

MSc in Oncology

Including PG Certificate and PG Diploma

Cancer Therapies

Module Guide 2018/19

Part A | Basic Sciences



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The information contained in this Module Guide is correct at the time of going to press. Any amendments relating to the course or changes to published dates will be announced to students via Canvas, the course virtual learning environment. Information found on Canvas will always be the most accurate and up to date information available. Where anything in this guide contradicts the ICR Academic Regulations, the ICR Academic Regulations take precedence.

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Module details

1.1 Module overview

The Cancer Therapies module provides students with an introduction to the fundamentals of both Radiation Science and Clinical Pharmacology as treatment options. Students will study both these areas initially by taking compulsory module sections in each. They are then given the opportunity to deepen their knowledge in one of the areas by taking one to an advanced level, through an optional pathway choice.

The module is compulsory and is taken in Part A of the course. Lectures take place over twenty weeks during the second semester, and assessment takes place at the end of the module.

1.2 Module specification

Cancer Therapies	
Full Title:	Cancer Therapies
Part of Course:	Part A: Basic Sciences
Compulsory or optional:	Compulsory
ICR Reference Number:	MS1010
Academic Level:	Level 7 (Masters)
Credit Value:	30 Credits

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Contact information

2.1 General enquires

Students are advised to contact the MSc course team regarding any administrative matters at mscadministrator@icr.ac.uk. Any academic matters should be forwarded to the Course Director, Module Leaders or Lecturers as appropriate.

2.2 Key people

Name	Contact Information
Course Director	
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Module structure and aims

3.1 Aims

This module aims to develop your critical awareness and appreciation of (i) the biological and physical processes and principles underlying the use of radiation in the treatment of cancer, and (ii) the pharmacology of drugs used in current clinical practice to treat cancer. It should also facilitate you to use this knowledge to support the safe treatment of cancer patients you encounter, particularly by including any awareness gained of practice in specialties other than your own.

In addition, the module will extend your ability to apply theoretical knowledge of cancer therapies to underpin and improve clinical practice, either in radiation oncology or pharmacology, including in the development of new cancer treatments.

3.2 Core learning objectives

The core components of this module will allow students to:

- Develop a critical awareness of the biological principles underpinning radiotherapy treatment, including tissue interactions and dangers;
- Describe different types of radiation treatment, including physical characteristics and constraints, and demonstrate critical awareness of how these affect management of cancer patients;
- Appreciate how interactions between radiation and cytotoxic chemotherapy may affect treatment delivery;
- Develop a wide-ranging knowledge of how anticancer drugs act, how their actions can be modified by cells, clinical conditions or other drugs, and their interactions with the body and side effects;

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- Develop a systematic understanding of how drugs used to treat cancer are identified and assessed;
 - Develop a systematic appreciation of the pharmacology of different classes of drugs used in cancer treatment or palliation of symptoms.

3.3 Optional section learning objectives

The optional sections, if chosen, will allow students to:

Radiation pathway

- Develop a comprehensive theoretical knowledge of processes and equipment for producing therapeutic radiation, and be able to apply this in clinical practice;
- Recognise the principles underlying radiotherapy fractionation, including modified fractionation schedules used in clinical practice and normal tissue radiobiology;
- Critically appraise the planning and delivery of radiation treatment (including understanding of dosimetry, interactions between radiation and systemic therapies, and diverse imaging modalities) and be able to integrate this into clinical practice;
- Appreciate the principles underlying advanced radiotherapy delivery techniques and processes for radiation quality assurance;
- Demonstrate appreciation of the principles of radiation safety and protection.

Or:

Pharmacology pathway

- Develop a systematic appreciation of how new drug target identification, assessment and validation is undertaken;

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- Develop a comprehensive theoretical and practical knowledge of the process of taking a lead compound into early clinical trials;
 - Recognise and critically appraise the principal strategies used to optimise drug effectiveness and to be able to select the appropriate use for individual agents;
 - Design clinical trials to assess the effectiveness of a new treatment at all stages of development;
 - Develop a comprehensive theoretical understanding of the approaches used in targeted therapy and to be able to design and critically appraise a strategy to assess such a therapy;
 - Appreciate the current challenges in developing novel anticancer agents.

3.4 Structure

This module is a core module for Part A of the Postgraduate Certificate / Postgraduate Diploma / MSc in Oncology course. Students should attend all lectures to prepare themselves for the end of module assessments.

The module is comprised of four main sections, of which the first two are compulsory and the second two are optional:

- Introduction to Radiation Sciences – compulsory
- Clinical Pharmacology – compulsory
- Advanced Radiation Sciences – optional radiation pathway
- Experimental Cancer Pharmacology – optional pharmacology pathway

Initially, students will take the first two compulsory introductory sections to gain an understanding of the fundamentals of radiation science and clinical pharmacology. After this, students must then take one of the final two advanced 'pathway' options, choosing to explore either radiation or pharmacology further. Clinical

oncologists will be required to take the Advanced Radiation Sciences pathway, while medical oncologists will be required to take the Experimental Cancer Pharmacology route. Students do not have to attend lectures on the advanced section that they do not choose, however they are permitted to attend the other teaching sessions as well if they wish and if they gain permission from their educational supervisor. Students will be expected to choose their preferred pathway option when registering at the start of the year.

For this module, students will submit a summative essay on a clinical scenario related to the advanced pathway they selected to follow. Students who selected the Advanced Radiation Sciences pathway will also have to present their work in a class presentation session prior to submission of the essays.

A full and up to date module timetable, including the dates of presentation sessions, is available in the calendar on Canvas. Any changes to this schedule will be announced through Canvas notifications.

Practical session for Introduction to Radiation Sciences

As part of the module, all students will have the opportunity to experience VERT (Virtual Environment for Radiotherapy Training) at one of several training centres. VERT uses a 3D virtual reality training system which allows students to become familiar with radiotherapy techniques and equipment. Students will interact with a virtual linear accelerator to set up and treat a virtual patient.

One full teaching day is dedicated to this experience. This date is in the course calendar on Canvas. It is highly recommended that all students attend this session.

Practical session for Advanced Radiotherapy

All students who choose the Radiation Science pathway (and any from the Experimental Cancer Pharmacology pathway who also wish to attend) will have the opportunity to attend a practical session at St Bartholomew's Hospital held on a Saturday towards the end of

the module. This session will include demonstrations on treatment machines and treatment planning software, brachytherapy and immobilisation devices. Students will be shown and have the opportunity to discuss example treatment plans and carry out example dose calculations. Past students have found this a useful revision session.

You will be asked to sign up in advance for this session. The date of this session is in the course calendar on Canvas. The session will not run unless a minimum of 10 students have registered.

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Syllabus content

4.1 Core syllabus content

The module aims to cover the main principles of cancer treatment options.

Therefore, the subjects covered in the compulsory sections are:

- Introduction to Radiation Sciences
 - general principles of radiobiology;
 - radiotherapy techniques;
 - effects of radiation on different tissues and organs;
 - radiotherapy treatment planning.
 - DNA repair mechanism, cell cycle
 - Cellular responses to radiation
- Clinical Pharmacology
 - mode of action of cytotoxic drugs;
 - drug design and development;
 - pharmacokinetics and pharmacodynamics;
 - principles of clinical use of drugs used in cancer therapy;
 - toxicity of chemotherapy;
 - clinical pharmacology of analgesics, steroids and anti-emetics;
 - drug interactions in cancer treatment;
 - endocrine therapy, biological therapies, novel therapies and high-dose therapy.

4.2 Optional section syllabus content

The subjects covered in the optional sections are:

- Advanced Radiation Sciences
 - principles of physics relevant to radiotherapy;
 - principles underlying radiotherapy fractionation including modified fractionation;
 - radiation dosimetry concepts and measurement;
 - using radiation beams in clinical practice;

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- theoretical basis of sealed and unsealed radioactive sources (including clinical use of brachytherapy and molecular radiotherapy);
 - radiation damage and repair processes at cellular and molecular level;
 - radiation protection;
 - advanced radiotherapy techniques (including intensity modulation, image-guided and stereotactic radiation therapies).
 - equivalent Uniform Dose
 - serial and parallel organs
 - protons, LET, RBE
 - nuclear medicine

Or:

- Experimental Cancer Pharmacology
 - target identification, validation and screening;
 - chemical matter and structure-activity relationships;
 - animal models;
 - immunotherapy
 - web-based resources and patient care;
 - clinical assessment of new drugs;
 - imaging;
 - challenges in drug development;
 - pharmacoeconomics.
 - design and conduct Phase 1 studies
 - biomarkers
 - end of life: when not to treat
 - CAR therapy

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Assessment

5.1 Assessment overview

This module is assessed via one formative and one summative assessment.

Please refer to the Assessment section on Canvas or in the Student Handbook for more guidance on more general aspects of assignment submission.

5.2 Formative single best answer test

For this module, all students will sit a compulsory single best answer (SBA) test. This SBA must be passed in order to pass the module overall, but the score will not contribute to the overall module mark.

There are two SBAs available: one for each of the two pathways within the module. You are only required to take and pass the SBA for the pathway you have chosen. One SBA relates to Advanced Radiation Sciences (with 5 questions on Basic Pharmacology) and the other to Clinical Pharmacology (although this is a core section of the module, only Experimental Cancer Pharmacology students need to take this SBA, which includes 5 questions on Basic Radiation Sciences). You are also allowed to take the SBA for the other pathway if you attended the teaching.

The test(s) will be taken on Canvas and will consist of 25 questions, each scoring 10 points. You must score at least 50% (130 points) to pass. You have two attempts at the SBA and your highest score will be recorded. The SBA must be completed within 45 minutes.

5.3 Summative assignment

This module is also assessed via an essay of **strictly up to 1,800 words**.

The essay must be written about a clinical scenario associated with the 'advanced pathway' option chosen by you, either Advanced Radiotherapy Sciences or Experimental Cancer Pharmacology. The essay will be used to assess the depth of your learning on the module and will test your higher-level understanding of the content. It will also allow you to display your critical analysis skills at a more advanced level, particularly regarding the scientific theory and clinical application of a certain therapeutic approach.

Be sure to include relevant references to journal papers where appropriate, and **remember that penalties will apply for any work that is late, over the word limit, or includes plagiarised material.**

Submit your essay via Canvas following the instructions in the Student Handbook. Ensure you submit the same essay to both markers that correspond to the 'advanced pathway' topic that you have answered on.

- **Advanced Radiation Sciences Essay**

Your essay must be based on the radiotherapeutic aspects of a particular clinical scenario, based on the set essay title allocated to you at the beginning of the module. The essay title given to you will be related to a topic that has been addressed in peer-to-peer class discussions or group work, so ensure that your write-up is wholly your own work.

Presentations

All students will also present their case discussions in a class peer group presentation session at the end of the module, before the final submission of the assignment. You do not have to have written your essay by the date of the presentations, only notes. You should take on board the comments made in the presentations and use these to refine your essay before submission.

- **Experimental Cancer Pharmacology essay**

Your essay must be based on the pharmacological aspects of a particular clinical scenario, based on a set essay title that you

choose from the selection provided to you at the beginning of the module. Students do not need to present their discussions to anyone.

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Learning resources

6.1 Learning resources: Radiation

The following learning resources are relevant to the Radiation topics, both basic and advanced, taught within this module:

The Radiobiology book (Joiner and Van Der Kogel) new edition

Main key textbooks and papers

You are strongly advised to read the following key papers:

- Basic Clinical Radiobiology, 4th edition. Joiner, van der Kogel. (2009) Hodder Arnold
- Methods of Radiotherapy Treatment, 3rd edition. Dobbs, Barrett, Ash (2009) Arnold
- Physics for Clinical Oncology. Sibtain, Morgan, MacDougall (2012) Oxford
- Perspectives in Oncology: Cancer Physics module

Additional key textbooks and papers

Students are encouraged to read these papers:

- Radiobiology for the Radiologist, 7th edition. Hall, Giaccia. (2011) Lippincott, Williams and Wilkins
- Radiotherapy in Practice – Brachytherapy, 2nd edition. Hoskin, Coyle. (2011) Oxford
- Oxford Handbook of Oncology, 3rd edition. Cassidy, Bissett, Spence, Payne. (2010) Oxford University Press
- Basic Science of Oncology, 5th edition. Tannock, Hill, Bristow, Harrington (2013) McGraw Hill Education
- Radiotherapy in Practice: External Beam Therapy, 2nd edition. Hoskin. (2006) Oxford
- The Physics of Radiation Therapy, 4th edition. Khan. (2009) Lippincott, Williams and Wilkins
- ICRU reports 50 & 62

6.2 Learning resources: Pharmacology

The following learning resources are relevant to the Pharmacology topics, both basic and advanced, taught within this module:

Main key textbooks and papers

You are strongly advised to read the following key papers:

- Practical Chemotherapy: A Multidisciplinary Guide. Summerhayes, Daniels. (2003) Radcliffe Medical Press
- The Cancer Chemotherapy Handbook, 6th edition. Fischer, Knobf. (2003) Mosby
- The Royal Marsden Hospital Handbook of Cancer Chemotherapy: A Guide for the Multidisciplinary Team. Brighton, Mallet. (2005) Churchill Livingstone
- DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology, 9th edition. DeVita, Lawrence, Rosenberg, et al. (2011) Lippincott Williams and Wilkins

Additional key textbooks and papers

Students are encouraged to read these papers:

- Oxford Handbook of Oncology, 3rd edition. Cassidy, Bissett, Spence, Payne (2011) Turtleback
- The Cancer Chemotherapy Handbook, 6th edition. Fischer, Knobf, Durividge, Beaulieu. (2003) Mosby
- Oxford Textbook of Oncology, 2nd edition. Souhami, Tannock, Hohenberger, Horiot. (2002) Oxford University Press
- Oxford Textbook of Palliative Medicine, 4th edition. Hanks, Cherny, Christakis, et al. (2011) Oxford University Press

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Making the discoveries that defeat cancer