voluntary movements, and postural instability. Occurrence and characterisation of symptoms, possible causes of Parkinson's disease, treatment.

Lecture 6. Peripheral Motor Pathways and Motor Neurone Diseases - Prof S. Parson

The lecture will provide an overview of peripheral motor pathways from spinal cord to the neuromuscular junction. Motor Neurone Diseases. Aspects of Amyotrophic Lateral Sclerosis, Spinal Muscular Atrophy and Peripheral Muscular Atrophy will be discussed.

Lecture 7. Activity, Genes and Plasticity: Long-term potentiation: Induction - Dr Derek Garden

The "big idea" is that you learn and remember things by increasing the strength of specific synapses in the brain. Long-term potentiation (LTP) is one form of use-dependent synaptic plasticity that has received particular attention as a possible neuronal basis for learning and memory. This lecture will build on your

understanding of the properties of glutamate and GABA receptors to explain the experimental evidence, which informs our understanding of the critical events that are required to trigger the formation of LTP.

Lecture 8. Activity, Genes and Plasticity: Long-term potentiation: Maintenance - Dr Derek Garden

The critical event during induction of LTP turns out to be the brief entry of Ca^{2+} through NMDA receptor gated channels in the postsynaptic membrane. This lecture will address what downstream mechanisms that Ca^{2+} transient might initiate that actually make the synapse stronger. We will address what intracellular signalling pathways the Ca^{2+} transient might affect, whether these pathways cause presynaptic or postsynaptic changes, and review in more detail the evidence that Camkinase II is involved in the maintenance of LTP.

Lecture 9. Huntington's disease – Prof Derek Scott

Huntington's disease is a hereditary disorder characterized by involuntary muscle movements. Symptoms, diagnosis, and treatment options.

Lecture 10. Stroke - Dr. M. MacLeod

An overview of the burden of stroke on society, the pathophysiology and how it relates to neuroanatomy, and treatments.

Live Online Discussion Sessions with clinician/patient: Discussions from the clinician's and the patient's perspectives to enhance and reinforce lecture content.

Stroke- Dr M J MacLeod

Lecture 11. The hypothalamus- Dr. A Gonzalez Sanchez

The hypothalamus provides central control of autonomic and endocrine functions together with a range of unconscious urges such as sleep and hunger. This lecture will offer an overview of the hypothalamus and will then focus on those aspects of it that regulate food intake and metabolism.

Lecture 12. Alzheimer's disease Prof. B. Platt

Types of dementia and demography, symptoms & diagnosis, causes (genetics vs lifestyle factors, amyloid vs tau, the role of ageing), current treatments.

Lecture 13. Enteric Nervous System I - Prof D. Scott

The enteric nervous system (ENS) is a separate nervous system embedded within the wall of the gut. It is highly specialised and is often termed as the body's "second brain". We will review the major elements of the ENS, studying the physiological processes that it regulates, what neurotransmitters and receptors are involved, and how we target these components therapeutically. We will end by considering different disorders where the ENS does not function appropriately.

Lecture 14. Enteric Nervous System II - Prof D. Scott

Following on from the previous lecture, this session will consider recent advances in ENS research. Can the ENS influence mood or respond to it? Are there "mental illnesses" of the gut? Why do some drugs used to

treat CNS disorders affect the ENS? Does the ENS have a larger role than first thought in various gut disorders? These are questions we will address during this class.

Practical/Tutorials/Case Study Work

Practical work (15% of the final course mark). The practical will be delivered in person using the Lab Tutor (Lt) system and consists of material related to reflexes and neuron circuitry.

Tutorial Session- delivered in person (see timetable). The tutorial aims to improve critical analysis and problem-solving skills relevant to the Case Study and Practical assignments and to support lecture content.

The tutorial session will focus on fundamental principles of neuroscience, neuroanatomy and neurophysiology. We will apply some of the concepts that many of you studied previously in BM3502 and use them to solve examples of clinical or experimental problems. You will hopefully realise that many of the principles of neurotransmission, receptors and targets can be applied to a multitude of nervous system problems. The questions will be made available to you in advance of the tutorial. All students will be expected to contribute to the discussion.

The case study (15% of the final course mark) will focus on Parkinson's Disease and various drugs that affect wider neurological/nervous function. We will explore whether people's health problems are always due to anatomical/physiological malfunctions, or whether drugs/treatments may also cause problems. The case study will also help you understand that there are many subtypes of receptors in different body locations. How we target them and avoid inappropriate drug effects is also of relevance in this case. The case will be delivered via the Lt system. Extra reading/research will be required.

University Policies

Students are asked to make themselves familiar with the information on key education policies, available here. These policies are relevant to all students and will be useful to you throughout your studies. They contain important information and address issues such as what to do if you are absent, how to raise an appeal or a complaint and how the University will calculate your degree outcome.

These University wide education policies should be read in conjunction with this programme and/or course handbook, in which School specific policies are detailed. These policies are effective immediately, for the 2022/23 academic year. Further information can be found on the University's Infohub webpage or by visiting the Infohub.

The information included in the institutional area for 2022-23 includes the following:

- Assessment
- Feedback
- Academic Integrity
- Absence
- Student Monitoring/ Class Certificates
- Late Submission of Work

- Student Discipline
- The co-curriculum
- Student Learning Service (SLS)
- Professional and Academic Development
- Graduate Attributes
- Email Use
- MyAberdeen
- Appeals and Complaints

Where to Find the Following Information:

C6/C7- University of Aberdeen Homepage > Students > Academic Life > Monitoring and Progress > Student Monitoriung (C6 & C7)

https://www.abdn.ac.uk/students/academic-life/student-monitoring.php#panel5179

Absences- To report absences you should use the absence reporting system tool on Student Hub. Once you have successfully completed and sent the absence form you will get an email that your absence request has been accepted. The link below can be used to log onto the Student Hub Website and from there you can record any absences you may have.

Log In - Student Hub (ahttps://www.abdn.ac.uk/studenthub/loginbdn.ac.uk)

Submitting an Appeal- University of Aberdeen Homepage > Students > Academic Life > Appeals and Complaints

https://www.abdn.ac.uk/students/academic-life/appeals-complaints-3380.php#panel2109

Academic Language & Skills support

For students whose first language is not English, the Language Centre offers support with Academic Writing and Communication Skills.

Academic Writing

- Responding to a writing task: Focusing on the question
- Organising your writing: within & between paragraphs
- Using sources to support your writing (including writing in your own words, and citing & referencing conventions)
- Using academic language
- Critical Thinking
- Proofreading & Editing

Academic Communication Skills

- Developing skills for effective communication in an academic context
- Promoting critical thinking and evaluation
- Giving opportunities to develop confidence in communicating in English
- Developing interactive competence: contributing and responding to seminar discussions
- Useful vocabulary and expressions for taking part in discussions

More information and how to book a place can be found here

Medical Sciences Common Grading Scale

Grade	Grade Point	% Mark	Category	Honours Class	Description
A1	22	90-100	Excellent	First	• Outstanding ability and critical thought • Evidence of extensive reading • Superior understanding •The best performance that can be expected from a student at this level
A2	21	85-89			
A3	20	80-84			
A4	19	75-79			
A5	18	70-74			
B1	17	67-69	Very Good	Upper Second	• Able to argue logically and organise answers well • Shows a thorough grasp of concepts • Good use of examples to illustrate points and justify arguments • Evidence of reading and wide appreciation of subject
B2	16	64-66			
B3	15	60-63			
C1	14	57-59	Good	Lower Second	• Repetition of lecture notes without evidence of further appreciation of subject • Lacking illustrative examples and originality • Basic level of understanding
C2	13	54-56			
C3	12	50-53			
D1	11	47-49	Pass	Third	• Limited ability to argue logically and organise answers • Failure to develop or illustrate points • The minimum level of performance required for a student to be awarded a pass
D2	10	44-46			
D3	9	40-43			
E1	8	37-39	Fail	Fail	• Weak presentation • Tendency to irrelevance • Some attempt at an answer but seriously lacking in content and/or ability to organise thoughts
E2	7	34-36			
E3	6	30-33			
F1	5	26-29	Clear Fail	Not used for Honours	• Contains major errors or misconceptions • Poor presentation
F2	4	21-25			
F3	3	16-20			
G1	2	11-15	Clear Fail/Abysmal		• Token or no submission
G2	1	1-10			
G3	0	0			

BM3804 Course Timetable: 2022-2023

Date	Time	Venue	Subject	Session	Staff
			Week 31		
Mon 27 Feb	09:00-10:00	FLT	Introductory lecture	Lecture	AMR
	10:00-11:00	FLT	Tutorial	Tutorial	DS
Tue 28 Feb					
Wed 1Mar	11:00-12:00	Suttie LT	Lecture 1-Early CNS development 1	Lecture	WH
Thu 2 Mar					
Fri 3 Mar	09:00-10:00	Suttie LT	Lecture 2-Early CNS development 2	Lecture	WH
			Week 32		
Mon 6 Mar	09:00-10:00	Suttie LT	Lecture 3-Early CNS development 3	Lecture	WH
Tue 7 Mar					
Wed 8 Mar	11:00-12:00	FLT	Lecture 4-Central Motor Pathways	Lecture	SP
Thu 9 Mar					
Fri 10 Mar	11:00-12:00	FLT	Lecture 5-Parkinson's disease	Lecture	DS
			Week 33		
Mon 13 Mar	09:00-10:00	FLT	Lecture 6-Peripheral Motor Pathways and Motor Neuron Diseases	Lecture	SP
Tue 14 Mar					
Wed 15 Mar	11:00-12:00	FLT	Lecture 7- Huntington's disease	Lecture	DS
Thu 16 Mar	10:00-13:00	STH 0.004 and 0.001	Lab Group 1	Practical	DS/AMR
	14:00-17:00	STH 0.004 and 0.001	Lab Group 2	Practical	DS/AMR
Fri 17 Mar	11:00-12:00	FLT	Lecture 8-Long-term potentiation (LTP): induction Lecture	Lecture	DG
			Week 34		
Mon 20 Mar	09:00-10:00	FLT	Lecture 9-Long-term potentiation (LTP): maintenance	Lecture	DG
Tue 21 Mar					
Wed 22 Mar	11:00-12:00	FLT	Lecture 10-Stroke	Lecture	MM
Thu 23 Mar					
Fri 24 Mar	9:00-10:00	Online	Patient/clinician Discussion- Stroke	Lecture	MM
	11:00-12:00	FLT	Lecture 11-Hypothalamus	Lecture	AGS
			Week 35		
Mon 27 Mar	09:00-10:00	FLT	Lecture 12-Alzheimer's disease	Lecture	BP
Tue 28 Mar					
Wed 29 Mar	11:00-12:00	FLT	Lecture 13-Enteric Nervous System I	Lecture	DS
Thu 30 Mar					
Fri 31 mar	11:00-12:00	FLT	Lecture 14-Enteric Nervous System II	Lecture	DS
	17:00	Lt KuraCloud	Deadline: Case Study	Assessment	DS

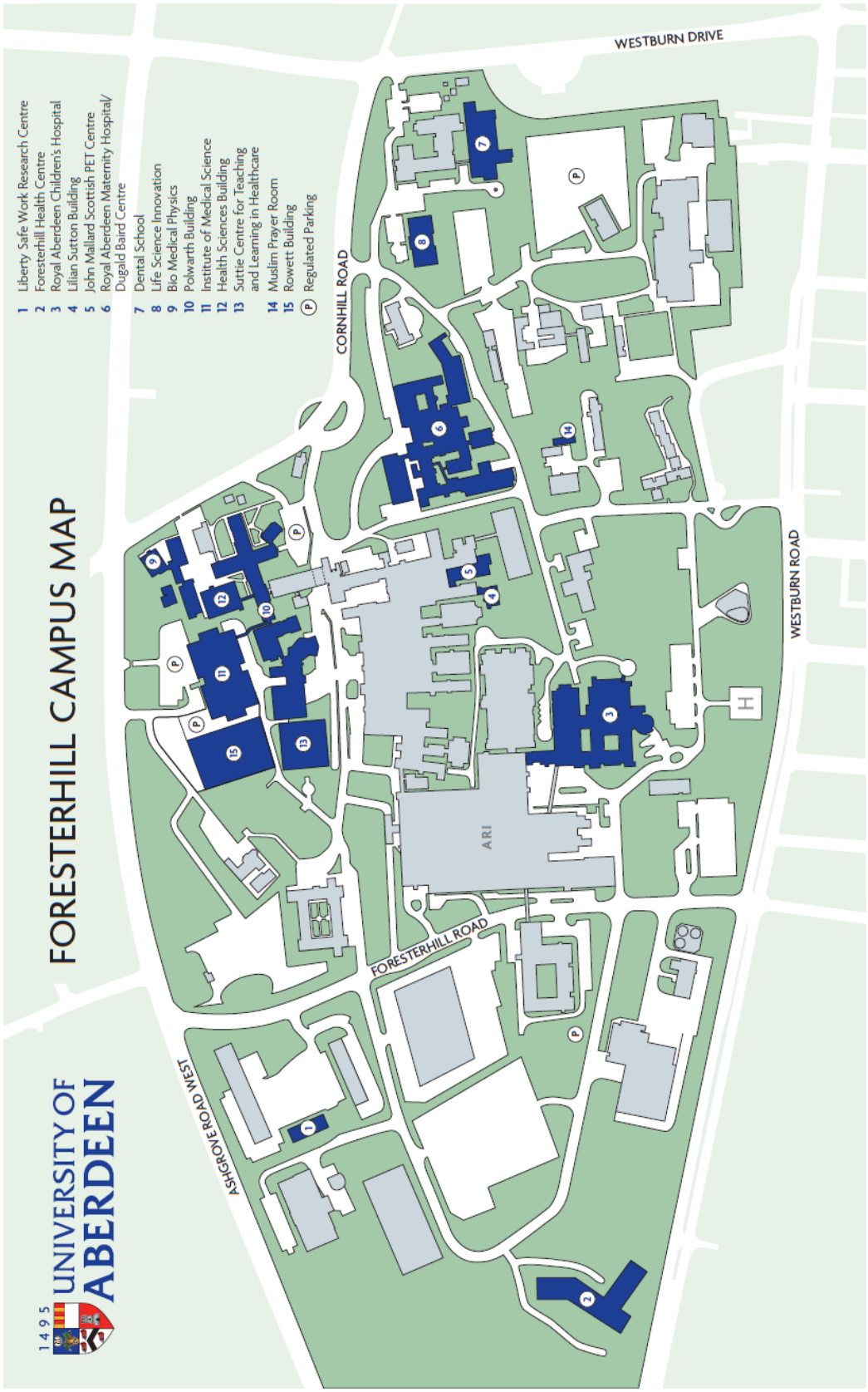
Staff

- Dr Derek Garden, (DG), Biomedical Sciences, **derek.garden@abdn.ac.uk**
- Dr Wenlong Huang (WH), Biomedical Sciences, **w.huang@abdn.ac.uk**
- Prof Martin Collinson (MC), Biomedical Sciences, **m.collinson@abdn.ac.uk**
- Prof Bettina Platt (BP), Biomedical Sciences, **b.platt@abdn.ac.uk**
- Dr Derek Scott (DS), Biomedical Sciences, **d.scott@abdn.ac.uk**
- Prof Simon Parson (SP), Biomedical Science, **simon.parson@abdn.ac.uk**
- Dr Mary Joan MacLeod (MM), Biomedical Sciences, **m.j.macleod@abdn.ac.uk**
- Dr Ann M Rajnicek (AMR), Biomedical Sciences, **a.m.rajnicek@abdn.ac.uk**
- Dr Antonio Gonzalez Sanchez (AGS), **antonio.gonzalez@abdn.ac.uk**

Venues

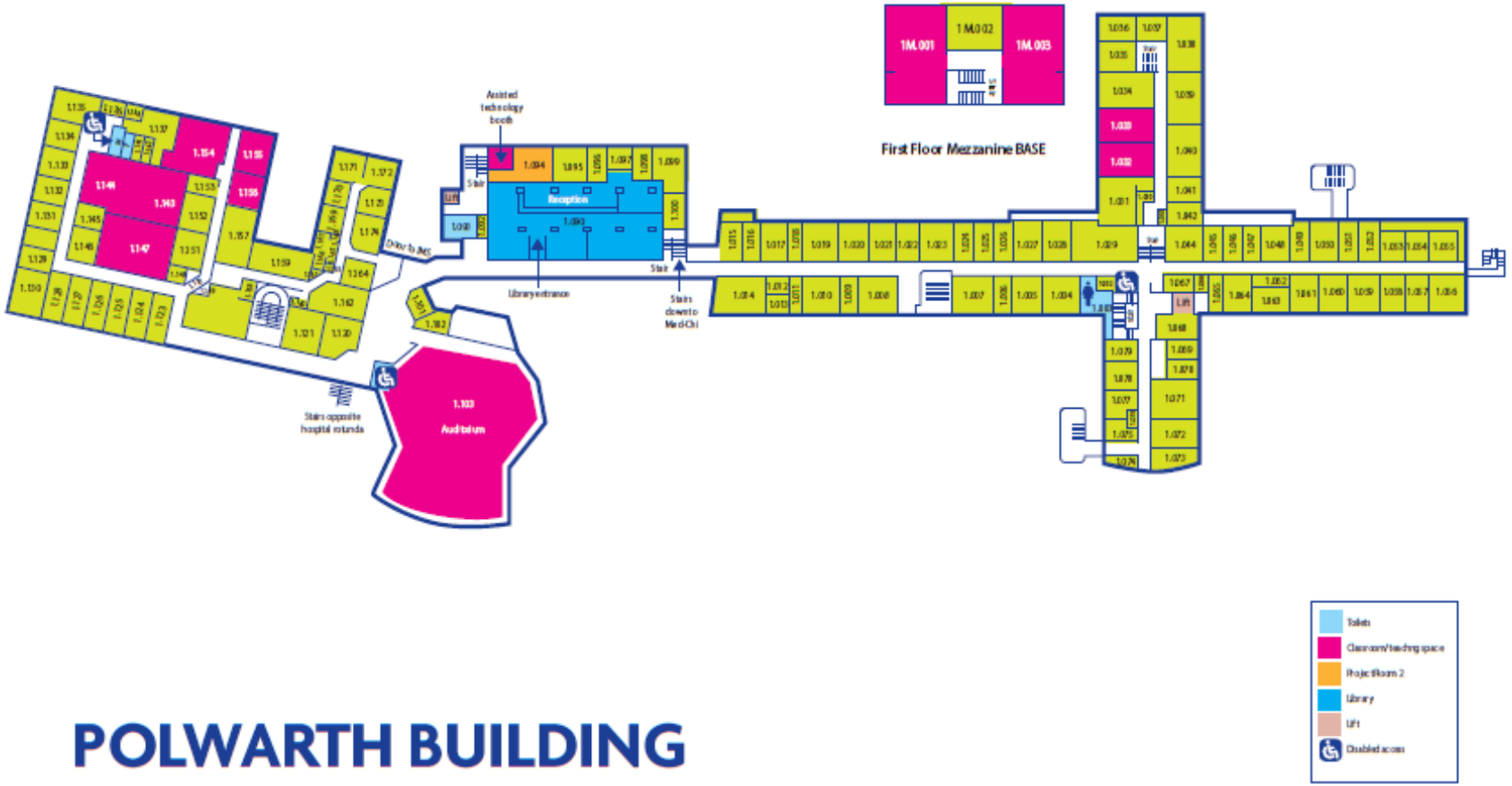
- FLT: Foresterhill Lecture Theatre, Polwarth
- Suttie 012: Lecture theatre 012, Suttie Centre, Foresterhill
- STH: Science Teaching Hub, Old Aberdeen, ground floor rooms 0.001 and 0.004

Campus Maps - Foresterhill



Polwarth Floor Plans

1495 UNIVERSITY OF ABERDEEN



POLWARTH BUILDING

First floor

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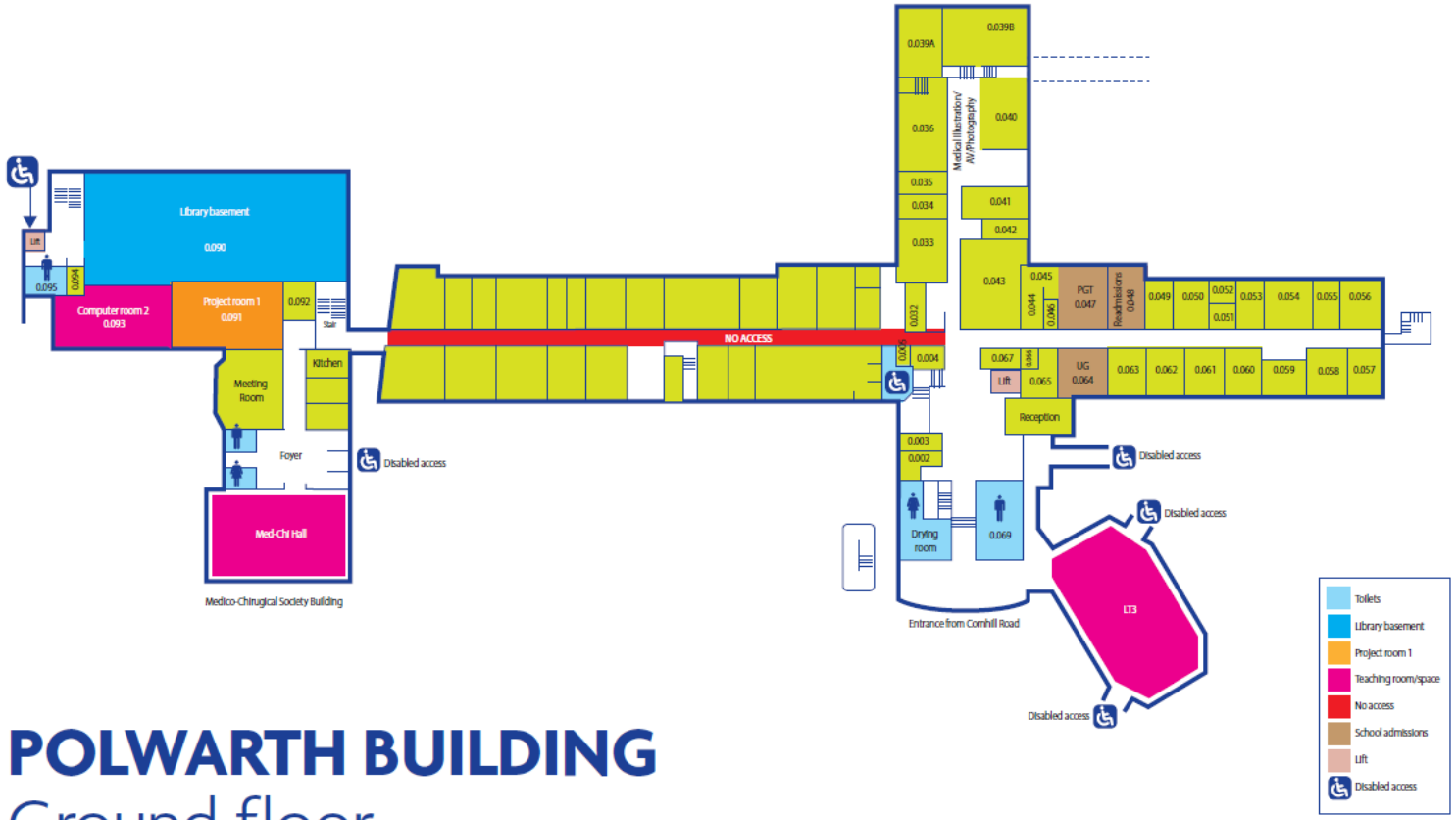

POLWARTH BUILDING
Ground floor

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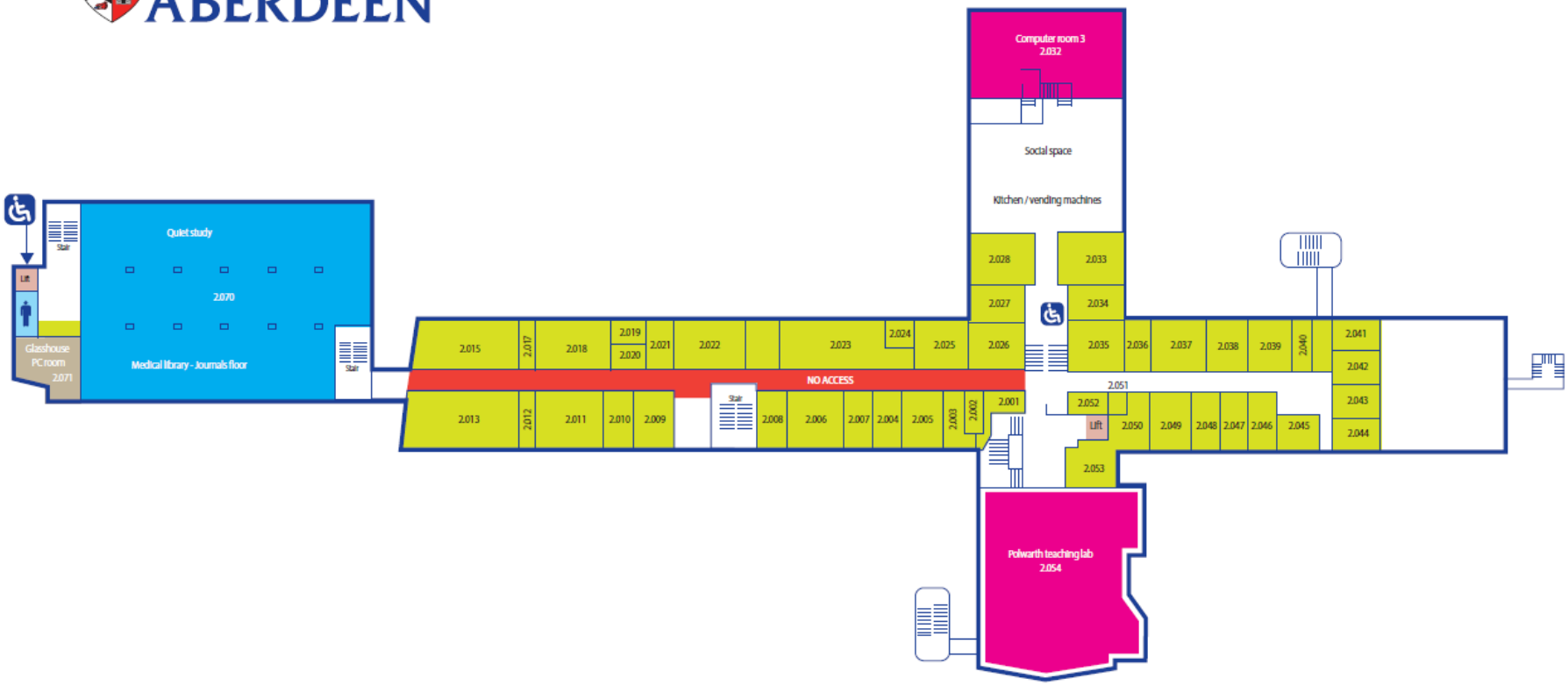

POLWARTH BUILDING
Second floor