AIR²
Access to INFRASTRUCTURES for Radiation protection Research

Issue 23
December 2017

Editorial

Unlike all other EJPs who use internal calls to select new projects, CONCERT made the decision to take a more open approach and use external calls. Openness to new partners is our policy and we reinforce this by requiring that each proposal includes at least one Third Party (TP). The downside of this approach is that four months after the results of the second call, we are still negotiating the operational process for inclusion of the TPs. This means that the selection results are not yet available. However, a special issue will be published early next year to present each of the selected projects, together with a summary of the results of the evaluation process.
As this is the last issue before Christmas, this one is for your Christmas stocking!

Dr Laure Sabatier, CEA

The floor to...

Developing training

Since the year 2000, Europe-wide studies have identified a problem with the maintenance of the range of expertise essential to keep up competence and run an effective programme of research into the risks to humans and the environment from ionising radiation. The findings indicate that specific programmes, aiming at knowledge management across generations, have to be designed in order to achieve sustainable continuity and development. Only in this way can the scientific basis for Radiation Protection (RP) be developed.

As a response to this challenge, CONCERT, through WP7, is promoting education and training in the sciences underpinning RP in general, and, in particular, specific research areas of scientific interest to the European RP platforms of MELODI, NERIS, ALLIANCE, EURADOS and EURAMED, such as the hazards from low-dose radiation, medical applications of ionising radiation, radioecology, emergency and recovery management, and dosimetry.

Working closely with WP7, the subtask 6.3.2 will examine the opportunities for developing or promoting specific training courses built around the use of infrastructures and the data resulting from their use. Courses can be developed for the use of targeted 'omics technologies, systems biology, the use of databases, etc., and will be based on the top research priorities as spelled out in the Strategic Research Agendas (SRAs) and roadmaps developed by each of the platforms in WP2 and WP3. In addition, already existing course modules in cutting-edge technologies or technologies not routinely used in radiation research, offered by academic institutions, can be promoted to the RP research community through the CONCERT website and mailing lists, and by offering student travel grants through WP7.

CONCERT offers a total of €10,000 per year for travel awards to students and young post-doctoral researchers for participation in a conference, a course or for an exchange visit to a laboratory, where this can be shown to be of value for increasing the applicant's skills and knowledge. Four application deadlines are announced every year, with the last one for 2017 being the 31st December (more details regarding Travel Grant applications and the list of CONCERT short courses can be found on the CONCERT website). After each deadline, up to €2,500 is paid out on a competitive basis to the 4 top applicants (a maximum of €625 per applicant).

Certainly there are other factors as to why the advantage of using newer, larger, faster, more powerful infrastructures is not taken, such as cost, location, and accessibility. But in many cases, the reason is because of the learning threshold needed to gain familiarity and confidence in their use. The provision of teaching initiatives to give researchers personal experience of the possibilities offered by the available infrastructures may be just what is needed.

Photos: G. Baiocco & V. Smyth/UniPv

Dr Vere Smyth and Dr Andrea Ottolenghi
UniPv
CONCERT WP 6.3.2

CONCERT CORNER

Future events:

31st December 2017
Deadline Call for Travel Grants

20th February 2018
EURATOM Call NFRP-2018-8 meeting
Munich, Germany

21st February 2018
- CONCERT MB Meeting
- Extraordinary and ordinary MELODI General Assembly
Munich, Germany

WP 6 News:

AIR²D²:
- Please complete the online form(s) to register your infrastructure(s) in the database.
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February 2018

This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

The Nuclear Metrology Group (NMG)

Neutron measurement and irradiation facility

NPL is the UK's National Measurement Institute and is a centre of excellence in developing and applying the highest quality measurement standards available. The Nuclear Metrology Group (NMG) represents one of NPL's many activities, and has world-class facilities for producing a wide range of well-characterised neutron fields. NMG can also determine the neutron output of radionuclide sources to high precision by measuring the activation of manganese in a manganese sulphate bath. These facilities are used for type testing and calibrating neutron-sensitive instruments, characterising neutron sources, and for research aimed at improving neutron standards and neutron measuring instruments. Much of the work is for radiation protection.

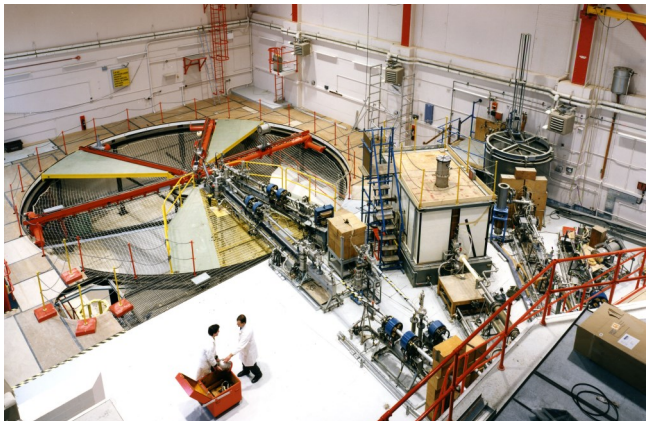

Photo: NPL

Main experimental area, measuring 18 x 18 x 26 m. From bottom right towards top left, the photo shows the accelerator beam lines, the thermal pile, and the low-scatter area.

In the main experimental area, protons or deuterons from a 3.5 MV Van de Graaff accelerator can be directed onto a suitable target to produce monoenergetic neutrons at energies from under 100 keV to 16.5 MeV (although not all energies within this range are available). The target is at the centre of a low-scatter area, at least 6 m away from the floor or any massive structures, in order to minimise room scatter. The neutron fluence is measured using carefully calibrated long counters.

To produce thermal neutrons, deuterons from the same accelerator are directed instead into the thermal pile, which consists essentially of two high-output neutron-producing targets inside a large graphite moderator. The highest fluence rates are available near the centre of the moderator via a 12 cm diameter access hole, while wider artefacts can be irradiated in a vertical thermal beam that emerges from the top of the pile.

The low-scatter area is also used for irradiations with radionuclide sources, of which the group has several of various types, including ^{241}Am/Be and ^{252}Cf. A D_2O-moderated ^{252}Cf field is also available. A pneumatic transfer system is used to bring the strongest of the sources from the shielded store to the irradiation position.

Photo: NPL

Dr Nigel Hawkes

In addition to its irradiation facilities, the NMG has several neutron instruments, including Bonner sphere spectrometer sets and tissue equivalent proportional counters. These are used for neutron research, usually dosimetry-related, or for making off-site measurements at a customer's own premises. NMG also has considerable expertise in neutron-related calculations, including Monte Carlo modelling and the unfolding of neutron energy spectra from pulse height spectra. Currently the group is planning a new facility to produce an intense neutron field for radiation hardness testing.

Some examples of the type of work undertaken by the group are:

- Irradiating personal dose meters to precisely known doses for an intercomparison exercise;
- Contributing to the design of novel neutron instruments through Monte Carlo modelling and experimental measurements;
- Characterising the angular distribution of the output of a neutron source or generator, relative to its symmetry axis;
- Measuring neutron dose rates close to radiotherapy facilities.

Photo: NPL

The Manganese Bath facility for measuring the neutron output of radionuclide sources by the activation of manganese sulphate solution.

Progress in providing neutron standards at the UK National Physical Laboratory, Hawkes N. P., Bennett A., Cheema S. S., Horwood N. A., Jones L. N., Kolkowski P., Roberts N. J., Taylor G. C. and Thomas D. J. (2007), Nuclear Instruments and Methods in Physics Research Section A, 580, 183–185

Recent developments in radionuclide neutron source emission rate measurements at the National Physical Laboratory, Roberts N. J. and Jones L. N. (2010), Applied Radiation & Isotopes, 68, 626-630

NPL National Physical Laboratory

ID Card:

Exposure type:
External

Source:
Am/Be, Am/B, Am/F, Am/Li, ^{252}Cf, D_2O-moderated ^{252}Cf; ^{60}Co, ^{137}Cs;
Monoenergetic neutrons 70 keV to 16.5 MeV;
Thermal pile.
Measurement of neutron source emission rate via Mn bath.

Dose rate:
Depending on source and energy, 1 to several thousand µSv/h at 1 m
Thermal pile: max neutron fluence rate 3×10^{7} cm^{-2} s^{-1}.

Irradiation type:
Neutron with gamma present, gamma

Irradiated organism type:
None

Address:
National Physical Laboratory
Hampton Road
Teddington,
Middx. TW11 0LW
United Kingdom

Access:
See contacts below

Internet link:
http://www.npl.co.uk/science-technology/neutron-metrology/

Contact:
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+44 20 8943 8637

Related to:
EURADOS

The Techa River Cohort (TRC)

Cohort study of general population exposed on the Techa River

The Techa River Cohort (TRC) includes individuals born before 1950 and who lived in any of the 41 villages situated along the Techa River (Russia) between 1950 and 1960. The TRC members were affected by external γ-radiation from contaminated river sediments and flood plain soil, and by internal exposure to radionuclides, including ^{89}Sr, ^{90}Sr and ^{137}Cs, due to consumption of local water, milk and food products which were contaminated following the release of radioactive waste into the Techa River by the Mayak Radiochemical Plant between 1949 and 1956.

Table 1. Demographic characteristics of TRC

Parameters	n	%
Sex		
Male	12,558	42%
Female	17,172	58%
Ethnicity		
Tatars & Bashkirs	5,950	20%
Slavs	23,780	80%
Age at January 1, 1950		
<1	1,032	3%
1-14	8,824	30%
15-59	17,279	58%
60 & older	2,595	9%
Total TRC	29,730	100%

Table 2. Vital status of TRC members

Vital status as of 31/12/2007	People
Alive in catchment area	5,684
Dead	17,307
% known cause of death	91%
Lost of follow-up	6,739
Including: migrants	4,696
persons with unknown status	2,043
Total TRC	29,730

The first specialised medical examinations of the residents of the Techa riverside villages took place in 1951. From 1955 to present, the residents of these villages have been followed up by the physicians of the Clinic of the Urals Research Centre for Radiation Medicine (URCRM), under the Federal Medical-Biological Agency.

A Registry of exposed persons and a medical dosimetry database were created at the URCRM in the 1970s. Between the late 1960s and the 1980s, URCRM researchers conducted an extensive review of official documents including tax records, vital statistics, medical records and population surveys, to identify potential cohort members. The demographic characteristics are shown in Table 1. Follow-up of vital status (Table 2), and of cancer incidence and mortality of TRC members, covers a period of more than 50 years and is based on the addresses provided by the bureau of information, the death certificates from the statistical offices of Chelyabinsk and Kurgan oblasts and cancer notification forms from the Chelyabinsk oblast oncology dispensary. The start date of the follow-up and the catchment areas used in the studies were dependent on data access.

Individualised organ doses for TRC members over the whole follow-up period were calculated by the URCRM dosimetry team using specially developed software (Techa River Dosimetry System-TRDS). The results presented are based on TRDS-2009, a software version which incorporates recent advances in radionuclide intake reconstruction, external exposure assessment and reduction in the uncertainty of dose estimates. Development work is in progress to further improve TRDS.

Photo: Krestinina L./URCRM

Dr Lyudmila Krestinina

The TRC is a unique resource for estimating cancer risks following chronic exposure to low-medium doses in the general population. It is one of the few human populations affected by protracted strontium exposure, a radionuclide which concentrates in the bone and is thus of great relevance for leukaemia studies. Studies of cancer incidence and mortality in this cohort have been undertaken in Russian-American projects (NCI: 1995-2013; DOE under JCCRER: 1996-2018) and in a European project (SOUL: 2006-2009). Results of radiation effects studied in the TRC show significant excess relative risk for all leukaemias, and also for leukaemias excluding chronic lymphatic leukaemia (CLL), as well as for solid cancer mortality in the TRC and for solid cancer incidence in the Chelyabinsk subcohort of the TRC. The study of non-cancer effects in the TRC (SOUL project) also showed significant risk for all diseases of the circulatory system and for ischaemic heart disease (Table 3).

Table 3. Dose response in Techa River Cohort

Parameters	Solid cancer			Leukemia		Cardio-vascular diseases (CVD)	
	Mortality[1]	Incidence[2]		Incidence[3]		Mortality[4]	
People	29,730	Techa River Incidence cohort 17,435		28,223		29,735	
Follow-up period	1950-2007	1956-2007		1953-2007		1950-2003	
Cases, n	2,303	1,933		99	72	7,595	3,194
Person-years	927,743	472,788		847,877		901,563	
Lag period, years	5	5	5	2		15	
ERR/Gy	0.61	0.87	Smoking adjusted 0.77	All leukemias 1.1	Leukemias Non-CLL 2.2	All CVD 0.36	Ischemic heart diseases 0.56
95% CI	0.04-1.3	0.2-1.6	0.13-1.5	0.4-2.4	0.8-5.4	0.02-0.74	0.01-1.19
P	0.03	0.008	0.02	<0.001	<0.001	0.04	<0.05
Model	linear	linear		linear			
Excess cases	50 (2.2%)	69 (3.6%)	61 (3.1%)	29 (30%)	34 (47%)	73 (1%)	49 (1.5%)

[1]- Schonfeld et al., 2013, Radiat Res (179); [2]- Davis et al., 2015, Radiat Res (184);
[3]-Krestinina et al., 2013, BJC (109); [4]-Krestinina et al., 2013, Radiat Environ Biophys (52)

ID Card:

Cohort type:
Approx. 30,000 persons from the general population, born before 1.1.1950 and resident in the Techa Riverside villages during 1950-1960, environmentally exposed to protracted low- and medium doses (<1 Gy) to soft tissues and to low-high doses to red bone marrow (<7 Gy).

Age/follow-up:
- at exposure: 0-90> years
- current age(2017): 67-90> years
- mean age of those alive at the end of 2014: 74.7 years

Mortality follow-up: 1950-2014.
Cancer incidence: 1956-2014

Biobank available:
Yes

Sample type:
Cells, DNA, fixed slides

Sample storage condition:
(-80°C, liquid nitrogen…)

Access:
The database is owned by URCRM. Access to coded (impersonalized) data is subject to permission from URCRM Commission of Experts.

Internet link:
www.urcrm.ru

Contact:
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Alexander V. Akleyev
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Urals Research Center for Radiation Medicine (URCRM), 68-a, Vorovsky Street, Chelyabinsk 454076, Russia

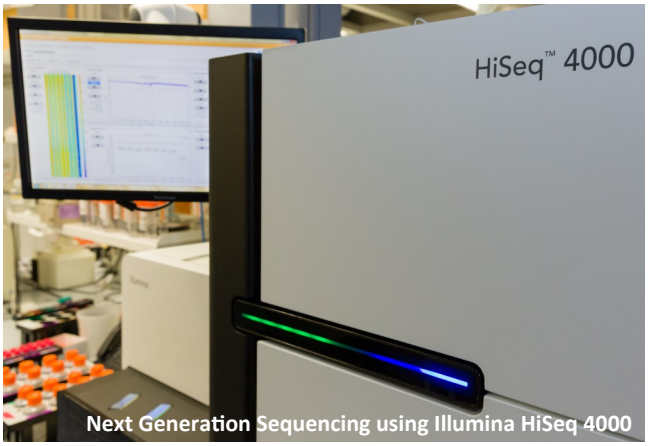
Related to:
MELODI

Leukaemia incidence in the Techa River Cohort: 1953–2007, Krestinina L. Y., Davis F. G., Schonfeld S., Preston D. L., Degteva M., Epifanova S. et al. (2013), British Journal of Cancer, 109, 2886–2893
Solid cancer mortality in the Techa River Cohort (1950–2007), Schonfeld S. J., Krestinina L. Y., Epifanova S., Degteva M. O., Akleyev A. V., Preston D. L. (2013), Radiation Research, 179, 183–189

The iGE3 Genomics Platform

Cutting-edge Genomic Technologies to support research

The iGE3 (**i**nstitute of **G**enetics and **G**enomics of **G**eneva) genomics platform of the University of Geneva provides access to a wide array of state of the art technologies ranging from high-throughput genomics to very targeted analysis. Established in 2002 as the "Frontiers-in-Genetics" genomics platform of the Swiss National Centers of Competence in Research (NCCR), its services were initially restricted to the research groups of the NCCR consortium. It rapidly became a reference laboratory in the genomics field and access was extended to all laboratories, including the private sector. In 2012, the platform joined the newly created interdisciplinary iGE3 consortium.



Next Generation Sequencing using Illumina HiSeq 4000

Photo: Brice Petit / Brice Petit Photography

The main activity of the iGE3 genomics facility is Next Generation Sequencing (NGS). Illumina HiSeq 4000, 2500 and MiSeq sequencers allow sequencing of whole genomes, exomes and transcriptomes as well as more targeted sequencing (of enriched regions). The laboratory has also implemented a single-cell NGS approach using the Fluidigm C1 prep station, which enables high parallel (800 single cells at a time) transcriptome analysis or targeted DNA sequencing. The applications of this high throughput single-cell technology include cell classification (Telley L. et al. 2016, data illustrated in the Figure below), tissue heterogeneity studies and CRISPR-Cas9 screening.

The platform is also equipped with Illumina and Affymetrix microarray technologies for Single Nucleotide Polymorphism (SNP) analysis (Genome-wide association studies and cytogenetics), DNA copy number profiling, DNA methylation status and expression profiling, including miRNA.

For projects requiring expression analysis of smaller gene sets, or specific metabolic pathway genes, the platform offers (since 8 years ago) the nCounter analysis system (nanoString Technologies); iGE3 is the third site in Europe to offer this technology. The nCounter allows digital counting of individual molecules using molecular barcodes with very high dynamic range, reproducibility and specificity, and with no enzymatic reaction.

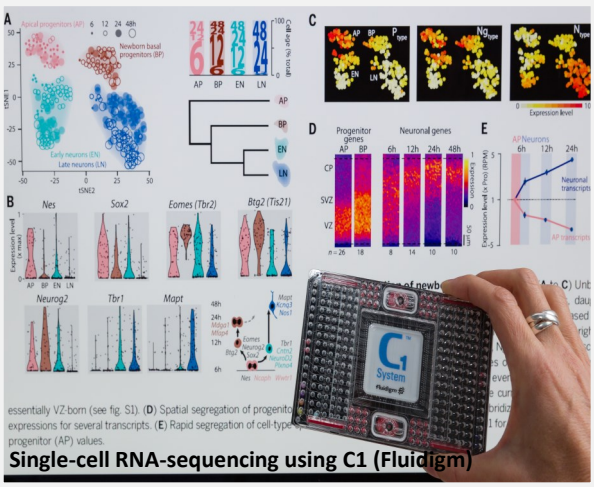
Photo: Brice Petit/Brice Petit Photography

Dr Mylène Docquier

For targeted expression analysis, the facility proposes the widely used real-time PCR technology. In response to growing interest in digital PCR, the platform has also implemented the QuantStudio3D digital PCR system (Thermo Fisher Scientific) for rare variant detection, absolute quantification, biomarker analysis and viral or bacterial detection.

All data generated by the platform can be further analysed by the bioinformatics team. Particular attention is given to understanding the projects and needs of each individual user in order to optimise the analysis pipeline, and new tools are developed as needed. For users who want to analyse their data themselves, guidelines and informatics tools are available.

The provision of proximity services is another of the strengths of the iGE3 platform. Every project and experimental design is directly discussed with the users. Additionally, in order to adapt platform capacity to match demand, continuous efforts are made to optimise protocols and develop and implement new technologies.



Single-cell RNA-sequencing using C1 (Fluidigm)

Photo: Brice Petit / Brice Petit Photography

ID Card:

Analytical platform type:
Genomics

Main techniques proposed:
-Next Generation Sequencing (RNA, DNA, exome-seq…)
-Microarrays (SNP, CNV, methylation, expression)
-nCounter (nanoString)
-q- and d-PCR

Capacity:
Several hundred NGS libraries and arrays per week

Delay to start:
None

Duration of experiment:
Depends on the request (maximum 1.5 months including the analysis)

Intercomparison exercise proposed:
Illumina Phix quality
Affymetrix spikes

Training proposed:
On request

Address:
University of Geneva
CMU 6 - laboratory A06.2707
Rue Michel Servet, 1
CH-1211 Geneva 4
Switzerland

Access:
Free

Internet link:
https://ige3.genomics.unige.ch

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+41 22 379 50 31

Related to:
MELODI

Metagenomics analysis of red blood cell and fresh-frozen plasma units, Lau P., Cordey S., Brito F., Tirefort D., Petty T. J., Turin L., Guichebaron A., Docquier M. et al. (2017), Transfusion, 57 (7) , 1787-1800
Sequential transcriptional waves direct the differentiation of newborn neurons in the mouse neocortex, Telley L., Govindan S., Prados J., Stevant I., Nef S., Dermitzakis E., Dayer A., Jabaudon D. (2016), Science, 351 (6280), 1443-1446

AIR²

Access to INFRASTRUCTURES for Radiation protection Research

Issue	Exposure platforms	Databases, Sample banks, Cohorts	Analytical platforms, Models & Tools
Published to date:			
Oct 2015, #1	FIGARO	FREDERICA	RENEB
Nov 2015, #2	B3, Animal Contamination Facility	The Wismut Cohort and Biobank	The Hungarian Genomics Research Network
Dec 2015, #3	Pulex Cosmic Silence	STORE	METABOHUB
Feb 2016, #4	SNAKE	French Haemangioma Cohort and Biobank	Dose Estimate, CABAS, NETA
Mar 2016, #5	Radon exposure chamber	3-Generations exposure study	PROFI
Apr 2016, #6	Biological Irradiation Facility	Wildlife TransferDatabase	Radiobiology and immunology platform (CTU-FBME)
May2016, #7	CIRIL	Portuguese Tinea Capitis Cohort	LDRadStatsNet
Jun 2016, #8	Mixed alpha and X-ray exposure facility	Elfe Cohort	ERICA Tool
Jul 2016, #9	SCRS-GIG	RES³T	CROM-8
Sep 2016, #10	Facility radionuclides availability, transfer and migration	INWORKS cohort	France Génomique
Oct 2016 #11	LIBIS gamma low dose rate facility ISS	JANUS	Transcriptomics platform SCKCEN
Nov 2016, #12	Microtron laboratory	EPI-CT Scan cohort	CATI
Dec 2016, #13	Nanoparticle Inhalation Facility	UEF Biobanking	The Analytical Platform of the PRE-PARE project
Feb 2017, #14	Infrastructure for retrospective radon & thoron dosimetry	Chernobyl Tissue Bank	HZDR Radioanalytical Laboratories
Special Issue	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES
Mar 2017, #15	Alpha Particles Irradiator Calibration Laboratory at KIT		SYMBIOSE
Apr 2017, #16	Changing Dose rate (SU) Low dose rate (SU)		Advanced Technologies Network Center
May 2017, #17	Chernobyl Exclusion Zone	Chernobyl clean-up workers from Latvia	BfS whole and partial body Counting
Jun 2017, #18	MELAF	Belgian Soil Collection	INFRAFONTIER
Jul 2017, #19	MICADO'LAB	Estchern Cohort	ECORITME
Sep 2017, #20	DOS NDS		CERES
Oct 2017, #21	CALLAB Radon Calibration Laboratory		CORIF
Nov 2017, #22	Calibration and Dosimetry Laboratory (INTE-UPC)	German airline crew cohort	Centre for Omic Sciences (COS)
Dec 2017, #23	NMG	Techa River Cohort (TRC)	iGE3
Coming soon:			
Feb 2018, #24	To Be Announced	To Be Announced	To Be Announced

Future events:

CONCERT Short Courses

5-9 February 2018

Emergency and recovery preparedness and response
National Center of Radiobiology and Radiation Protection, Sofia, Bulgaria

Contact:
Nina Chobanova
n.chobanova@ncrrp.org

19-23 February 2018

Radiation Protection: Basics and Applications
Forschungszentrum Jülich, Germany

Contact:
Ralf Kriehuber
r.kriehuber@fz-juelich.de

5-16 March 2018

Assessment of long-term radiological risks from environmental releases: modelling and measurements, Technical University of Denmark, Roskilde, Denmark

Contact:
Bastian Breustedt
Bastian.breustedt@kit.edu

12-23 March 2018

Two-week training course on radiation-induced effects with particular emphasis on genetics, development, teratology, cognition, cancer as well as space-related health issues, SCK•CEN, Belgium

Contact:
Sarah Baartout
sbaatout@sckcen.be

Other Events

5-8 February 2018

EURADOS AM2018, Lisbon, Portugal

27-28 February 2018

ISBER European Biospecimen Research Symposium, Luxembourg, Luxembourg

12-14 March 2018

4th Conference on Small Animal Precision Image-Guided Radiotherapy, Lisbon, Portugal

11-15 June 2018

EPRBioDose 2018, Munich, Germany

1-5 October 2018

3rd ERPW, Rovinj Rovigno, Croatia

See also on CONCERT website

Editorial Committee: Maria Panagiotopoulou, Jean-Michel Dolo, Elisabeth May, Laure Sabatier

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