

PA4303

**Current Topics in
Pharmacological
Research**

**Course Handbook
2019-20**

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Cover image:

Confocal micrograph of fluorescently labelled HeLa cells.

Nuclei are labelled in blue, tubulin in green and actin fibres in red.

Courtesy of:

Kevin Mackenzie

Microscopy and Histology Core Facility

Institute of Medical Sciences

University of Aberdeen

<http://www.abdn.ac.uk/ims/microscopy-histology>

Course Summary

This course extends your previous knowledge in the area of drug mode of action, molecular targets and toxicology. The process of drug development will be examined from the importance of understanding the design and metabolic profile of drugs and their transport to covering molecular aspects of pre-clinical toxicology. This course provides focus on hot topics in pharmacology and toxicology, using specific examples from research at the University of Aberdeen and thus opens up new opportunities for employability in academia and the pharmaceutical industry.

Co-ordinator: Dr Steve Tucker (437491); IMS room 6.32

Course Aims & Learning Outcomes

The course aims to develop an understanding of pharmacological targeting and molecular toxicology at an advanced level. The learning outcomes are:

- To gain knowledge of drug-induced toxicity including organ specific toxicity, oxidative stress and the role of drug transport
- To develop advanced understanding of the processes surrounding pharmacological drug design and molecular targeting using specific examples
- To develop knowledge of the processes involved in cell death including apoptosis, autophagy and necrosis
- To enhance understanding of the use of biomarkers in pharmacology and toxicology
- To develop advanced knowledge of molecular carcinogenesis (genotoxic and non-genotoxic)

Course Teaching Staff

Course Co-ordinator(s):

Dr S Tucker School of Medicine, Medical Sciences, Dentistry and Nutrition

Other Staff:

Dr J Barrow (JB), School of Medicine, Medical Sciences and Nutrition
Dr E Collie-Duguid (ECD), School of Medicine, Medical Sciences and Nutrition
Dr P Marini (PM), School of Medicine, Medical Sciences and Nutrition
Professor IJ McEwan (IJM), School of Medicine, Medical Sciences and Nutrition
Professor HM Wallace (HMW), School of Medicine, Medical Sciences and Nutrition

Assessments & Examinations

Students are expected to attend the lectures, practical classes and tutorials. Any period of absence must be covered by a medical certificate in accordance with University regulation (see Notice Boards). Practical reports and assignments must be handed in for marking by the dates indicated. A 100% attendance is required at practical classes. If assignments are not

handed in on time e.g. if an assignment is more than 1 week late without good cause, it will not be marked.

The distribution of assessments is as follows:

1. Degree written exam 2h paper, answer 2 questions = 70% of the grade for this course
2. Continuous assessment: 3D practical project (20%), editorial (10%) = 30% of the grade for this course.

Past papers for PA4302 (previous code) and PA4303 are available on the Web.

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 Mrs Jenna Reynolds (medsci@abdn.ac.uk) in the School Office (based in the IMS, Foresterhill), or Mrs Sheila Jones (s.jones@abdn.ac.uk) in the Old Aberdeen office associated with the teaching laboratories,

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 semester 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

Books recommended for purchase

Rang and Dale's, Pharmacology 8th Edition

The following are available at Foresterhill Library Counter (Heavy Demand)

- Pratt & Taylor Principles of Drug Action (Third edition). ISBN. 0443086761
- Casarett & Doull's Toxicology. (Fifth edition). ISBN. 0071054766.

Foresterhill Library holds issues of Trends in Pharmacological Sciences and the British Journal of Pharmacology, which may be very useful for reading around many topics relevant to the course.

Lecture Synopsis

Drug Transporters - Professor Heather Wallace

- Drug transporter families
- Toxicity issues with drug transporters
- Regulation of drug transport by nuclear receptors

Biomarkers - Dr Elaina Collie-Duguid

- Biomarkers in the management of human disease
- Types of biomarkers and their potential clinical utility
- Biomarkers in current clinical use

Pharmacology of cannabinoids – Dr Pietro Marini

- The endocannabinoid system
- Natural and synthetic ligands
- Use of cannabis in therapy
- Applied pharmacology: cannabinoid and cholinergic systems cross-talk

Quadruplex targeting – Dr John Barrow

- What are G-quadruplexes?
- G-quadruplex roles in gene regulation
- Current research in using quadruplexes as a drug target

Drug targeting in prostate cancer – Professor Iain McEwan

- Steroid Hormone Receptors: From basic biology to drug targets
- Androgen receptor-Structure and Function
- Prostate cancer
- Novel Small Molecule Inhibitors of receptor function

Endocrine pharmacology – Dr Steve Tucker

- Endocrine regulation of female reproduction
- Pharmacology of the female hormonal contraception
- Endocrine regulation of male reproduction
- Pharmacology of the male hormonal contraception

The chemistry of pharmacokinetics and pharmacodynamics – Dr Steve Tucker

- Synthetic chemistry and drug design
- Chemical groups that modify pharmacokinetics
- Chemical groups that modify pharmacodynamics

Chronotherapeutics – Dr Steve Tucker

- Circadian rhythm
- Influence of circadian rhythm on cancer initiation
- Influence of circadian rhythm on anticancer drug side effects / resistance
- Chronotherapy in cancer

Cell death - Professor Heather Wallace

- Apoptosis
- Necrosis
- Programmed cell death
- Autophagy
- Lysosomal cell death

Molecular carcinogenesis - Professor Heather Wallace

- Proto-oncogenes, oncogenes and tumour suppressor genes
- Cell cycle regulation
- Carcinogens: genotoxic and non-genotoxic

Adverse effects of manipulating the immune system – Dr Isabel Crane

Although drugs that manipulate the immune system can be very effective treatments for many conditions from cancer to multiple sclerosis, their use, not surprisingly, can also have adverse effects.

We will discuss:

- Immunosuppression in transplantation
- Effects of boosting the immune system in cancer
- Monoclonal antibody therapy

Drug targeting in breast cancer – Dr Steve Tucker

- Introduction to breast cancer
- Traditional targets (hormone receptors and growth factor receptors)
- Popeye domain containing (POPDC) proteins and breast cancer
- Targeting POPDC1

Pre-clinical testing in drug discovery – Professor Heather Wallace

- Outline of the pre-clinical testing environment
- Regulatory requirements for testing
- New alternative methodologies

3D project/Editorial/Case study

3D Practical project (20% of final mark): Dr Steve Tucker

- examine target/drug structures and how these relate to pharmacological consequences
- develop an understanding of how to communicate with the public
- employ problem solving skills to design new synthetics for use on the target
- develop group and individual working skills

The project will involve small groups of students researching and selecting a drug target to focus upon and preparing individual short justification/explanation for their choice aimed at the public. Groups will then investigate a small number of drugs that act on the target, and using 3D prints of the target and drugs, prepare a short video demonstrating the molecular interaction that takes place to produce the pharmacological response. Finally, groups will use their knowledge to propose a new synthetic drug with specific pharmacodynamic/pharmacokinetic properties enabled by its chemical structure.

Assessment: individual justification (5%); group video (5%); new synthetic (10%)

Editorial (10% of final mark): Dr Steve Tucker

- condense complex information from scientific literature into clear and structured discursive writing
- to develop and explore a mature pharmacological theme considering all sides of the issue in a balanced and informed manner

The exercise will involve students being issued with a small number of research papers to read and interpret before writing a short editorial exploring the main themes linking the articles under exam conditions.

University Policies

Students are asked to make themselves familiar with the information on key institutional policies which been made available within MyAberdeen (<https://abdn.blackboard.com/bbcswebdav/institution/Policies>). 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 indicate how seriously the University takes your feedback.

These institutional policies should be read in conjunction with this programme and/or course handbook, in which School and College specific policies are detailed. Further information can be found on the **University's Infohub webpage** or by visiting the Infohub.

The information included in the institutional area for 2019/20 includes the following:

- Absence
- Appeals & Complaints
- Student Discipline
- Class Certificates
- MyAberdeen
- Originality Checking
- Feedback
- Communication
- Graduate Attributes
- The Co-Curriculum

Medical Sciences Common Grading Scale

Grade	Grade Point	Category	Honours Class	Description
A1	22	Excellent	First	<ul style="list-style-type: none"> 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			
A3	20			
A4	19			
A5	18			
B1	17	Very Good	Upper Second	<ul style="list-style-type: none"> 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			
B3	15			
C1	14	Good	Lower Second	<ul style="list-style-type: none"> Repetition of lecture notes without evidence of further appreciation of subject Lacking illustrative examples and originality Basic level of understanding
C2	13			
C3	12			
D1	11	Pass	Third	<ul style="list-style-type: none"> 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			
D3	9			
E1	8	Fail	Fail	<ul style="list-style-type: none"> Weak presentation Tendency to irrelevance Some attempt at an answer but seriously lacking in content and/or ability to organise thoughts
E2	7			
E3	6			
F1	5	Clear Fail	Not used for Honours	<ul style="list-style-type: none"> Contains major errors or misconceptions Poor presentation
F2	4			
F3	3			
G1	2	Clear Fail/ Abysmal	-	<ul style="list-style-type: none"> Token or no submission
G2	1			
G3	0			

Course Timetable PA4303: 2019-2020

Date	Time	Place	Subject	Session Type	Staff
Week 13					
Mon 21 Oct	10:00-11:00	1:147	Introduction to the course	Lecture	SJT
	11:00-12:00	1:147	Drug Transporters	Lecture	HMW
Wed 23 Oct	11:00-12:00	1:147	3D modelling project: introduction	Lecture	SJT
Thu 24 Oct	1400-16:00	1.143/144	Cannabinoid pharmacology	Lecture	PM
Fri 25 Oct	10:00-13:00	Comp room 3	3D modelling project	Practical	SJT
Week 14					
Mon 28 Oct	9:00-11:00	Polwarth LT (LT3)	Biomarkers	Lecture	ECD
Wed 30 Oct	11:00-12:00	1.147	Molecular Carcinogenesis	Lecture	HMW
Thu 31 Oct	10:00-11:00	1:147	Cell Death 1	Lecture	HMW
	14:00-15:00	1.143/144	Cell Death 2	Lecture	HMW
Fri 1 Nov	10:00-13:00	Comp room 3	3D modelling project	Practical	SJT
Week 15					
Mon 4 Nov	10:00-12:00	1:147	Quadraplex targeting	Lecture	JB
Wed 6 Nov	12:00-13:00	1:147	Editorial introduction	Lecture	SJT
Thu 7 Nov	10:00-12:00	1:147	Drug targeting in prostate cancer	Lecture	IJM
	14:00-16:00	Med Chi DELS	3D modelling project	Practical	SJT
Fri 8 Nov	10:00-13:00	Comp room 3	Editorial	Assessment	SJT
Week 16					
Mon 11 Nov	10:00-12:00	1:147	Contraceptive pharmacology	Lecture	SJT
Wed 13 Nov	11:00-12:00	1:147	The Chemistry of Pharmacokinetics and Pharmacodynamics	Lecture	SJT
	12:00-13:00		Chronotherapeutics	Lecture	SJT
Thu 14 Nov	11:00-12:00	1:147	Adverse effects of manipulating the immune system	Lecture	IC
Fri 15 Nov	11:00-13:00	1.143/144	Drug targeting in breast cancer	Lecture	SJT
Week 17					
Mon 18 Nov	10:00-11:00	1:147	No class	Lecture	
Wed 20 Nov	10:00-12:00	1:147	Pre-clinical testing in drug discovery	Lecture	HMW
Thu 21 Nov	11:00-13:00	1:147	Course round up and exam tutorial	Lecture	SJT
Fri 22 Nov					

Staff

Dr SJ Tucker (SJT) Course Co-ordinator, School of Medicine, Medical Sciences and Nutrition
Dr J Barrow (JB), School of Medicine, Medical Sciences and Nutrition
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