

Editorial

This first week of October puts Radiation Protection research under the spotlight with the "3rd Radiation Protection Week" meeting in Rovinj, Croatia.

Although there will be no special session on Infrastructures, they will be everywhere as Infrastructures are at the heart of most of the research in our field. You will already be aware of the research carried out in the numerous infrastructures presented in AIR², but there are still other infrastructures that deserve to be featured.

However, we are now at the 31st issue of AIR² and CONCERT WP6 has committed to publishing 40 issues (excluding special issues). Thus the countdown has started, and we can't present more than 27 infrastructures in the 9 remaining issues. So, if you want to highlight your infrastructure in AIR², now is the time to contact us.

Dr Laure Sabatier, CEA

The floor to...

The mission of the Croatian Institute for Medical Research and Occupational Health (IMROH) is to become an excellence-driven, modern high quality research institute that will shift the boundaries of discovery in the field of anthropogenic effects on health and the environment, and set the standards for academic professionalism and excellence. Established 70 years ago, IMROH is the second largest research institute in Croatia.

As a member of the MELODI and ALLIANCE research platforms, IMROH participates in the CONCERT project as the Croatian PoM. Its participation is guided by its long-term research and professional experience in radiation dosimetry (several thousand occupational dosimetry users), radiobiology, radiation protection in medicine (medical X-ray facilities), radioecology (monitoring and radioactivity of biosphere compartments) and biodosimetry, which complements activities such as biomonitoring exposure, effects of susceptibility to radiation, and the gathering and archiving of data on unstable chromosomal aberrations for more than 4000 individuals occupationally exposed to ionising radiation.

Dr Ivica Prlic

&

Prof. Davor Zeljezic

IMROH CONCERT PoM - Croatia

Research at IMROH combines the FISH technique with chromosomal aberra-

tions and micronuclei. Primary damage to DNA is assessed by several types of comet assay. Susceptibility biomarkers are evaluated using the Q-

PCR technique to determine the occurrence of XRCC1, XRCC3, OGG1, BRCA1 and BRCA2 genes, in order to assess the burden to the environment due to released radioactive ma-

terials. Evaluation of these biomarkers provides significant input to the biological assessment of low level exposure to ionising radiation.

IMROH is certified by the State Office for Radiological and Nuclear Safety (regulatory body) for radiation protection activities based on accreditation of methods and procedures by the Croatian Accreditation Agency. This certification enables IMROH to create new job opportunities for young researchers and enhances its profile to win competitive funding for international R&D projects, in particular those based on collaborations with small and medium-sized enterprises in the fields of radiation protection, radiobiology and biodosimetry, with special emphasis on medical applications.



Future events:

October 3rd 2018

ExB/ESAB

October 4th 2018

MB meeting

Call for Travel Grants

Next deadline: 31st December 2018

Information

WP 6 News:

October 2nd 2018

WP6 meeting, Meeting room 4, Hotel Lone, Rovinj, Croatia

The first version of CONCERT's Web-handbook ([D6.4](#)) is now online!

AIR²D²:

- Please complete the online [form\(s\)](#) to register your infrastructure(s) in the database.

Follow [STORE](#) on Twitter:
[@STOREDatabase](#)

Follow the TERRITORIES PROJECT BLOG

<https://territoriesweb.wordpress.com/>

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November 2018

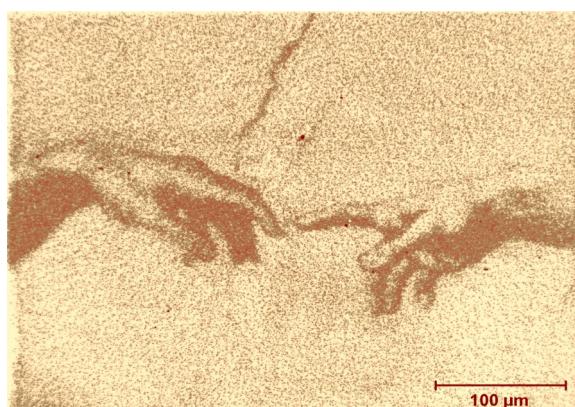


Exposure platforms

PTB-Microbeam, ion and neutron fields

High- and low-LET Microbeam irradiations

The PTB accelerator facility (PIAF) for ion and neutron research and the charged-particle microbeam are established user facilities which have been used for a variety of international projects and European framework programmes. The microbeam facility has been in routine operation for more than 15 years and irradiations of various cell types have been carried out for a variety of collaborative projects with outside groups. In particular, the PTB-microbeam has been part of the INTERSTANDER project for the investigation of bystander effects and the BioQuaRT project.



80 000 α -particles on a CR39 track etch detector

The microbeam provides high-LET α -particles and low-LET protons with energies of (2 to 20) MeV. This range of ions and energies allows the selection of radiation qualities with LET values between (3 to 200) keV/ μ m, which covers almost entirely the range from diagnostic X-rays to naturally occurring α -radiation. With the charged-particle microbeam, substructures (cell nucleus or cytoplasm) of individual cells can be targeted with a spatial resolution of about 2 μ m, and irradiated with a single particle or with precisely counted multiple particles.

For the study of bystander effects, it is possible either to target selected cells or a fraction of cells in a dish and study the radiation response in directly irradiated and bystander cells. Presently, up to 50,000 cells per hour can be automatically processed including all experimental steps (imaging, cell recognition, position analysis and irradiation). The use of reference markers allows revisiting of each cell in a dish for later analysis of radiation response using a variety of endpoints. Live-cell imaging of GFP- or RFP-tagged reporter genes has been established at PTB and is available.

In addition to microbeam irradiations, broadbeam irradiations with protons or α -particles and irradiations in neutron fields with energies in the range (0.1 to 15) MeV can also be made available.



Photo: PTB

Dr Ulrich Giesen

An S1 laboratory for cell culture and microbiological preparations is available in close proximity to the microbeam facility. The local research team will carry out all the procedures at the microbeam and will support the external partners as much as possible. Access to the biology laboratory well ahead of the scheduled microbeam time can be provided for initial preparations and developments, studies of backgrounds (γ -H2AX, etc) and controls, as well as tests using an α -source. There is a guest house on site and a hotel located close to PTB.

In summary, the experimental conditions are perfectly suited to external research groups studying in detail biological effects at the level of individual cells (or co-cultures) and tissues with single particles, low doses or inhomogeneous dose distributions.

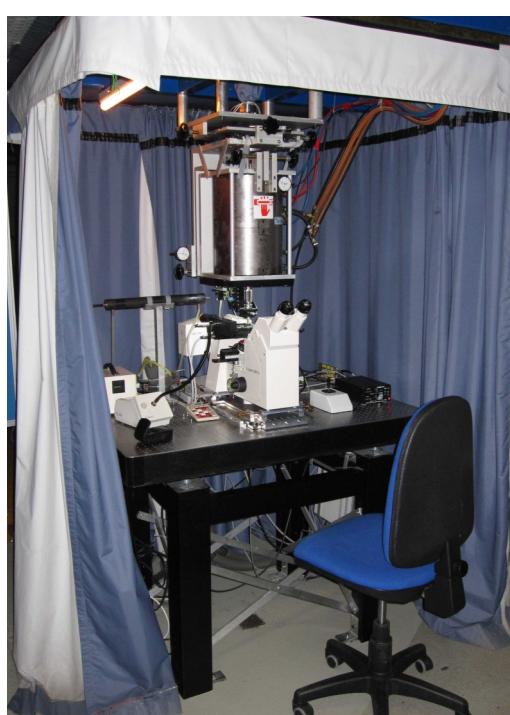


Photo: U. Giesen/PTB

Microbeam cell irradiation station

ID Card:

Exposure type:

External

Source:

3 MV Tandem Accelerator
Compact Cyclotron

Dose rate:

Single ion irradiation
up to about 100 Gy/s

Irradiation type:

Proton- and alpha-microbeam
from top
proton and alpha broadbeam
neutrons

Irradiated organism type:

Cells, tissue

Address:

Physikalisch-Technische
Bundesanstalt (PTB)
Bundesallee 100
D-38116 Braunschweig
Germany

Access:

Joint research collaborations,
up to 10 weeks per year

Supporting lab:

Cell culture lab, detector
electronics lab

Internet link:

www.ptb.de/cms/en/ptb/fachabteilungen/abt6/fb-65/654-biological-radiation-effects.html

Contact:

Dr Ulrich Giesen
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+49 531 592 6410

Involved in:

INTERSTANDER
BioQuaRT

Related to:

EURADOS
MELODI

The BRIDE platform

List of mouse genes affected by low-dose ionising radiation

BRIDE is a data integration platform which offers a lightweight approach for storage, analysis and distribution of relevant low-dose ionising radiation (LDIIR) omics datasets at gene level and, through connections to other resources, it provides access to a wide range of additional information that can be explored by interested researchers.

Tools

- NCBI Identity links
- Intact Identity links
- Rbstore Identity links
- Allen Brain Atlas Identity links
- MGI Phenotypes Identity links
- PC Viz Expansion links

List of tools by which the data can be accessed and/or linked to other domains (NCBI for sequence and other databases, Intact for protein interactions, Rbstore for StoreDB context, Allen Brain Atlas for relevant entries, MGI Phenotypes for phenotypic and other information and PC Viz for vizualisation).

It was developed as part of the FP7 project, CEREBRAD (Cognitive and Cerebrovascular Effects Induced by Low Dose Ionizing Radiation), the main aim of which was to identify the potential cognitive and cerebrovascular risks of radiation doses below 100mGy. In this project, experimental data were gathered from carefully crafted experiments using animal models exposed to radiation at different stages of brain development, with a range of doses and exposure times. The data were recorded in BRIDE, together with all other information available in the literature, extracted by curation of relevant articles. BRIDE currently lists 3174 instances of genes, mostly from the mouse (and some human genes), which exhibit responses in-

duced by low dose radiation. All instances are connected via more than 50,000 links to other database entries, including genes, transcripts and transcriptomes, proteins and protein interactions, pathways, taxonomy, tissues and other relevant experimental information.

These open access data are made available for reuse with the aim of supporting further research into the underlying molecular processes which represent stress responses to LDIR in the mammalian brain, and for the discovery of relevant cellular pathways.

All the results recorded in BRIDE are supported by carefully curated articles from the scientific literature as well as transcriptomics and proteomics data sets. BRIDE deploys a hybrid, distributed solution using both local storage and cloud technology. For the more technically oriented, the BRIDE platform is a browser client, 3-tier system, with the application running on the end-user's web browser, while the database and server components run on a database server; the tiers of BRIDE communicate through standard interfaces. Thus, the internals (including data storage and updates) can change without affecting the platform architecture.

BRIDE acts as a knowledge broker platform for LDIR researchers, to boost research on the systems biology aspects of the LDIR response in the mammalian brain. The data captured by a range of experiments in genomics, transcriptomics and proteomics are expected to grow, both in number and depth, with additional funding and support.

The data collection stored in BRIDE is available at: [<bride.azurewebsites.net>](http://bride.azurewebsites.net).

| PMID | GENE NAME | UNIPROT | TISSUE | DOSIMETRY | TIME | ORGANISM |
|----------|-----------|---------|--------|-----------|------|----------|
| 25329592 | Abr | H3BJY3 | Brain | 0.5 Gy | 24h | Mouse |
| 25329592 | Abr | H3BJY3 | Brain | 1 Gy | 24h | Mouse |
| 25329592 | Abr | H3BJY3 | Brain | 1 Gy | 24h | Mouse |
| 25329592 | Acaa2 | Q8BW1 | Brain | 0.1 Gy | 24h | Mouse |
| 26420666 | Acat1 | Q8QZT1 | Brain | 2 Gy | 24w | Mouse |
| 26420666 | Acat2 | Q8CAY6 | Brain | 2 Gy | 5w | Mouse |
| 26420666 | Acat2 | Q8CAY6 | Brain | 2 Gy | 24w | Mouse |
| 26420666 | Acot7 | Q9IV12 | Brain | 2 Gy | 24w | Mouse |
| 26578848 | Acp1 | Q9D358 | Brain | 0.1 Gy | 6m | Mouse |
| 25329592 | Acsbg1 | Q99PU5 | Brain | 1 Gy | 24h | Mouse |

Sample of the list of genes stored in BRIDE. PMID is the PubMed identifier of the corresponding article, Gene Name is the name of the corresponding gene, UniProt lists the UniProt identifier of the corresponding protein, Tissue reflects the relevant tissue where the gene response was detected, Dosimetry lists the dose in Gray units (Gy), Time lists the time of exposure in the experiment and Organism records the species (in this case, mouse).



CERTH

CENTRE FOR RESEARCH & TECHNOLOGY HELSAS

ID Card:

Database topic:

Systems Radiobiology, LDIR effects on the mammalian brain, list of 3174 affected genes

Information available type:

Gene name, Database identifier, Tissue type, Dosimetry (dose), Exposure (time), searchable

Data type:

Tabular format, various identifiers (over 55000 links to other resources), tissue, dose, time (brain-specific)

Links with other databases:

NCBI identifier (gene/protein), IntAct identifier (known binary interactions), Rbstore (StoreDB) context (inexact match), Allen Brain Atlas context (inexact match), MGI phenotypes, PCViz (visualisation of interactions, user-selected)

Exportable:

Interactive only, not exportable (yet)

Species:

Mostly mouse (some human)

Internet link:

<http://bride.azurewebsites.net>

Access:

Free

Contact:

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+30 23 10 49 84 73

Involved in:

CEREBRAD

Related to:

MELODI



Analytical platforms, Models & Tools

BRENDA

Biological Radiation Effects for Non-human Dose Assessment

BRENDA is a continuous, ordinary differential equations, dual life stage, logistic model for generic populations of wildlife, which is designed to assess the non-stochastic effects of radiation on repairable radiation damage, reproductive ability and mortality. Population change is modelled as a function of survival, fecundity, natural mortality and low density 'Allee' effects. Radiation-induced damages in young and adult life stages are modelled by means of a recovery pool representing the organism's repair system, which can itself be depleted by radiation or recover in a logistic manner. The direct effect of radiation on fecundity is also incorporated in the model.

that the same model is also applicable for that type of radiation.



Photo: Personal archive

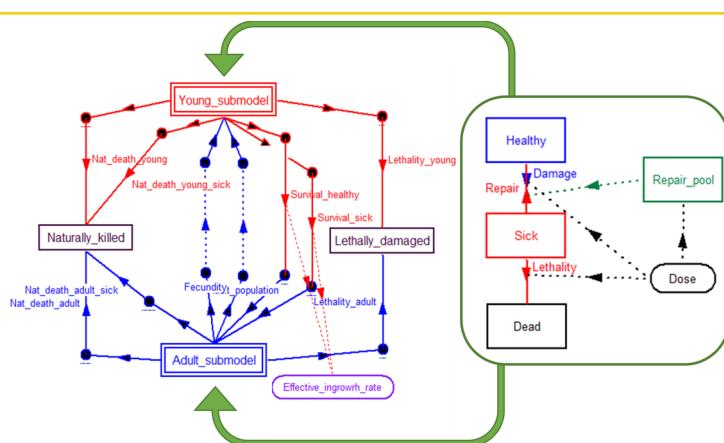
Prof. Jordi Vives i Batlle

BRENDA is set-up in the ModelMaker 4 platform and, in this format, it has been extended for species with four life stages (benthic crustaceans).

Further developments are underway to study radiation effects at the level of the ecosystem, such as time-dependent resources, inter-connected populations of different radiation sensitivity (predator/prey competition), migration of species between contiguous and unequally contaminated areas, and how historical doses can have effects over the generations (transgenerational effects, epigenetics and adaptation).

The potential of BRENDA to assess the defensibility of screening values for the protection of wildlife has been evaluated in the course of the IAEA project MODARIA, where additionally BRENDA has been inter-compared with other population effects models. It remains a strong tool to assess protection at the level of ecosystems, helping to test the validity of the radiation protection benchmarks proposed at the ecosystem level.

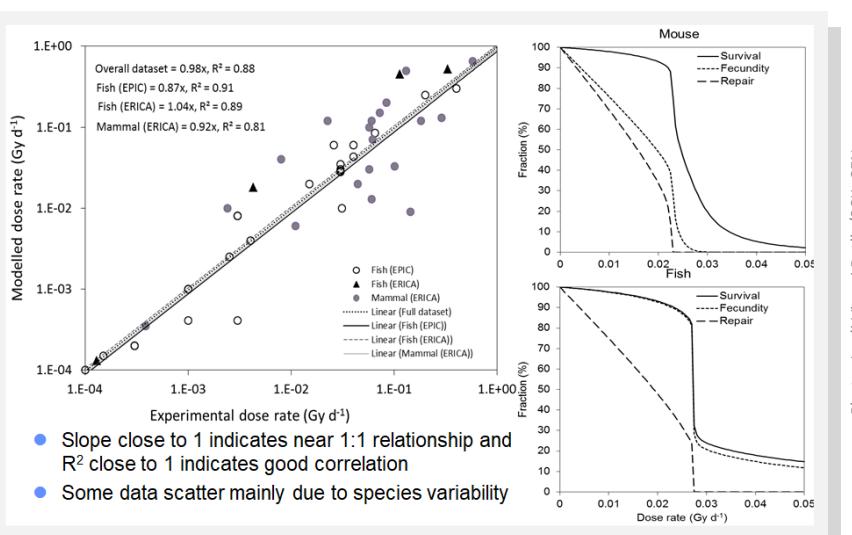
Photo: Jordi Vives i Batlle/SCK•CEN



BRENDA conceptual model in ModelMaker format (left) and detail of the repair mechanism present in both young and adult submodels (right), showing the relevant compartments (rectangles), fluxes (arrows) and variables (rounded rectangles).

The model has been tested against radiation effects data for freshwater fish and small mammal populations, predicting approximately the observed mortality, morbidity and reproductive changes for fish and mouse populations at various doses of γ -radiation as reported in the FREDERICA radiation effects database for wildlife. Experimental doses at which effects were observed, and those for which the model predicts the same effect, are well correlated. Limited data for low-energy β -exposures in mammals suggests

protection benchmarks proposed at the ecosystem level.



Results of BRENDA simulation for external exposure of mice and fish to gamma rays.

ID Card:

Purpose:

Dynamic model for the assessment of the effects of radiation on repairable radiation damage, reproductive ability and mortality for age-structured populations of non-human biota.

Capacity:

The model has been applied to lobsters, mammals (mice, rabbits, wolves and deer), fish and phyto/zooplankton populations. It has been tested against radiation effects data at various doses of γ -radiation as reported in the FREDERICA radiation effects database for wildlife. The model has also been applied to cases involving α - and β -radiation.

Use:

Requires knowledge on how to use ModelMaker and some ability to configure the model for a population with a specific age structure, life history and radiosensitivity.

Housed at:

Current model versions for different species are implemented on the ModelMaker 4 for Windows® modelling platform, and reside at the host institute (SCK•CEN)

Training proposed on the software:

A training session has been given with a 2-age structure version of the model as part of the IAEA project MODARIA

Address:

Belgian Nuclear Research Centre (SCK•CEN)
Boeretang 200,
2400 Mol, Belgium.

Access:

The model is proprietary to SCK•CEN but we can perform model runs and share results as part of scientific collaborations.

Internet link:

www.sckcen.be

Contact:

Prof. Jordi Vives i Batlle
jvibatll@sckcen.be

Related to:

ALLIANCE



Future events:

CONCERT Short Courses

21 January-1 February 2019

Radiation epidemiology, dosimetry and radiation protection concepts of ICRP, Helmholtz Center, Munich Institute for Radiation Protection, Germany

Contact:

Werner Rühm
werner.ruehm@Helmholtz-muenchen.de

4-15 February 2019

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 Baatout
sbaatout@sckcen.be

Other Events

1-5 October 2018

3rd ERPW, Rovinj Rovigno, Croatia

8-11 October 2018

HEIR 2018: 12th International Conference on the health effects after intake of Radionuclides, Fontenay-aux-roses, France

8-12 October 2018

NKS-B RadWorkshop 2018: Workshop on Radioanalytical Chemistry for Nuclear Decommissioning and Waste Management, Roskilde, Denmark

22-25 October 2018

MODARIA II (Modelling and Data for Radiological Impact Assessments) - Third technical meeting, Vienna, Austria

| 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) |
| May 2016, #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 PREPARE project |
| Feb 2017, #14 | Infrastructure for retrospective radon & thoron dosimetry | Chernobyl Tissue Bank | HZDR Radioanalytical Laboratories |
| Special Issue 1 | 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 |

| Issue | Exposure platforms | Databases, Sample banks, Cohorts | Analytical platforms, Models & Tools |
|---------------------------|---|--|---|
| Published to date: | | | |
| Oct 2017, #21 | CALLAB Radon Calibration Laboratory | | |
| Nov 2017, #22 | Calibration and Dosimetry Laboratory (INTE-UPC) | German airline crew cohort | |
| Dec 2017, #23 | NMG | Techa River Cohort (TRC) | |
| Special Issue 2 | MEDIRAD | MEDIRAD | CORIF |
| Feb 2018, #24 | UNIPI-AmBe | Greek interventional cardiologists cohort | Centre for Omic Sciences (COS) |
| Special Issue 3 | 2nd CONCERT Call: <u>LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS</u> | 2nd CONCERT Call: L <u>EU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS</u> | iGE3 |
| Mar 2018, #25 | IRRAD | MARiS | MEDIRAD |
| Apr 2018, #26 | Forest observatory site in Yamakiya | BBM | SNAP |
| May 2018, #27 | Belgian NORM Observatory Site | The German Thorotrast Cohort Study | 2nd CONCERT Call: <u>LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS</u> |
| Jun 2018, #28 | CERF | Mayak PA worker cohort | BIANCA |
| Jul 2018, #29 | TIFPA | RHRTR | OEDIPE |
| Sep 2018, #30 | HIT | The TRACY cohort | VIB Proteomics Core |
| Oct 2018, #31 | PTB Microbeam | The BRIDE platform | Geant4-DNA |
| Coming soon: | | | |
| Nov 2018, #32 | To Be Announced | To Be Announced | To Be Announced |

Future events:

Other Events

29-31 October 2018

[3rd Geant4 International User Conference at the Physics-Medicine-Biology frontier](#), Bordeaux, France

6-9 November 2018

[15th SPERA Conference: South Pacific Environmental Radioactivity Association](#), Perth, Australia

9-25 January 2019

Radioecology Courses 2019 - NMBU, Aas, Norway

Contact:
Ole Christian Lind
olelin@nmbu.no

25-28 March 2019

TRANSAT:
[First Tritium School](#), Ljubljana, Slovenia

3-5 April 2019

5th NERIS Workshop & 10th General Assembly, Roskilde, Denmark

13-16 May 2019

Confidence training course
Use of uncertain information by decision makers at the various levels within the decision making process and its Communication, VUJE, Trnava, Slovak Republic

27-31 May 2019

[ICDA-3: 3rd International Conference on Dosimetry](#), Lisbon, Portugal

[See also on CONCERT website](#)