Oxford Radiobiology Training

Sarah Norman
Course Coordinator
Gray Institute for Radiation Oncology & Biology
Department of Oncology
Radiotherapy and Related Radiobiology Progress Review Group of the National Cancer Research Institute (NCRI) in 2003
- Unsustainable number of scientists active in clinically-applied radiobiology
- Critical mass / concentration of expertise
- New Institute for Radiation Oncology and Biology

Supported by CRUK & MRC
Professor W Gillies McKenna
Current Radiobiology training programme

- Growth in graduate training in past 5 years
  - From 7 to >50 registered graduate research students
  - Annual Student Symposium in June/July
- 100% 4-year DPhil submission rates
- Embedded Clinical Research Fellowship training
- Expanded Postdoctoral Training
- Establishment of MSc in Radiation Biology
DPhil in Radiobiology

- Attract a large number of excellent quality applicants
- Well funded doctoral programme
  - 45% funded from Research Councils; 45% Charities; 10% Industry/Overseas
- Capacity building in Radiobiology
  - 50% into research; 25% into clinical NHS positions

Simon Scrase
2008 cohort of DPhil students; CRUK funding
Supervised by Eric O’Neill
Published Radiosensitivity of lung cancer cells attributed to RASSF1A
(Current Biology 2009)

Laura Eccles
2006 cohort of DPhil students; MRC funding
Supervised by Peter O’Neill
Published in Mutat Res 2011 & Nucleic Acids Res 2010
Post doc Simon Powell (Memorial Sloan-Kettering Cancer Center, NY)
MSc & DPhil 4-Year Programmes

- 4-year funded students take a formal MSc course in their 1st year and progress onto the DPhil in Radiobiology
- Broaden the research students’ knowledge base
- Sustainability in Radiation Biology

Monica Olcina del Molino
1st class degree in Pharmacy (Manchester)
Top in class 2009 cohort MSc Radiation Biology
Published in *Clin Cancer Res* 2010
DPhil Project with Ester Hammond
MSc in Radiation Biology

- The one-year, full-time, taught course in Radiation Biology leading to an MSc awarded by the University of Oxford
  - First year of training for students for DPhil degree in Radiobiology
    - Or academic careers in Radiation Biology research at other Universities
    - Or a career in professions that require knowledge of Radiation Biology e.g. academic personnel associated with Radiation Protection issues

Course Coordinator: Sarah Norman
Deputy Course Director: Prof Bleddyn Jones
Course Director: Prof Peter O’Neill
Course Assistant: Katy Higgins
MSc Radiation Biology Course Structure

- High-quality basic and clinically-applied theoretical course
  - Fundamental low dose biology, DNA damage and repair
  - Current and future cancer treatment by radiotherapy
- Taught in the first 2 terms, over a series of 12 modules
  - Each module is delivered over one-two weeks
  - Lectures are given by local, national and international experts
  - Tutorials, practical sessions, demonstrations and visits given/hosted by local staff
- Last 6 months - high quality research project in one of the associated laboratories, written up as a 10,000 word dissertation
1. Physics and Chemistry of Radiation Action

2. Molecular Radiation Biology

3. Cellular Radiation Biology

4. Whole Body Exposure and Carcinogenesis

5. Radiation Epidemiology

6. Radiation Protection

7. Imaging Technologies

8. Tumour microenvironment

9. Principles of Clinical Radiation Biology

10. Applications of Radiation Therapy

11. Translational Radiation Biology

12. Clinical Radiation Biology
External Speakers in Low Dose Risk

- Dudley Goodhead
- Jolyon Hendry
- Simon Bouffler, John Harrison, John Cooper et al HPA, Oxfordshire
- Sarah Darby, Oxford
- Mark Pearce, Newcastle
- Richard Wakeford, Manchester
- Chris Gibson and other NHS protection personnel, Oxford

Normal Tissue (OncoRay Dresden)
- Wolfgang Dörr and colleagues
MSc in Radiation Biology Previous Cohorts

- 2009/2010 cohort
  - 9 students: 2 physicists; 1 biomedical engineer; 5 biologists; 1 medic
  - 3 gained distinctions & 6 passed

- 2010/2011 cohort
  - 10 students: 1 chemists; 1 radiotherapist; 5 biologists; 3 medics
  - 1 gained distinctions & 9 passed

Cindy Körner
1st class degree in Inorganic Chemistry (TU Dresden)
2010 cohort MSc Radiation Biology
DPhil Project with Ester Hammond & Stuart Conway (Chemistry)
Current year - 2011/2012

9 students:
2 x BSc Biomedical Science; 2 x BSc Biology; BSc Molecular Medicine;
3 x MBBS Medicine & Surgery; DDS in Dentistry.

We also allow DPhil students in Radiobiology, Medicinal Chemistry and Physics to attend the lectures, as well as local hospital personnel (clinicians, radiotherapists and cancer nurses).
## Modules 1-3 including pre-sessional physics

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<thead>
<tr>
<th>PS1 Units, Measurements and Errors</th>
<th>Claire Timlin</th>
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<tr>
<td>PS2 The electromagnetic spectrum</td>
<td>Boris Vojnovic</td>
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<tr>
<td>PS3 Image, signals, information</td>
<td>Boris Vojnovic</td>
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<td>PS4 Mathematics for the radiation</td>
<td>Bleddyn Jones</td>
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<td>PS5 Particle Physics, a brief</td>
<td>Bleddyn Jones</td>
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<td>2.01 Molecular damage and damage</td>
<td>Peter O'Neill</td>
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<td>2.02 Cell cycle controls and</td>
<td>Isabel Pires</td>
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<td>2.03 Repair mechanisms of base</td>
<td>Jason Parsons</td>
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<td>2.04 Repair mechanisms of</td>
<td>Natsuko Suwaki</td>
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<td>2.05 Genome Stability and</td>
<td>Tim Humphrey</td>
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<td>2.06 Tumour supressor genes</td>
<td>Eric O'Neill</td>
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<td>2.07 Molecular events in apoptosis</td>
<td>Karen Yee</td>
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<td>2.08 Oncogenes</td>
<td>Eric O'Neill</td>
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<td>3.01 Cell population kinetics</td>
<td>Jolyon Hendry</td>
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<tr>
<td>3.02 Colony formation versus</td>
<td>Jolyon Hendry</td>
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<td>3.03 LQ and 2-component exponential</td>
<td>Roger Dale</td>
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<td>3.04 Sublethal and potentially</td>
<td>Jolyon Hendry</td>
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<td>3.05 OER, RBE and LET</td>
<td>Bleddyn Jones</td>
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<td>3.06 Radiosensitisers and</td>
<td>Gillies McKenna</td>
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<td>3.07 Non-targetted effects</td>
<td>Boris Vojnovic</td>
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<td>3.08 Statistics for radiation biology</td>
<td>Francesca Buffa</td>
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## Modules 4-6

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Speaker</th>
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<tr>
<td>4.01</td>
<td>Whole body irradiation syndromes</td>
<td>Liz Ainsbury</td>
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<tr>
<td>4.02</td>
<td>Established and emerging methods of biological dosimetry</td>
<td>Kai Rothkamm</td>
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<tr>
<td>4.03</td>
<td>Radiation accidents and medical management</td>
<td>David Brown</td>
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<tr>
<td>4.04</td>
<td>Multistage carcinogenesis</td>
<td>Christophe Badie</td>
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<tr>
<td>4.05</td>
<td>Genomic instability 1</td>
<td>Munira Kadhim</td>
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<tr>
<td>4.06</td>
<td>Genetic susceptibility to radiation induced cancer</td>
<td>Simon Bouffler</td>
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<tr>
<td>4.07</td>
<td>Heritable effects of radiation exposure and risk models</td>
<td>Liz Ainsbury</td>
</tr>
<tr>
<td>5.01</td>
<td>Cohort vs case control studies</td>
<td>Kate Venables</td>
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<tr>
<td>5.02</td>
<td>Risk modification, confounding and causality</td>
<td>Sarah Lewington</td>
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<tr>
<td>5.03</td>
<td>Radiation-induced heart disease</td>
<td>Sarah Darby</td>
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<td>5.04</td>
<td>Radon and lung cancer</td>
<td>Sarah Darby</td>
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<tr>
<td>5.05</td>
<td>Cancer risks from Low-LET radiation</td>
<td>Richard Haylock</td>
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<tr>
<td>5.06</td>
<td>Medical exposures</td>
<td>Richard Haylock</td>
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<tr>
<td>5.07</td>
<td>Environmental exposures</td>
<td>Richard Wakeford</td>
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<tr>
<td>6.01</td>
<td>ICRP system of protection and population exposures</td>
<td>John Cooper</td>
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<tr>
<td>6.02</td>
<td>Legislative aspects of radiation protection</td>
<td>Mark Bradley</td>
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<tr>
<td>6.03</td>
<td>Risks and doses for stochastic and deterministic effects</td>
<td>John Harrison</td>
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<tr>
<td>6.04</td>
<td>Tissue/radiation weighting factors : effective doses and the LNT hypothesis</td>
<td>John Harrison</td>
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<td>6.05</td>
<td>Accident scenarios</td>
<td>Lesley Prosser</td>
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<td>6.06</td>
<td>Retrospective dosimetry and modelling</td>
<td>Jane Simmonds</td>
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<td>6.07</td>
<td>Radiation protection: radionuclides</td>
<td>Chris Gibson</td>
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<td>6.08</td>
<td>Radiation protection: external irradiation</td>
<td>Therese Crawley</td>
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<tr>
<td>6.09</td>
<td>Patient protection and optimisation for medical exposures</td>
<td>Mary Cocker</td>
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[GRAY INSTITUTE FOR RADIATION ONCOLOGY & BIOLOGY]

[UNIVERSITY OF OXFORD]

[MRC Radiation Oncology and Biology]

[CANCER RESEARCH UK]
MSc Radiation Biology Assessment

- Six short essays and a series of laboratory reports will be assessed to provide formative assessment of student progress
- Students sit:
  - A qualifying examination end of term 1 on Modules 1 – 6, MCQ format
  - A second examination comprising short essays is sat end of term 2
- Students submit:
  - An extended essay of approximately 3,000 words
  - A research dissertation of approximately 10,000 words based upon their project and they are examined on their research dissertation, by oral presentation and by a short *viva voce*
The UK has a well-established two-cycle system and several qualifications frameworks (nationally established for each of England, Scotland, Wales and Northern Ireland) within Bologna there is a very wide range of second-cycle qualifications, and no sense in which the Bologna Process imposes a single model of master’s qualification, our integrated master’s do not fit with the two-cycle system. The doctoral level was established as the ‘third cycle’ by Ministers meeting in Berlin in 2003. University will supply indicative credit values for its undergraduate and graduate programmes at whole programme level only. We have no external accreditation. The third cycle corresponds to 3-4 years full time, and meet the needs of the wider employment market by promoting interdisciplinary training and the development of transferable skills.
Clinical Research Fellowships

- 7 CRFs currently registered at Oxford (1 at Leeds)
- Working alongside scientists in the laboratories
- Translation direct to the clinic
- 2 CRFs completed DPhil in 2010/2011

Dr Geoff Higgins
Supervised by Gillies McKenna, submitted in October 2010
Published in Oncotarget 2010 & Cancer Research 2010
Recently awarded a 4-year CR-UK funded Clinician Scientist Fellowship
Postdoctoral Training

- Expanded to > 60
- Give internal seminars, attend external conferences
- Supervise undergraduate FHS and post graduate MSc and DPhil students
- Informal mentoring system to support career development

Dr Eva Petermann
Supervised by Thomas Helleday; Mentored by Ester Hammond
Extensively published, recent: *Proc Natl Acad Sci USA* - Chk1 promotes replication fork progression by controlling replication initiation
Awarded a University Lectureship in the School of Cancer Sciences at the University of Birmingham