AIR² Access to INFRASTRUCTURES for Radiation protection Research

Issue 11
October 2016

Editorial - AIR²: 1 year old!

Already one year!!!
Starting from the first issue in October 2015, our AIR² bulletin has reached its objective of 10 issues per year. Thirty infrastructures have been highlighted from both old and new member states, mostly linked to the priorities of Melodi, Alliance, and Eurados. We are still lacking contributions from Neris and EURAMED, but I hope that we will overcome this weakness during the coming year. For this first anniversary, the floor is given to all those who have worked backstage to make AIR² possible due to their past and present involvement.
Thanks to all of them. Thanks to all of you who contribute to and read the bulletin: this bulletin is yours. **Dr Laure Sabatier, CEA**

The floor to...

Already a whole year has passed since the launch of the first bulletin! The time when the layout of the bulletin was created and the editorial committee met to decide the colours, format, etc, is now long gone. This has given way to the routine tasks of inviting infrastructure owners to contribute to the bulletin, of collecting the content (text, images), sending the contribution for English revision, creating each issue and then proof-reading before going to press. To keep this machine well-oiled, we are counting on your participation to feature your open infrastructures. Some categories of infrastructure are quite straight-forward while others, such as the Databases, Sample Banks and Cohorts category, are more complex. Please don't hesitate to contact the editorial committee for assistance to increase the visibility of your infrastructures!

Laure Piqueret-Stephan

When I joined the CEA CONCERT team, I was not really aware of the meaning of "visibility of infrastructures". Clearly, as a physicist and dosimetrist, my understanding was above all directed to the irradiation platforms. Over the past year, after many interactions with numerous colleagues in the radiation protection community, I have widened my horizons, and the bulletin has contributed greatly to this process. My first contribution to our bulletin was through a brainstorming session to generate ideas for its name and structure. Since then, I have become more and more convinced, especially after our successful RPW in Oxford, that this bulletin forms part of the research landscape, stabilizing our network of infrastructures and offering potential new ideas and partners with which to develop new research projects. My wish is that this issue will be seen as a step towards increasing the use of our infrastructures, and what a step it is! Happy birthday AIR²!

Jean-Michel Dolo

Coming from an administrative background (business administration and modern languages), I have provided support for many years to scientists in the genomics field, particularly for their EU grants. The opportunity to join the AIR2 team (from Issue No2) has allowed me to dip my toes in the EURATOM programme and the CONCERT project, and to discover the field of low-dose radiation. As a native English speaker, my role on the Editorial Committee is to edit the English in the contributions we receive from Europe and beyond. I enjoy playing with words and language, analysing and reformulating sentences, and the challenge of capturing the ideas of the author and re-expressing them faithfully in easily readable English. Thanks for your contributions so far, and please keep them coming!

Elisabeth May

Already one year and the 11th issue. I left the CEA just after the publication of the inaugural issue of AIR². It's odd, but when you leave one job for another, you have the impression that everything stops at the old one as your mind turns towards your new future. Of course, this is not true and MELODI, CONCERT, and the other associations and networks continue their important work in the low dose radiation research field. The same holds true for AIR². It is deeply gratifying to see the success of AIR² during its first year and this concrete manifestation of my small contribution to the beginnings of CONCERT in support of access to research infrastructures. "Chapeau" to my former CEA colleagues and all of those of you who have already contributed to the success of this important resource.

William Hempel

CONCERT CORNER

Future events:

18 Nov 2016: CONCERT open consultation meeting for 2nd Call, Brussels, Belgium

Jan 2017: Launch of 2nd Call

WP 6 News:

31 Oct 2016: D6.3
Recommendations for infrastructure related topics for the 2nd CONCERT call and Recommendations for funding schemes to support infrastructure use for the 2nd CONCERT call input to WP3 (M17)

AIR²D²:
- Please complete the online form(s) to register your infrastructure(s) in the database.
- A new option to feature your infrastructure is now available: add document.

Contents:

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November 2016

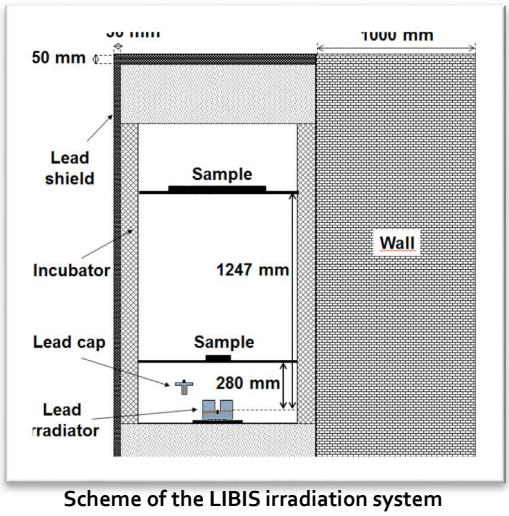
This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

LIBIS

Low dose rate gamma irradiation facility for cell cultures

The Italian National Institute of Health (Istituto Superiore di Sanità, ISS) has a long- standing tradition in radiation research, dating back to the days of its foundation in the 1930's. In 1993, ISS acquired a Gammacell® 40 Exactor (Nordion International Inc.) for acute irradiation of biological samples, with gamma rays from a Cs-137 source, at a dose rate of about 1 Gy/min.

The support of DoReMi made it possible to build a facility for low dose rate and chronic gamma irradiation of cell cultures: LIBIS (**L**ow dose/dose rate gamma **I**rradiation facility for in vitro **BI**ological **S**ystems). This recently completed facility, designed and built at ISS, was explicitly conceived to accommodate a very wide range of low dose rates. It allows samples to be irradiated with Cs-137 gamma rays, from 20 mGy/h down to 2 mGy/h, and the rate can be varied in a practically continuous way within this range. The irradiations are performed inside a CO_2 cell culture incubator, allowing the physiological conditions to be maintained even in experiments lasting many weeks. The incubator is shielded by lead shields (on two sides and on the top) and by very thick brick walls (on the other two sides).



Drawer: Institute: G. Esposito/ISS

Scheme of the LIBIS irradiation system

The main components of the facility are its three lead irradiators, each of which houses a Cs-137 source; the activities of the three sources are in the ratio 1:20:500, with the activity of the strongest source being about 18 GBq. To conduct an experiment, one of the irradiators is placed at the bottom of the incubator, and the sample can be placed at a distance from the source varying from 28 cm to about 125 cm (see illustration). All experiments are performed in completely safe operating conditions, in line with radiation protection criteria. The facility has been designed to ensure that the irradiation areas for samples placed at various distances will provide a high dose rate uniformity over the sample. It is also possible to irradiate several samples at the same time with different dose rates. Accurate measurements can be performed before and during an experiment to ensure precise dosimetry.

Photo: B. Caccia/ISS

Alessandro Campa

Given the dose rates involved, the LIBIS facility allows the biological effects on cell cultures to be studied under low and very low dose rate low LET radiation. The facility offers added value through its ability to enable comparisons to be made with the effects of acute irradiations, using the Gammacell® 40, which is housed in the same room of LIBIS, and with the effects of low dose rate high LET irradiation, using the alpha irradiator available within the same department. Thus, the relevance of radiation quality in low dose rate exposures can be studied.

LIBIS is open to collaboration with all interested research groups. Suggestions and proposals for projects are most welcome. Access to the infrastructure for joint research collaboration is free of charge under written agreement. The department also offers access to cell culture, biochemistry and molecular biology laboratories.

Photo: G. Esposito/ISS

The LIBIS facility: the lead shields surrounding the incubator

ID Card:

Exposure type:
External

Source:
Cs-137

Dose rate:
2 µGy/h - 20 mGy/h

Irradiation type:
Gamma

Irradiated organism type:
Cells

Address:
Istituto Superiore di Sanità
Viale Regina Elena, 299
00161 Roma, Italy

Access:
Joint research collaboration

Supporting lab:
Cell culture, biochemistry and molecular biology labs

Internet link:
Under construction

Contact:
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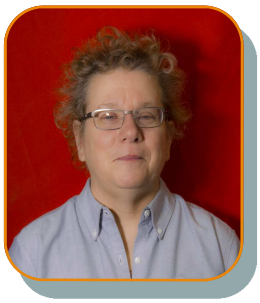
Related to:
DOREMI, MELODI, EURADOS

FACILITY FOR GAMMA IRRADIATIONS OF CULTURED CELLS AT LOW DOSE RATES: DESIGN, PHYSICAL CHARACTERISTICS AND FUNCTIONING. G. Esposito, et al. Applied Radiation and Isotopes, 115, 227-234 .

JANUS Animal Radiobiology Archive

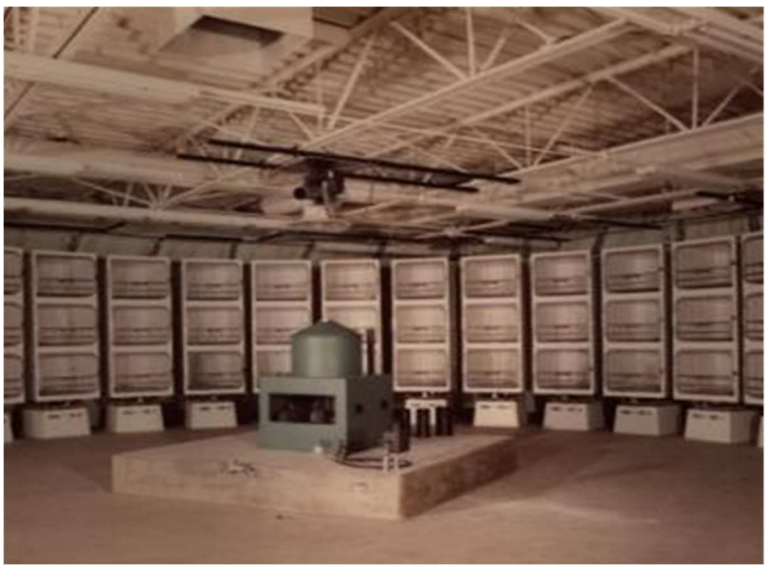
Irradiated animal data and tissue archive

Created by Dave Paunesku for the Woloschak Lab at Northwestern University and financed by NASA and the US Depatment of Energy, a collection of data and tissue samples from materials made at different US National Laboratories during animal studies done between 1950's and 1990's is accessible. The Janus experiments, carried out at Argonne National Laboratory from 1972 to 1989 and supported by grants from the US Department of Energy, investigated the effects of neutron and gamma radiation on mouse tissues primarily from B6CF1 mice.



photographer T. Paunesku

Pr Gayle Woloschak

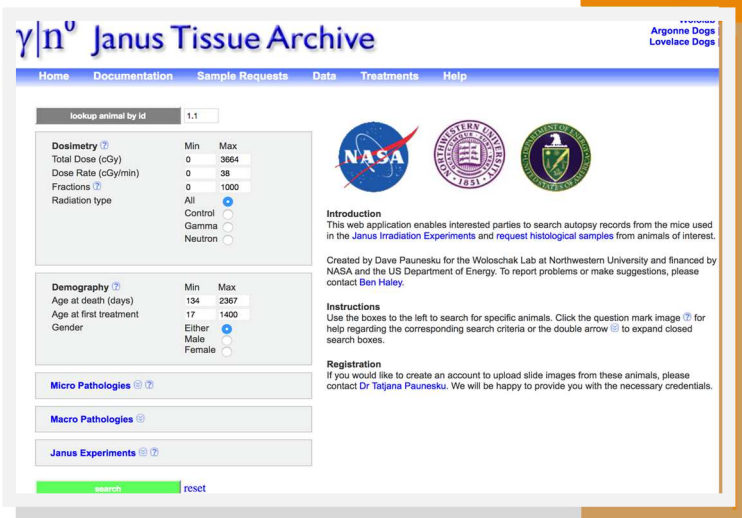


Historic ANL photo

Janus irradiator configuration surrounded with animal cages

Data and paraffin embedded tissues from thousands of mice and dogs exposed to ionizing radiation are available for research. These materials were collected over several decades of DOE funded research. Studies using these materials and information include computational research (see e.g. reference 1) as well as use of tissues for PCRs, immunohistochemistry, X-ray fluorescence microscopy (e.g. reference 2) etc. All of these resources are available for collaborative research with CONCERT projects and may be of interest for several reasons: (a) archival materials include tissues from many thousands of animals exposed to low dose rates or low doses of radiation; (b) data about radiation exposures of these animals is comprehensive, including details about irradiations (age of first exposure, dose, dose rate, delivery protocol etc.) as well as animals (gender, species, strain, age at first and final exposure, age at death, health status etc.). Much of the recent work was made public not only through publication but also through open source sharing.

For example, both data [https://github.com/benjaminhaley/janus/blob/master/data/external5.rds] and scripts [https://github.com/benjaminhaley/janus/blob/master/scripts/exp/ddref.Rmd] used for work published in reference 1 are available on github. Therefore, materials available in Janus Animal Radiobiology Archive may also be used for training/educational purposes.



THE INCREASE IN ANIMAL MORTALITY RISK FOLLOWING EXPOSURETO SPARELY IONIZING RADIATION IS NOT LINEAR QUADRATIC WITH DOSE
Haley BM, Paunesku T, Grdina DJ, Woloschak GE. PLoS One. 2015 Dec 9;10(12)
PAST AND FUTURE WORK ON RADIOBIOLOGY MEGA-STUDIES: ACASE STUDY AT ARGONNE NATIONAL LABORATORY
Haley BM, Wang Q, Wanzer B, Vogt S, Finney L, Yang PL, Paunesku T, Woloschak G. Health Phys. 2011 Jun;100(6):613-21.

ID Card:

Database topic:
Radiobiology

Information available type:
Exposure dose, age of exposure, gender, species, dose rate, time of death, necropsy report (gross and micro pathology), searchable

Data type:
animal lifespan, diseases at time of death

Link with a biobank:
yes (paraffin tissues only)

Exportable:
yes

Species:
mice,dogs

Internet link:
http://janus.northwestern.edu/janus2/index.php

http://janus.northwestern.edu/janus2/dog_tissues/

http://janus.northwestern.edu/lovelace/

Access:
free

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Benjamin Haley
Benjami.haley@gmail.com

The SCK•CEN Genomics platform

Exploring the genomic changes induced by radiation

Since the discovery of the DNA (Deoxyribonucleic acid) double helix in the 1950's, several techniques were developed to study this mysterious molecule and to illustrate its role in the cell and in life. The human genome consists of (44 + XX/XY) chromosomes, made out of supercoiled and compacted stretches of DNA. These DNA sequences contain coding and non-coding areas. The coding genes are regulated at different levels to fine-tune their expression into effector proteins.

Photo: R. Benotmane/SCK•CEN

Quality control of RNA samples

Since the 1950's, genetics has been the discipline that studies the structure and function of single genes while genomics, which emerged in the new millennium after the full sequencing of the human genome, addresses the functioning of all genes and their interactions. Thus genomics seeks to understand the influence of genes on the development and growth of organisms, as well as in cancer and other diseases. The term "omics" has come to refer generally to the study of large, comprehensive biological data sets.

The Genomics Platform at SCK•CEN was established in 2003, based on microarray technology to study global gene expression. Initially, the platform was equipped with a DNA spotting robot (MicroGrid, UK) producing homemade spotted glass slide arrays. The genomics platform was later upgraded through acquisition of Affymetrix technology (Santa Clara, USA), for which precast arrays are commercially available. The Affymetrix GeneChip arrays cover quite a large variety of sequenced and well-annotated genomes from different species for transcriptomics (gene expression and alternative splicing). In addition, other applications can now also be performed, including microRNA quantification and chromatin immunoprecipitation (ChIP) for epigenetic studies, as well as genotyping (SNP, CNV) and tiling. This upgrade has provided a wider genomic vision and more in-depth knowledge with which to uncover the hidden layers of the genome in different biological systems.

Photo: R. Benotmane/SCK•CEN

Rafi Benotmane

When considering an experiment with replicates and different conditions and time points, translating these data into a biological hypothesis becomes challenging. Data analysis is therefore a critical step in genome-wide analysis involving statistics and bioinformatics. Advanced statistical methods help to reduce the complexity of the data to reveal highly significant changes between two conditions (treated *vs.* untreated). On the other hand, bioinformatics is a new discipline that emerged in parallel with genomic studies, and which provides biological meaning to the numerical variations. It involves data mining to identify gene interactions and regulatory networks leading to pathway inference. The Genomics Platform at the Radiobiology Unit of the Belgian Nuclear Research Centre has been involved in several EU-funded projects for more than a decade. The long-term expertise gathered has led to high quality, reproducible data, and to the development of dedicated bioinformatics pipelines for optimal data analysis.

Photo: R. Benotmane/SCK•CEN

Affymetrix installation for staining and scaning of GeneChip arrays

ID Card:

Analytical platform type:
Microarray platform for transcriptomic, microRNA, LncRNA, methylation and tiling analyses

Main techniques proposed:
Gene expression quantification using microarray technology

Capacity:
50 to 100 array per week

Delay to start:
at least a month in front

Intercomparison exercise options:
Several quality controls are run by Affymetrix (the array provider) and many other controls are assessed in house

Training options:
possible

Access:
Selection (no more than 4 persons at once)

Internet link:
www.sckcen.be

Contact:
Rafi Benotmane
abenotma@sckcen.be

Related to:
MELODI and many other EU radiation research projects

IDENTIFICATION OF NOVEL RADIATION INDUCED p53 DEPENDENT TRANSCRIPTS EXTENSIVELY REGULATED DURING MOUSE BRAIN DEVELOPMENT
Quintens R, Verreet T, Janssen A, Neefs M, Leysen L, Michaux A, Verslegers M, Samari N, Pani G, Verheyde J, Baatout S, Benotmane MA. . Biol Open. 2015 Feb 13;4(3):331-44
TRANSCRIPTOMIC AND PROTEOMIC ANALYSIS OF MOUSE RADIATION INDUCED ACUTE MYELOID LEUKAEMIA (AML)
Badie C, Blachowicz A, Barjaktarovic Z, Finnon R, Michaux A, Sarioglu H, Brown N, Manning G, Benotmane MA, Tapio S, Polanska J, Bouffler SD. .Oncotarget. 2016 May 26. doi: 10.18632/oncotarget.9626. PubMed PMID: 27250028

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	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 Transfer Database	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
Sept2016,#10	Facility radionuclides availability, transfer and migration	INWORKS cohort	France Génomique
Oct 2016 #11	LIBIS gamma low dose rate facility ISS	JANUS radiobiology animal archive	The SCK CEN Genomics platform
Coming soon:			
Nov 2016, #12	Microtron MT25	EPI-CT Scan coho	CATI

Future events:

3-5 Oct 2016: International Conference on Research Infrastructures, ICRI2016, Cape Town, South Africa

5-7 Dec 2016: 8th EAN_{NORM}, Stockholm, Sweden

27 Feb-2March 2017 : Eurados Annual Meeting KIT, Karlsruhe, Germany

25-27 April 2017: COMET final event, Bruges, Belgium

14-19 May 2017: Neutron and Ion Dosimetry Symposium, NEUDOS13, Krakow, Poland

23-26 May 2017: Operra final event, Budapest, Hungary

10-12 Oct 2017: Joint ICRP-RPW 2017, Paris, France

Editorial Committee: Jean-Michel Dolo, Elisabeth May, Laure Piqueret-Stephan, Laure Sabatier