1495 UNIVERSITY OF ABERDEEN

AN4301- Developmental Neuroscience (with Anatomy) Course Handbook 2023-2024

School of Medicine, Medical Sciences & Nutrition

Undergraduate Medical Sciences

Contents

Course Summary

This course considers the development of the nervous system and examples of functional networks. Areas discussed: 1) The initial establishment of the nervous system in the embryo and subsequent neuron growth. 2) Development of functional networks. 3) Synaptogenesis, development of the neuromuscular junction and pain pathways. Topics incorporate aspects of stem cell function, nerve and muscle function and examples of disease states. The course consists of 4 lectures per week and is examined by continuous assessment of a group presentation topic (group and individual elements), an elective anatomy dissection (dissection performance, dissection plan and an essay), and a 2-hour written exam.

Course Aims & Learning Outcomes

- To consider how the central and peripheral nervous systems become established from undifferentiated cells and integrates to generate specific functions.
- To learn how nerves grow, how they move, how they transport materials, how they communicate, what signals regulate these activities and how the nervous system produces complex behaviours.
- To refine teamworking and PowerPoint skills by creating and delivering a focussed scientific presentation
- To hone skills in concise scientific writing (abstract writing)
- Through the dissection practical component students will identify the tissue associations nerves have as they are distributed through the body.

Course Teaching Staff

Course Co-ordinator(s):
Course Organiser: Dr Ann M. Rajnicek (**a.m.rajnicek@abdn.ac.uk)**
Anatomy organiser: Dr Prem Ballal (**p.ballal@abdn.ac.uk)**

Other Staff:
Dr Daniel Berg (**daniel.berg@abdn.ac.uk**)
Dr Guy S Bewick (**g.s.bewick@abdn.ac.uk**
Prof Martin Collinson (**m.collinson@abdn.ac.uk**)
Dr Derek Garden (**derek.garden@abdn.ac.**uk)
Dr Antonio Gonzalez Sanchez (**antonio.gonzalez@abdn.ac.uk**)
Dr Wenlong Huang (**w.huang@abdn.ac.uk**)
Dr Eunchai Kang (**eunchai.kang@abdn.ac.uk**)

Assessments & Examinations

Students are expected to access and study all lectures and online materials, and to complete all assignments by the given deadlines. Assessment consists of 70% course exam and 30% continuous assessment. The dissection exercise and short essay on brain organoids contribute 15% to the overall mark (half of the continuous assessment elements) for AN4301.

Individual elective dissection & Dissection Essay – 15%

The layout of the essay should be similar to the one you see in a journal or a research paper and it should have an Introduction and a Conclusion with a minimum of 5 or more references. Discuss in detail about the topic and its advances, applications and challenges. It should be 1000-1200 words in length. Further details will be handed out by Dr Ballal. Submission date: See Timetable.

Overall Course Assessment

a). Continuous assessment - 15% of the course total will be based on the elective dissection and essay

- 7.5% Dissection plan and the final dissection will be considered together.
- 7.5% the dissection essay on 'Brain organoids, advances, applications and challenges'.

b). Group Presentation – 15% of the total course assessment. See MyAberdeen for full details.

- 7.5% Mark for group presentation/infographic
- 7.5 Individual written abstract/summary (limit-500 words)

c). Examination 70% of the assessment for AN4301 DEVELOPMENTAL NEUROSCIENCE WITH ANATOMY. This will take place in the summer diet, April/May. It will take the form of an essay-based examination. It is likely to be a 2-hour exam in which 2 essays are attempted from a choice of 6. All assessments (continuous and examined) will be made using the University Common Grading Scale (copy attached).

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.

Course Reading List

Reading lists for lecture content are incorporated in lecture slides on MyAberdeen. Additional materials are in the Leganto Reading List. If you have difficulty accessing materials, please contact the staff member delivering that component of the course (as indicated in timetable).

Lecture Synopsis

PART 1: BUILDING THE CNS

Lectures 1 & 2: Nervous system induction: Dr A. Rajnicek

The earliest stages of nervous system formation will be discussed. The lectures describe experimental evidence that the nervous system arises by a series of induction events and identify roles for specific inducing signals incorporating the experimental evidence.

Lecture 3: Neuronal migration – Dr D. Garden

Nerve cells are born in sites distant from those that they finally occupy. The locations and controls of neuronal differentiation will be considered together with the mechanisms controlling neuronal migration. The consequences of disrupting normal migration of neurones are also considered.

Lecture 4: Neuronal motility – Dr D. Garden

How newborn neurons move to correct positions in the developing nervous system. How nerves transport materials intracellularly, axonal transport, the microstructure and function of the neuronal cytoskeleton. The postulated mechanisms controlling these events will be outlined.

Lecture 5: Electrical axon guidance – Dr A. Rajnicek

The nervous system develops within a natural electric field generated by embryonic epithelia and the neural tube itself. The effects this has on growing axons, the underlying cellular mechanisms and possible clinical uses will be discussed.

Lecture 6: Neural Stem Cells in the Developing Brain: Dr D Berg

Neural stem cells are the source of most of the cells in the brain, including neurons, astrocytes and oligodendrocytes. In this lecture we will discuss general features of neural stem cells and the techniques used to study their behaviour and potential. The students will also learn how brain organoids generated from induced pluripotent stem cells (IPSCs) can be used to study the development of the human brain in the dish.

PART 2: LINKING ANATOMY, DEVELOPMENT, PHYSIOLOGY AND FUNCTION

Lecture 7: Adult Neurogenesis: Dr D Berg

In some areas of the brain, neurogenesis is not restricted to development but continues into adulthood. In this lecture we will go through the different areas of the adult mammalian brain in which neurons are added and how this process is regulated. We will also discuss how adult neurogenesis is affected in the diseased human brain and what we can learn from adult neurogenesis to regenerate the injured brain.

Lecture 8: Neurotrophic factors- Dr D. Garden

Nerve growth factor and the other members of the neurotrophin family of secreted proteins will be discussed. Their mechanism of action, functional significance, and their roles in neuronal survival, development and regeneration will be considered.

Lecture 9: Exocytosis: the basis of quantal neurotransmitter release: Dr G.S. Bewick

The process of exocytosis as the underlying mechanism of quantal transmitter release at synapses will be discussed, with particular reference to the NMJ. The lecture will also cover recent work, both on the NMJ and on other preparations, concerning the proteins and ion channels involved in exocytosis and their position within the nerve terminal.

Lecture 10: Endocytosis and vesicle recycling: Dr G.S. Bewick

Membrane lost from the vesicle pool during exocytosis is thought to be recaptured via endocytosis then repackaged with neurotransmitter, ready for re-release. This lecture will describe our current state of knowledge of these processes, including recent studies of vesicle recycling kinetics using tracers and the molecules involved in this process.

Lecture 11: Modulation of transmitter release: Dr G.S. Bewick

Neurotransmitter release can be modulated by a variety of factors. The effect of activity and naturally occurring modulators will be examined, together with the underlying presynaptic changes thought to bring these about.

Lecture 12: Genetic control of nervous function: Dr A. Gonzalez Sanchez

Modern tools, including optogenetics and chemical genetics, can be used to control nervous system function. This lecture will consider how cutting-edge techniques reveal how neural circuitry underpins functional outcomes.

Lecture 13: Developing pain: Dr Wenlong Huang

Pain results from the detection of intense or noxious stimuli by specialized sensory neurons (nociceptors), a transfer of action potentials to the spinal cord and onward transmission of the warning signal to the brain. In this lecture, students will learn the development of these sensory neurons in mammals and how they function in pain processing.

Practical/ Lab/ Tutorial Work

Group Work (15% of course total) **Full details and further guidance are on MyAberdeen.**

During the first week the class will be divided into groups to research a topic and each group will make a PowerPoint presentation (see timetable). This exercise aims to promote confidence and self-directed research, so students should expect minimal direct participation by staff. However, a Tutor has been assigned to each group to help with issues that cannot be resolved within the group or to assist with difficult scientific concepts.

- The presentation content reinforces concepts from this course (and others) and is examinable. Therefore, students not able to attend in person are responsible for viewing the Panopto recordings. The recordings will also aid revision.
- The presentation topics, starter references, tutor contact information, guidelines, infographic examples and assessment marking sheets are on MyAberdeen. You should look at these before you start work.

Learning outcomes:

- Collaborative effectively in a group to research a scientific topic.
- Prepare and deliver a scientific presentation aimed at a scientific audience
- Prepare and present an infographic aimed at a general (lay) audience.
- Hone writing skills in a concise, scientifically accurate abstract/summary.
- Practice targeting the same scientific concepts to diverse audiences: peers, scientific professionals, and the general (lay) public.

Marked elements:

Group Presentation

- ***Group mark (7.5% total)*** *arising from the oral presentations*
    - Scientific **ORAL PRESENTATION (6%)**. The mark is an assessment by the audience (students and staff) reflecting style and content and will be awarded to the whole group. The target audience is your peers.
    - I**NFOGRAPHIC** aimed at the general public **(1.5%**). The final slide of the presentation (place after the scientific conclusions/summary) should be a general audience 'Infographic' that targets a lay audience, assuming a reasonable scientific knowledge of cells, proteins etc. It should relay the Take Home message of the presentation topic simply, in an eye catching and scientifically accurate way. Although it should work as a stand-alone item, one person should 'walk the audience' through the infographic (build one or two minutes into the overall timing).
- **Individual mark components (7.5%**)
    - ***SUMMARY*** *(7.5%)- Each student* is required to prepare an independent abstract (summary) of *their Group's topic*. This component reflects your *own* interpretation of the entire topic, knitting together the whole group's research, not just your bit. The target audience here is a professional scientist/lecturer.

Group meetings. Groups are responsible for organising meetings themselves. These sessions can be the library, a coffee shop, or online, and should be agreed by the group. It is expected that **the group will meet at least once during the first week of the course**. Be flexible, but mindful of the time required to complete the task. The group should practice the presentation together before their scheduled presentation day.

Each group should divide itself into subgroups, each taking responsibility for researching one aspect of the topic. Decide on presentation structure and who will cover each part, working together to share information and to and discuss findings. Meeting conduct is to be professional and respectful. A successful presentation should make a coherent story without repetition. Groups presenting on the same day will cover related topics, so discuss potential overlap with the other group to avoid repetition. **IMPORTANT**-If someone fails to connect with the group early on, you are responsible for telling the tutor/course coordinator as soon as possible so any problems can be identified and resolved.

Written summary (contributes 7.5% to course mark) MyAberdeen submission

- Prepared as an individual but incorporates research gathered by other group members. Share information and work cooperatively.
- Snappy and to the point. No waffle, no bullet points.
- It should represent the content of the *entire* topic, not just the part you researched.
- **Strict 500-word limit**- include the word count at the end of the summary

- Figures are permitted and are very useful for presenting complex concepts. However, they must be referred to in the text and each needs a brief figure legend, which will eat into your word count. So, use them wisely. Figures 'borrowed' or 'adapted' from published work need to cite the appropriate reference.
- Include key references, as if you were writing a *very* short essay. The reference citations in the text and the reference list are *not included in the word* count. But they should be very few, proving to the marker that you have identified the most important/relevant papers. These are likely to include relevant (more recent??) papers that are *not* provided in the list of *starter references*.

Treat these topics as you would any other lecture material. Students attending the presentation (non-presenting group) are expected to contribute actively by asking questions at the presentations. Panopto recordings and Powerpoint slides will be made for revision purposes.

Anatomy practical component (contributes a total of 15% to the final course mark)

- **Dissection plan and dissection (7.5% of final mark)**

The Dissection plan needs to be handed in for assessment. The dissection plan and final dissection together will carry 7.5% of the total assessment.

You have already selected your dissection topic (course of a nerve) during AN4003 course. Now you will extend that dissection topic and complete it. Write a dissection plan (500 -700 words) to help with your dissection.

You will carry out your dissection mostly un -supervised but staff and support will be there during the session. You will be given 4 x 3 hours = 12 hours (Thursdays- see timetable) to carry out the dissection activity of the selected part. Complete the dissection and show the course and relations of a chosen nerve. You must work within the stipulated time because it will not be possible to provide any extra time.

You will be assessed on the quality and neatness of your dissection, showing the complete course and its relations of the nerve.

- **Anatomy Essay (7.5% of the final mark)**

Another 7.5% of your assessment will be awarded for your essay- 1000-1200 words. The topic of the essay is **'Brain Organoids: advances, application and its challenges'**.

  - Writing succinct reports is an everyday skill for practicing science professionals. The aim of this part of the assessment is to get you to relate your course topic with a scientific research interest. The word limit is 1000- 1200 words, and it is not negotiable. Your essay should include introduction, main body and summary (concluding remarks). Good spacing between the paragraphs. Insert chart/diagram /images where necessary.
  - Do not underestimate the effort required to digest a broad topic and write a concise report. This essay is expected to be well researched in the library or using other proper sources of information and should be referenced. However, you should aim to centre your essay with a minimum of six key references and your own knowledge of the topic. Your final report must link to recent advances of brain organoids. You should give some thought to the topic and do at least some preliminary background reading during the second half of the course.

Essay DEADLINE: see timetable:

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 2023/24 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 2023-24 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			

Course Timetable AN4301: 2023-2024

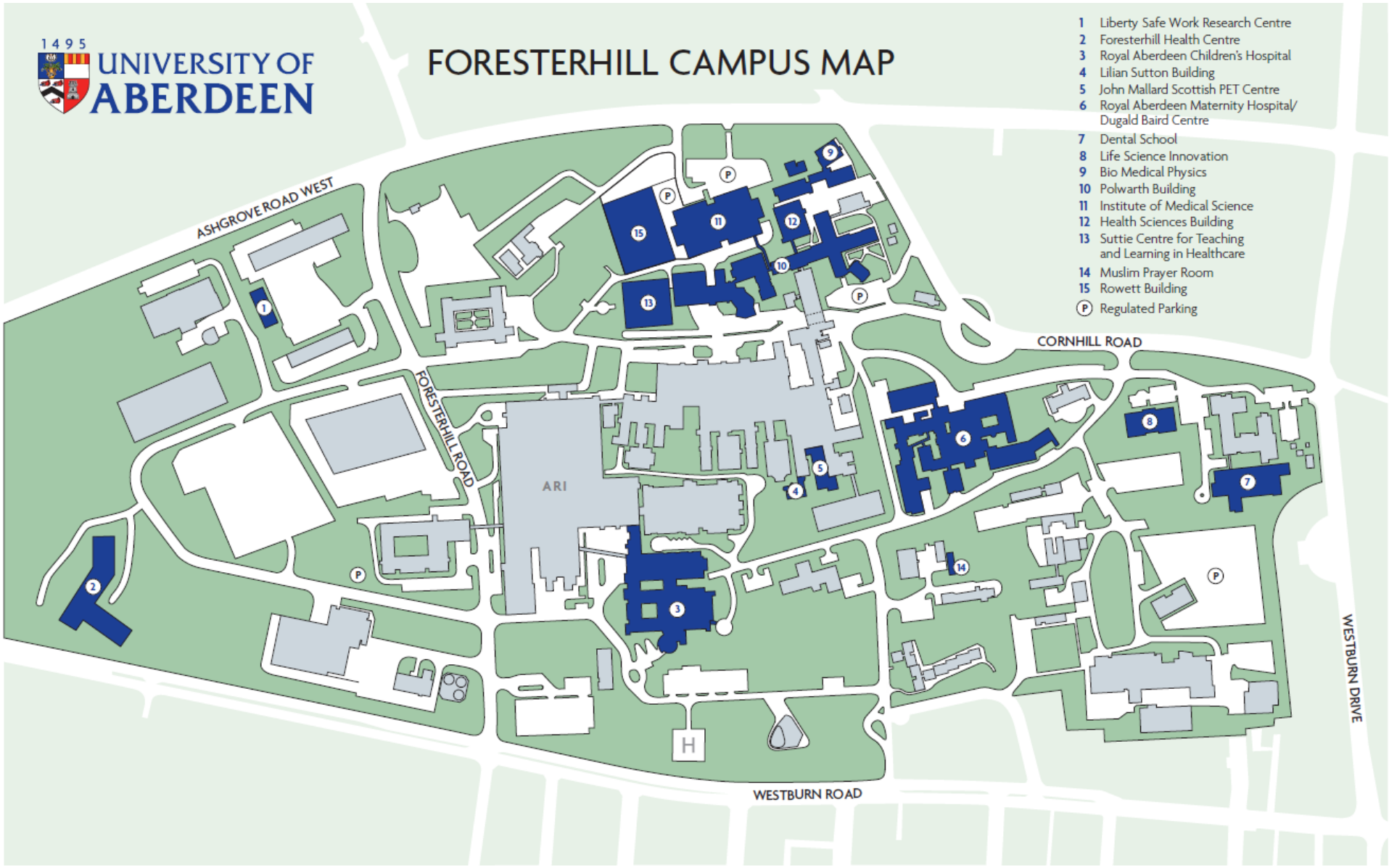
Date	Time	Place	Subject	Session	Staff
Week 13					
Mon 23 Oct	11:00-12:00	Polwarth 2:054	Lecture 1- Nervous System Induction 1	Lecture	AMR
Tue 24 Oct					
Wed 25 Oct	11:00-12:00	Polwarth 2:054	Lecture 2- Nervous system induction 2	Lecture	AMR
Thu 26 Oct	11:00-12:00	Polwarth 2:054	Tutorial 1: Concise Scientific Writing	Tutorial	AMR
	14:00-17:00	Anatomy DR, Suttie Building, FH	Dissection 1	Practical	PB
Fri 27 Oct	11:00-12:00	BIOMEDICAL PHYSICS LECTURE THEATRE	Tutorial 2: Scientific paper critique/peer review	Tutorial	AMR
Week 14					
Mon 30 Oct	11:00-1200	Polwarth 2:054	Lecture 3- Neuron migration	Lecture	DG
Tue 31 Oct					
Wed 1 Nov	11:00-1200	Polwarth 2:054	Lecture 4- Neuron motility	Lecture	DG
Thu 2 Nov	11:00-1200	Polwarth 2:054	Lecture 5- Electrical axon guidance	Lecture	AMR
	14:00-17:00	Anatomy DR, Suttie Building, FH	Dissection 2	Practical	PB
Fri 3 Nov	11:00-1200	BIOMEDICAL PHYSICS LECTURE THEATRE	Lecture 6- Neural stem cells in the developing brain	Lecture	DB
Week 15					
Mon 6 Nov	11:00-1200	Polwarth 2:054	Lecture 7- Adult Neurogenesis	Lecture	DB
Tue 7 Nov					
Wed 8 Nov	11:00-1200	Polwarth 2:054	Lecture 8- Neurotrophic factors	Lecture	DG
Thu 9 Nov	11:00-1200	Polwarth 2:054	Lecture 9- Exocytosis: quantal neurotransmitter release	Lecture	GSB
	14:00-17:00	Anatomy DR, Suttie Building, FH	Dissection 3	Practical	PB
	DEADLINE	MyAberdeen	All groups- email final PowerPoint slides	DEADLINE	
Fri 10 Nov	11:00-1200	Polwarth 2:054	Presentations by Groups 1 & 2 Gut-Brain Axis	Presentations	AMR/DG/ EK
Week 16					
Mon 13 Nov	11:00-1200	BIOMEDICAL PHYSICS LECTURE THEATRE	Presentations by Groups 3 & 4- LTP/memory	Presentations	DG/AMR
Tue 14 Nov					
Wed 15 Nov	11:00-1200	Polwarth 2:054	Presentations by Groups 5 & 6- neuromuscular junction/plasticity	Presentations	GSB/AMR
Thu 16 Nov	11:00-1200	Polwarth 2:054	Presentation by Groups 7 & 8- schizophrenia	Presentations	EK/AMR
	14:00-17:00	Anatomy DR, Suttie Building, FH	Dissection 4	Practical	PB
Fri 17 Nov	11:00-1200	Polwarth 2:054	Presentation by Groups 9 & 10- radial glia/Mueller glia	Presentations	MC/AMR
	DEADLINE	MyAberdeen	All groups- submit written summaries	DEADLINE	
Week 17					
Mon 20 Nov	11:00-1200	Polwarth 2:054	Lecture 10- Endocytosis and vesicle recycling	Lecture	GSB
Tue 21 Nov					

Wed 22 Nov	11:00-1200	Polwarth 2:054	Lecture 11- Modulating neurotransmitter release	Lecture	GSB
Thu 23 Nov	11:00-1200	Polwarth 2:054	Lecture 12- Genetic control of nervous function	Lecture	AGS
Fri 24 Nov	11:00-1200	BIOMEDICAL PHYSICS LECTURE THEATRE	Lecture 13- Developing Pain	Lecture	WH
Week 18 - No teaching during this week (Consolidate into 10 weeks)					
Mon 27 Nov					
Tue 28 Nov					
Wed 29 Nov	11:00-1200		Essay Preparation	Lecture	
Thu 30 Nov					
Fri 1 Dec	17:00		**Deadline: Dissection Essay**	N/A	

Staff

Dr Ann M Rajnicek (AMR), (Course Co-ordinator)
Dr Prem Ballal (PB), (Anatomy Coordinator)
Dr Daniel Berg (DB)
Dr Guy S Bewick (GSB)
Prof Martin Collinson (MC)
Dr Eunchai Kang (EK)
Dr Antonio Gonzalez Sanchez (AGS)
Dr Wenlong Huang (WH)
Dr Derek Garden (DG)
Teaching Venues
Room 2:054, Polwarth Building, Foresterhill
Biomedical Physics Lecture Theatre, Medical Physics Building, Foresterhill
Anatomy Dissecting Room, Suttie Building, Foresterhill

Campus Maps - Foresterhill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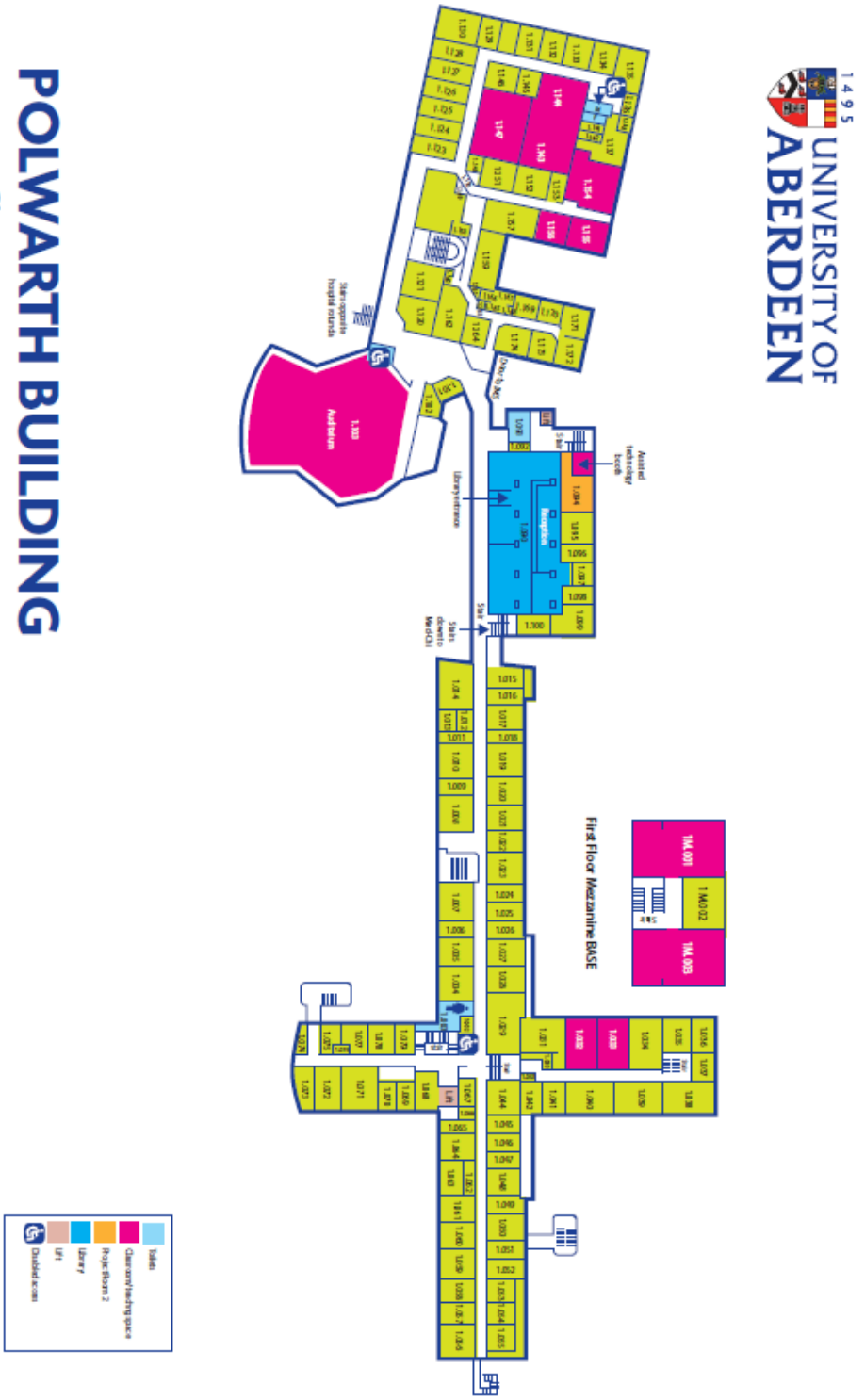
FORESTERHILL CAMPUS MAP
1 Liberty Safe Work Research Centre
2 Foresterhill Health Centre
3 Royal Aberdeen Children's Hospital
4 Lilian Sutton Building
5 John Mallard Scottish PET Centre
6 Royal Aberdeen Maternity Hospital/ Dugald Baird Centre
7 Dental School
8 Life Science Innovation
9 Bio Medical Physics
10 Polwarth Building
11 Institute of Medical Science
12 Health Sciences Building
13 Suttie Centre for Teaching and Learning in Healthcare
14 Muslim Prayer Room
15 Rowett Building
P Regulated Parking
ASHGROVE ROAD WEST
FORESTERHILL ROAD
CORNHILL ROAD
WESTBURN ROAD
WESTBURN DRIVE
ARI
H

Polwarth Floor Plans



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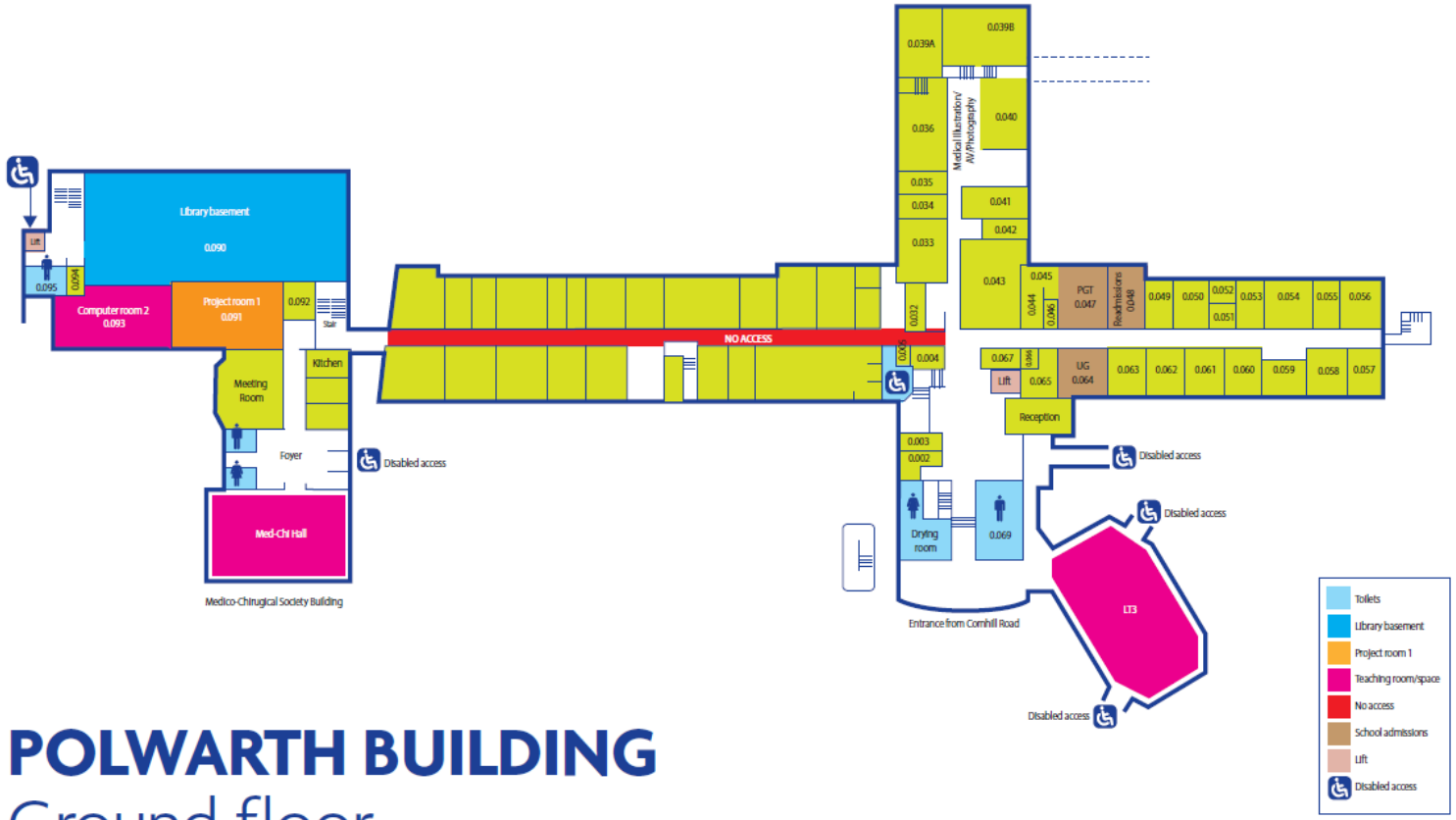

POLWARTH BUILDING
Ground floor

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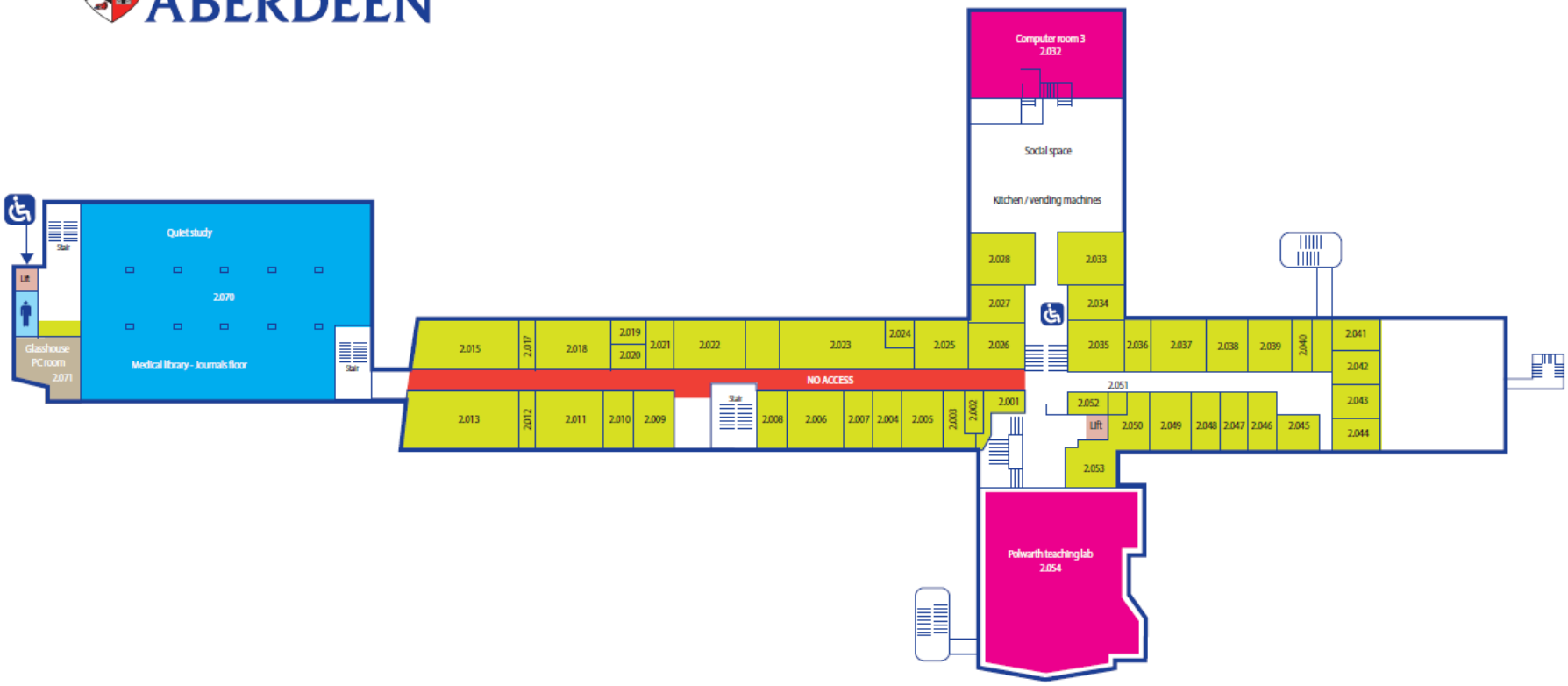

POLWARTH BUILDING

Second floor