



Two-week course on

**Radiation-induced effects with particular emphasis on  
genetics, development, teratology, cognition  
as well as space-related health issues**

**05.03-2012- 16.03.2012**

**Belgian Nuclear Research Centre (SCK•CEN)**

**Mol, Belgium.**

**General information:**

DoReMi ([www.doremi-noe.net](http://www.doremi-noe.net)) is a Euratom-funded Network of Excellence set up to promote and integrate European research into the risks of exposure to low doses of ionising radiation. In addition, DoReMi facilitates and promotes training and education in support of the research programme within the project, and also makes more widely available training opportunities in order to help attract top-level students into the field.

As part of this initiative, a short course of two weeks duration on "**Radiation-induced effects with particular emphasis on genetics, development, teratology, cognition as well as space-related health issues**" is organized by the Belgian Nuclear Research Centre. It is open to postgraduate students and researchers working in the European Union, who are interested in radiation research.

**Scope of the course:**

The objective of this course is to provide a comprehensive summary of the biological effects of low and intermediate radiation doses, with particular emphasis on developmental effects caused by an irradiation of either the parental germ cells (hereditary effects) or the embryo at the various developmental stages. Beside hereditary and embryonic effects, a second and important part of the course will consist in an overview of the recent and current research performed at SCK•CEN in the field of oncology, including a large-scale epidemiological study of cancer incidence and mortality among nuclear workers (in collaboration with IARC and WHO) and an introduction to new technologies for cancer treatment such as hadrontherapy or nanobody-based molecular radionuclide therapy. As SCK•CEN is also much involved in space biology programmes, a third part of the course will be devoted to the various aspects covered by this research, from space radiation and dosimetry to space health effects or the control and use of microbes to support human life in space. These three main parts of the course will be completed with an introduction to



the international advisory bodies (UNSCEAR and ICRP) as well as with other aspects of the research performed at the SCK•CEN in the field of "non-cancer effects" of ionizing radiation or in radioecology. The lectures will be accompanied by a number of practical lessons in the fields of developmental biology and molecular biology.

### Information for applicants:

The course is open to any postgraduate student or researcher working in an EU academic Institution. There is no course fee but very limited financial support is provided in terms of travel, accomodation and catering. SCK•CEN has limited logging possibilities in dormitories and extra rooms are available at the club house (<http://www.sckcen.be/clubhouse/EN/>).

People wishing to apply should submit by mail the following documents to Sarah Baatout at [sarah.baatout@sckcen.be](mailto:sarah.baatout@sckcen.be) with a copy to [els.van.musscher@sckcen.be](mailto:els.van.musscher@sckcen.be) and [doremi.training@pv.infn.it](mailto:doremi.training@pv.infn.it):

1. A letter of application
  2. A CV with a description of the scientific career
  3. A supporting letter from the supervisor/head of laboratory (for PhD students)
- The deadline for applications is February 5<sup>th</sup> 2012. Information confirming the acceptance will be sent by February 10<sup>th</sup> 2011. A certificate will be issued to each participant.

For any scientific questions related to the course, please contact:

Prof. Sarah Baatout, Dr Paul Jacquet or Dr Rafi Benotmane  
Radiobiology Unit  
Belgian Nuclear Research Centre  
SCK•CEN  
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B-2400 Mol  
Belgium  
Tel: +32 14 33 28 77  
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For any administrative questions related to the course, please contact:

Els van Musscher  
Administrative secretariat EHS  
Belgian Nuclear Research Centre  
SCK•CEN  
Boeretang 200  
B-2400 Mol  
Belgium  
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e-mail: [els.van.musscher@sckcen.be](mailto:els.van.musscher@sckcen.be)

## Detailed course description

### WEEK 1

#### Monday March 5

9-00-9.40	Frank Hardeman	Welcome and introduction about SCK•CEN
9.40-10.10	Michèle Coeck	Introduction about education & training programme at SCK•CEN
10.10-10.30		Introductory film about SCK•CEN
<b>10.30-11.00</b>	<b>Coffee break</b>	
11.00-11.15	Sarah Baatout	Presentation of the theoretical and practical programme of the two weeks
11.15-12.30	Sarah Baatout	Research programmes of the radiobiology group at SCK•CEN
<b>12.30-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-15.00	Hans Vanmarcke	Society : Introduction to the international advisory bodies: part 1, UNSCEAR
15.00-15.30	Wietse Heylen, Sarah Baatout	<b>Practical I: Biosafety:</b> Introduction to biosafety matters, technical visit of the Class II lab
<b>15.30-16.00</b>	<b>Coffee break</b>	
16.00-17.00	Gaston Meskens	Society : The ethics of justifying nuclear technology applications

#### Tuesday March 6

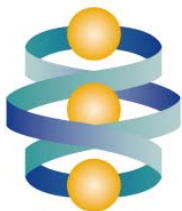
9.00-10.00	Jasmine Buset, Mieke Neefs	<b>Practical II: Dev. Bio.:</b> Dissection of mouse ovaries and culture of oocytes at the germinal vesicle stage
10.00-11.00	Paul Jacquet	Dev. Biol. : Prenatal effects of ionising radiation according to ICRP
<b>11.00-11.30</b>	<b>Coffee break</b>	
11.30-12.30	Paul Jacquet	Dev. Biol. : Recent scientific data on prenatal effects of ionising radiation
<b>12.30-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-14.45	Rafi Benotmane	Dev. Biol. : Radiation-induced molecular effects in the embryo
14.45-15.30	Filip Vanhavere, Anne-Laure Lebacqz	<b>Practical III: Irradiation platforms:</b> Technical visit irradiation facility & X-irradiation of the cells
<b>15.30-16.00</b>	<b>Coffee break</b>	
16.00-17.00	Jasmine Buset, Mieke Neefs	<b>Practical IV: Dev. Biol.:</b> Fixation of oocytes in 1 <sup>st</sup> meiosis

#### Wednesday March 7

09.00-10.30	Klaus Trott or Sankha	Dev. Biol. : Mouse radiation genetics
<b>10.30-11.00</b>	<b>Coffee break</b>	
11.00-12.30	Klaus Trott or Sankha	Methods of genetic risk estimation
<b>12.30-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-14.30	Paul Jacquet	Dev. Biol. : Environmental risk factors and reproductive toxicity
14.30-15.00	Hanane Derradji	Dev. Biol.: Radiation-induced developmental limb defects



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15.00-15.30	<i>Coffee break</i>	
15.30-17.00	Mieke Neefs & Jasmine Buset	<b>Practical V : Dev. Biol.</b> Dissection of pregnant mice and observations of external radiation-induced malformations in fetuses
17.00-17.30	Hanane Derradji	<b>Practical VI : Dev. Biol.</b> Observations of radiation-induced limb skeleton malformations

### Thursday March 8

09.00-10.00	Louis de Saint-Georges	Dev. Biol. : Brain development
10.00-11.00	Nada Samari	Dev. Biol. : Neuronal maturation : neurogenesis and synaptogenesis
<b>11.00-11.30</b>	<b><i>Coffee break</i></b>	
11.30-12.30	Rafi Benotmane	Dev. Biol. : Radiation-induced cognitive effects (including epidemiological data)
<b>12.30-14.00</b>	<b><i>Lunch at the cafeteria</i></b>	
14.00-15.00	Jasmine Buset, Mieke Neefs	<b>Practical VII : Dev. Biol.</b> Staining of the chromosome preparations of the oocytes in 1 <sup>st</sup> meiosis
<b>15.00-15.30</b>	<b><i>Coffee break</i></b>	
15.30-16.30	Hussein el-Saghire	Radiation effects in newborn and pediatric patients
16.30-17.30	Hans Vanmarcke	Society : Introduction to the international advisory bodies: part 2, ICRP

### Friday March 9

09.00-10.00	Rafi Benotmane	Dev. Biol. : Radiation-induced molecular effects in the developing brain
10.00-10.45	Hussein el-Saghire	Potential risks of diagnostic radiation on paediatric patients undergoing Computed Tomography (CT)
<b>10.45-11.15</b>	<b><i>Coffee break</i></b>	
11.15-11.45	Sarah Baatout	Cancer research programmes at SCK•CEN
11.45-12.45	Roel Quintens	Introduction to -omics technologies and their use in radiation and cancer research
<b>12.45-14:00</b>	<b><i>Lunch at the cafeteria</i></b>	
14.00-16.00	Nada Samari, Giuseppe Pani, Mieke Neefs	<b>Practical VIII: Dev. Biol.</b> Brain dissection
<b>16.00-16.30</b>	<b><i>Coffee Break</i></b>	
16.30-18.00	Nada Samari, Giuseppe Pani, Mieke Neefs	<b>Practical IX: Dev. Biol.</b> Neuron cell cultures
18.00-18.30	Paul Jacquet, Sarah Baatout	<b>Practical X: Dev. Biol.</b> Hormonal (PMS) injection for induction of superovulation and culture of mouse preimplantation embryos

Sunday 18.00-18.30: Injection of 2<sup>nd</sup> hormone for future preimplanted embryo dissection

## WEEK 2

### Monday March 12

N.B. 7.30-9.30 mating of superovulated mice for the collection and culture of preimplantation embryos

09.00-10.15	Liselotte Leysen	<b>Practical XI: Dev Biol.</b> Control of vaginal plugs at the animal facility for the culture of mouse preimplantation embryos
<b>10.15-10.30</b>	<b>Coffee break</b>	
10.30-11.30	Roel Quintens	Analysis of data by means of systems biology
11.30-12.30	Pieter Monsieurs	Next-Generation Sequencing: A New Revolution in Molecular Biology
<b>12.30-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-15.00	Paul Jacquet, Jasmine Buset	<b>Practical XII: Dev Biol.</b> Observations of meiotic chromosomes
<b>15.00-15.30</b>	<b>Coffee break</b>	
15.30-17.00	Jasmine Buset, Mieke Neefs	<b>Practical XIII: Dev. Biol.</b> X-irradiation, mouse dissection and <i>in vitro</i> culture of the 1-cell embryos

### Tuesday March 13

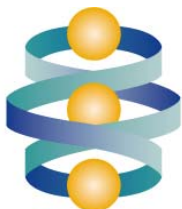
09.00-9.45	Khalil Abouelaradat	Examples of systemic approach on radiation-induced effects on cells
9.45-10.15	An Aerts	Radiation induced non-cancer effects : Cardiovascular risks
10.15-10.45	Charlotte Rombouts & An Aerts	Current <i>in vitro</i> and <i>in vivo</i> models for evaluating radiation-induced cardiovascular risks
<b>10.45-11.15</b>	<b>Coffee break</b>	
11.15-11.45	Rafi Benotmane	Visit of the genomic platform facilities at SCK•CEN
11.45-12.45	Nathalie Impens	Use of radiopharmaceuticals for cancer treatment
<b>12.45-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-14.30	Giuseppe Pani, Nada Samari	<b>Practical XIV: Dev. Biol.</b> Phase contrast microscopy observations of neuronal cultures radiation-induced effects on neuronal cultures
14.30-15.00	Nada Samari & Giuseppe Pani	<b>Practical XV: Dev. Biol.</b> X-irradiation of neuronal cultures
<b>15.00-15.30</b>	<b>Coffee break</b>	
15.30-17.00	Nada Samari & Giuseppe Pani	<b>Practical XVI: Dev. Biol.</b> Cytoskeleton and DNA damage (gamma-H2AX) immunostaining of neuronal cell cultures
17.00-18.00	Giuseppe Pani & Nada Samari	<b>Practical XVII: Dev. Biol.</b> Observation of the effects of radiation on neuronal cell cultures by fluorescence microscopy

### Wednesday March 14

9.00-9.30	Matthias D'huyvetter	Nanobody-based molecular radionuclide therapy for cancer treatment
9.30-10.15	Emiliano d'Agostino	Introduction to hadrontherapy : technological, dosimetric and physical aspects
<b>10.15-10.45</b>	<b>Coffee break</b>	
10.45-11.30	Marjan Moreels	Introduction to hadrontherapy: biological and clinical aspects
11.30-12.00	Annelies Suetens & Marjan Moreels	Current <i>in vitro</i> and <i>in vivo</i> models for hadrontherapy



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12.00-12.30	Hussein el-Saghire, Kevin Tabury & Roel Quintens	<b>Practical XVIII: Apoptosis</b> Technical introduction about RNA extraction
<b>12.30-13.30</b>	<b>Lunch at the cafeteria</b>	
13.30-15.00	Arlette Michaux, Kevin Tabury & Hussein el-Saghire	<b>Practical XIX: Apoptosis</b> RNA extraction of irradiated cells
15.00-16.00	Hussein el-Saghire, Kevin Tabury & Arlette Michaux	<b>Practical XX: Apoptosis</b> Radiation-induced apoptosis : Quality control of extracted RNA
16.00-18.00	Arlette Michaux	<b>Practical XXI: Apoptosis</b> Radiation-induced apoptosis : Reverse transcription of X-irradiated samples <b>(including coffee break during incubation)</b>

### Thursday March 15

9.00-9.30	Sarah Baatout	Space research programmes at SCK-CEN
10.00-10.30	Filip Vanhavere	Space radiation and dosimetry
<b>10.30-11.00</b>	<b>Coffee break</b>	
11.00-12.00	Sarah Baatout & Marjan Moreels	Space health effects
12.00-12.45	Marjan Moreels, Myriam Ghardi & Sarah Baatout	Space immunology
<b>12.30-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-14.30	Jasmine Buset & Mieke Neefs	<b>Practical XXII: Dev. Biol. :</b> Observation of radiation-induced effects in preimplantation embryos at the morula stage
14.30-16.30	Roel Quintens & Ann Janssen	<b>Practical XXIII: Apoptosis</b> Radiation-induced apoptosis : Real time quantitative PCR of selected genes in apoptosis <b>(including coffee break during incubation)</b>
16.30-17.15	Michaël Beck	Space developmental biology
17.15-18.15	Giuseppe Pani	Space neurobiology

### Friday March 16

9.00-10.00	Natalie Leys	Space microbiology : Control and use of microbes to support human life in space
10.00-11.00	Hildegard Vandenhove	Radioecology: a snapshot of a multidisciplinary science
<b>11.00-11.30</b>	<b>Coffee break</b>	
11.30-12.30	Luc Holmstock	Epidemiology : results of the IARC/WHO nuclear workers study regarding cancer mortality
12.30-13.00	Jasmine Buset, Mieke Neefs	<b>Practical XXIV: Dev. Biol.:</b> Observations of radiation effects in preimplantation embryos at the blastula stage
<b>13.00-14.00</b>	<b>Lunch at the cafeteria</b>	
14.00-16.00		Examination (1h30) and survey (30')
<b>16.00-16.30</b>	<b>Coffee break</b>	
16.30-17.30	Sarah Baatout	Conclusions and take home message