AN3301

Human Embryonic Development

Course Handbook

2022-2023

School of Medicine, Medical Sciences & Nutrition
Contents

- Course Summary – (3)
- Course Aims & Learning Outcomes – (3)
- Course Teaching Staff – (3)
- Assessments & Examinations – (4)
- Class Representatives – (5)
- Problems with Coursework – (5)
- Course Reading List – (6)
- Lecture/ Course Content Synopsis – (6)
- Workshop/Tutorial – (9)
- University Policies – (9)
- Academic Language & Skills support – (10)
- Medical Sciences Common Grading Scale – (11)
- Course Timetable AN3301: 2022-2023 – (12)
- Campus and Floor Maps – (13)
Course Summary

Focusing on human development, this course will examine the question of how a single fertilised cell develops into a fully functioning organism with a complex, highly patterned body structure. The course will begin with an overview of embryonic and foetal development, the major signalling systems sculpting normal development, and causes of birth defects. The structural changes underlying the development of each of the major tissues and organs of the body will be discussed in turn, and the genes and signalling pathways involved will be introduced briefly.

The course consists of a mixture of live and recorded lectures, live tutorials, a workshop, a group oral presentation on a specific aspect of abnormal development and completion of other course work.

The course is assessed by continuous assessment (50%) and written exam (50%).

Course Aims and Learning Outcomes

1. Provide a broad understanding of the major structural changes underlying the development of the mature body form from an initial single cell.

2. Describe the early stages in the development of the body plan, and the major developmental events defining the embryonic and foetal periods.

3. Explore how specific tissues and organs develop, and the timescale and progression of events, including processes that may continue after birth.

4. Explain the major causes of birth defects, including teratogenic agents, and their effects.

Course Teaching Staff

Course Co-ordinator:

LE – Professor Lynda Erskine, I.erskine@abdn.ac.uk

Other Staff:

CDB – Professor Cosimo de Bari, c.debari@abdn.ac.uk

JMC – Professor Martin Collinson, m.collinson@abdn.ac.uk

VV – Dr Victor Velecela, victor.velecela@abdn.ac.uk

NV – Professor Neil Vargesson, n.vargesson@abdn.ac.uk
Assessments and Examinations

Students are expected to access and study **ALL** lectures, attend and actively engage in the workshops and tutorials, and to complete all assignments by the stated deadlines. The minimum acceptable performance is engagement with all lecture material, attendance at the workshop and 50% of the live lectures and tutorials, as well as submission of all set course work, written and oral.

Assessment is derived from:

Continuous assessment: 50% of the total marks, consisting of:

1. MCQs throughout the course – 20%
2. A group oral presentation on a selected aspect of abnormal development – 20%
3. Workshop write up – 10%

Written exam: 50% of the total marks

Topics for the oral presentations will be selected during the 1st week of the course. Preparation time has been included throughout the course, with online rooms set aside for practice.

**Key dates for in-course work:**

**Oral presentations** – at the start of the course groups will be assigned a 10 min slot for their presentation. The presentations will take place on **Tuesday 15th November** (10:00-13:00). **Everyone is expected to attend these presentations.**

**Workshop** - write up to be submitted on the day (**Tuesday 22nd November**). **Attendance and active engagement at the workshop is compulsory.**

**MCQs** – deadlines TBC

**Written Exam** – Date of exam TBC

Resit assessment will be based on resitting the exam and/or resubmission of any failed/missing in course assessments as relevant.

Your overall performance will be expressed as a grade awarded on the Common Grading Scale (CGS).
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 in 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. 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**

Langman’s Medical Embryology, Lippincott, Williams &Wilkin


[Related text book: Moore KL, Persaud TVN. Before we are born: essentials of embryology and birth defects]

Additional, specific references, may be provided by individual members of the teaching staff

**Lecture Synopsis**

Lectures will be delivered either live or available as recordings. Live lectures will provide an overview of the key concepts, with time available throughout the session for asking questions. More detailed recordings of each topic delivered live will be available online.

**Introduction – Professor Lynda Erskine (live session)**

This introductory lecture will provide an overview of the course, and its content, aims and goals.

**Lecture 1: Embryonic development – Professor Neil Vargesson (recording)**

This lecture will examine the early events in embryonic development. Topics that will be covered include, fertilisation and the pre-implantation stages of development, implantation, formation of the bilaminar germ disc, formation of the trilaminar germ disc, and origins of the ectoderm, mesoderm, endoderm and their functions.

**Lecture 2: The foetal Period; Teratogens – Professor Neil Vargesson (recording)**

Following on from embryonic development, this lecture will cover pattern formation, organogenesis, formation of the placenta, growth and foetal milestones. The main causes and risk factors for birth defects will also be discussed.

**Lecture 3: Signalling systems in development – Professor Martin Collinson (recording)**

In order to understand human embryology, we need to understand how cells talk to each other. Despite the incredible complexity of embryonic development, most developmental processes are controlled by a few, highly conserved families of signalling molecules. This lecture will introduce the major players, including the
fibroblast growth factors (FGFs), wingless-family proteins (Wnts), bone morphogenetic proteins (BMPs) and Hedgehog-family ligands (Hh).

Lecture 4:  Head and neck development – Professor Lynda Erskine (live)

This lecture will consider the structural development of the head and neck. Major players in this process are the pharyngeal (branchial) arches. The composition of the pharyngeal arches and the various structures derived from them will be described. The development of the face from mesenchyme surrounding the mouth, the separation of the oral and nasal cavities through formation of the palate and the development of the skull (cranium) will also be covered.

Lecture 5:  Respiratory system development – Professor Lynda Erskine (live)

Breathing is essential to life, and a major cause of neonatal lethality in premature infants is under development of the lungs. This lecture will describe the development of the thoracic and abdominal cavities, the formation of the lung buds from the foregut, the development of the trachea, oesophagus, larynx and bronchi, and the maturation of the lungs. Anomalies of respiratory system development will also be introduced.

Lecture 6:  Digestive system development - Professor Lynda Erskine (live)

This lecture covers the development of the major derivatives of the foregut (e.g. stomach, liver, pancreas), midgut (most of the intestines) and hindgut (distal part of the colon and anorectal canal). Anomalies of gut development will be introduced briefly.

Lecture 7:  Bone development – Professor Cosimo de Bari (recording)

This lecture explores the processes of cellular condensation that lead to the formation of cartilage and bone. Processes of intramembranous and endochondral ossification will be studied, and the genetic and cellular pathways that lead to the formation and maintenance of bone. We will all fall off a wall and break a bone at some point in our lives – this lecture will briefly describe the process of bone repair with hints of bone tissue engineering.

Lecture 8:  Cardiovascular system development – Dr Victor Velecela (recording)

The cardiovascular system is the first functional organ system to develop in the human embryo, and cardiovascular function is from then on required continuously throughout life. The heart is also one of the most complex organs to develop and, as a consequence, congenital heart defects account for approximately a quarter of all human congenital abnormalities.

This lecture focuses on introducing the normal development of the cardiovascular system; its origin in the lateral plate mesoderm, the formation of the linear heart tube and the major arteries and veins connected to the heart, the morphogenesis of the linear heart tube into a four-chambered heart, and the changes at birth that give rise to separate systemic and pulmonary circulation.

Lecture 9:  Nervous system development – Professor Lynda Erskine (live)

The nervous system is arguably the most complex tissue in our body, composed of billions of cells connected together in a very precise fashion. Normal nervous system development is essential for making us who we are and defining all of our interactions with the world around us. This lecture will introduce the development
of the central nervous system (brain and spinal cord) from the neural tube, and generation of the different neuronal and glial cell types. Neural tube defects, such as spina bifida as well as other brain anomalies will be discussed. The formation of the ventricular system and the development of major brain regions will be described briefly. The development of the peripheral nervous system from neural crest cells and cranial placodes also will be considered.

**Lecture 10: Development of the integumentary system – Professor Neil Vargesson (recording)**

The integumentary system protects the body from various kinds of damage, including water loss or abrasion from outside. The system comprises the skin and its appendages. This lecture will discuss the development of the epidermis, dermis, and role of neural crest cells in skin development. Formation of nails, hair, sebaceous and sweat glands will be discussed. In addition, we also will look at the development of the teeth.

**Lecture 11: Urinary system development – Professor Neil Vargesson (recording)**

This lecture will begin by examining the relationship between the development of the urinary and reproductive systems. The development of the kidneys via a series of successively more complex excretory organs, the pronephros, mesonephros and metanephros will be described. The development of bladder and the renal tubules, collecting ducts and resulting structure of the kidneys also will be discussed.

**Lecture 12: Genital system development - Professor Neil Vargesson (recording)**

This lecture will describe the development of the male and female reproductive systems. Topics that will be covered include formation of the testis, formation of the excretory ducts, descent of the testis, the female genital tract, ovarian development, the development of the uterine tubes, uterus and vagina. Urinary-genital anomalies also will be considered.

**Lecture 13: Development of the eye and ear – Professor Lynda Erskine (recordings)**

Vision and hearing are two of our most precious senses. This lecture will look at the development of the anatomical structures important for these senses - the eye and ear. Topics that will be discussed include:

Eye development: Development of the optic vesicle, lens induction and development, cellular differentiation in the retina, development of the other structures of the eye (iris, ciliary body, sclera, choroid and vitreous), development of the eye lids, eye anomalies.

Ear Development: Development of the external, middle and inner ear. Deafness and external ear anomalies will be introduced.

**Lecture 14: Somite and Muscle development - Professor Martin Collinson (recording)**

Many tissues in the body have their origins in the somites, balls of mesodermal tissue that form on either side of the developing body axis, and are the clearest physical evidence that we are segmented animals. The development of somites is one of the most spectacular examples of how dynamic changes in gene expression control morphogenesis, and this lecture will describe this process. The somites also give rise to muscles of the axis, body wall and limbs, and the dynamic processes of cell specification, migration and muscle block formation will be explained.

**Lecture 15: Limb development – Professor Neil Vargesson (recording)**
Although vertebrate limbs take many different shapes and functions, for walking, flight, swimming and manipulation, the basic growth and patterning of the pentadactyl limb has a very uniform and well-studied basis, which will be covered in this lecture. The origins of the limb bud and the two-way interaction between the apical ectodermal ridge and the underlying limb mesenchyme will be studied. The genes and signalling pathways that make forelimbs different from hindlimbs, arms different from hands, and fingers from thumbs also will be discussed.

**Lecture 16: Thalidomide embryopathy – Professor Neil Vargesson (recording)**

This lecture will describe and discuss the notorious teratogen Thalidomide. Included in the lecture will be discussions on why the drug was made, the defects it caused, what we know about this drug today and its current uses (and risks).

**Workshop/Tutorial Work**

The workshop will take place live. Participation and active engagement in the workshop is compulsory.

Handouts detailing the work to be carried out in the workshop will be posted on MyAberdeen.

Weekly tutorials will be held on Fridays 2-3pm in weeks 14 - 17. Attendance and active engagement in at least 50% of the tutorials will be required to obtain a class certificate. The tutorial in week 17 (25th November) will focus on preparation for the written exam and student feedback on the course. The other tutorials will involve active learning approaches aimed at consolidation your understanding of the material covered in the course.

**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

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Point</th>
<th>% Mark</th>
<th>Category</th>
<th>Honours Class</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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 AN3301: 2022-2023

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Place</th>
<th>Subject</th>
<th>Session Type</th>
<th>Staff</th>
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</thead>
<tbody>
<tr>
<td><strong>Week 13</strong></td>
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<tr>
<td><strong>Mon 24 Oct</strong></td>
<td>15:00-17:00</td>
<td>1.154</td>
<td>Introduction, Presentation Topic Selection</td>
<td>Live Lecture</td>
<td>LE</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Embryonic development</td>
<td>Recorded Lecture</td>
<td>NV</td>
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<tr>
<td></td>
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<td>The foetal period; teratogens</td>
<td>Recorded Lecture</td>
<td>NV</td>
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<td></td>
<td>Signaling Systems</td>
<td>Recorded Lecture</td>
<td>JMC</td>
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<tr>
<td><strong>Friday 28 Oct</strong></td>
<td>14:00-15:00</td>
<td>1.154</td>
<td>Head and Neck</td>
<td>Live Lecture</td>
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<tr>
<td><strong>Week 14</strong></td>
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<td><strong>Mon 31 Oct</strong></td>
<td>15:00-16:00</td>
<td>1.154</td>
<td>Respiratory System</td>
<td>Live Lecture</td>
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<td>16:00-17:00</td>
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<td>Digestive System</td>
<td>Live Lecture</td>
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<td>Bone Development</td>
<td>Recorded Lecture</td>
<td>CDB</td>
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<td>Cardiovascular System</td>
<td>Recorded Lecture</td>
<td>VV</td>
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<tr>
<td><strong>Fri 4 Nov</strong></td>
<td>14:00-15:00</td>
<td>1.154</td>
<td>Tutorial</td>
<td>Live on campus</td>
<td>LE</td>
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<tr>
<td><strong>Week 15</strong></td>
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<td><strong>Mon 7 Nov</strong></td>
<td>15:00-16:00</td>
<td>1.154</td>
<td>Nervous system</td>
<td>Live Lecture</td>
<td>LE</td>
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<td><strong>Mon 7th Nov</strong></td>
<td>09:00</td>
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<td>MCQ Set 1 released</td>
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<td>Integumentary System</td>
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<td>Urinary System</td>
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<td>Genital System</td>
<td>Recorded Lecture</td>
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<tr>
<td><strong>Fri 11 Nov</strong></td>
<td>14:00-15:00</td>
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<td>Tutorial</td>
<td>Live on campus</td>
<td>LE</td>
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<td><strong>Fri 11 Nov</strong></td>
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<td><strong>Week 16</strong></td>
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<td><strong>Tue 15 Nov</strong></td>
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<td>Presentations</td>
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<td>Eye and Ear</td>
<td>Recorded Lecture</td>
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<td>Somite and Muscle</td>
<td>Recorded Lecture</td>
<td>JMC</td>
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<td><strong>Fri 18 Nov</strong></td>
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<td>Tutorial</td>
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<td><strong>Week 17</strong></td>
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<tr>
<td><strong>Tue 22 Nov</strong></td>
<td>10.00-16.00</td>
<td>BMP D2</td>
<td>Workshop</td>
<td>Live on Campus</td>
<td>LE/NV</td>
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<td>Limb Development</td>
<td>Recorded Lecture</td>
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<td>Thalidomide</td>
<td>Recorded Lecture</td>
<td>NV</td>
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<tr>
<td><strong>Fri 25 Nov</strong></td>
<td>14:00-15:00</td>
<td>1.154</td>
<td>Tutorial – feedback/exam prep</td>
<td>Live on campus</td>
<td>LE/NV</td>
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<tr>
<td><strong>Fri 25 Nov</strong></td>
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<td>MCQ Set 2 released</td>
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<td><strong>Week 18</strong></td>
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<tr>
<td><strong>Fri 2nd Dec</strong></td>
<td>17:00</td>
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<td>Deadline completion MCQ Set 2</td>
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</tbody>
</table>

**Staff**

- CDB – Professor Cosimo de Bari
- NV – Professor Neil Vargesson
- JMC – Professor Martin Collinson
- VV – Dr Victor Velecela
- LE – Professor Lynda Erskine (course co-ordinator)
Campus Maps - Foresterhill