

THE 12TH INTERNATIONAL CONFERENCE ON HEALTH EFFECTS OF INCORPORATED RADIONUCLIDES



The 12th international conference on the health effects of incorporated radionuclides (HEIR 2018), took place in Fontenay-aux-Roses, from October 8 to October 11, 2018. Jointly organized by the French Institute of Radioprotection and Nuclear Safety (IRSN) and the Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA), this international conference was the first one organized in France. The series began in 1974 in Alta (Utah, USA). Further ones followed almost every 3-4 years: Neuherberg (Germany) in 1976, Lisbon (Portugal) in 1977, Lake Geneva (Wisconsin, USA) in 1981, Neuherberg in 1984, Bethesda (Maryland, USA) in 1988, Heidelberg (Germany) in 1994, Tokyo (Japan) in 1999, Neuherberg in 2004, Santa Fe (New Mexico) in 2009 and Berkeley (California, USA) in 2013.

In the 1970s, the first HEIR conference has focused on radium and thorotrast health consequences; since then the spectrum of the conferences has extended to other radionuclides, such as radon and risk of cancer among uranium miners, mixed oxides of uranium and plutonium and their biological effects, more recently radioactive iodine and potential health effects after the Fukushima accident. The wide scope of technical, biological tools (for example 'omics technologies') and specific models developed contribute largely to address health and biological questions due to the human contamination by radionuclides.

The program was divided into 7 sessions: *biokinetics*, *dose assessment*, epidemiology, biological effects, *medical countermeasures*, *nuclear medicine* and *what's next*. For the first time in this series of conferences, a session was dedicated to the medical use of radioisotopes.

More than 140 scientists coming from Algeria, Belgium, Canada, Czech Republic, France, Germany, Hungary, Japan, Kazakhstan, Romania, Russia, Spain, Switzerland, United Arab Emirates, UK and USA, attended the conference. Over almost four days, more than 80 presentations or posters were given and discussed. All these contributions are collected in this new issue of Bio Web of conferences.

We would like to thank the members of the scientific committee for the evaluation process of the abstracts and the building of the scientific program. They are:

Rebecca Abergel, USA	Valérie Lemerrier, France
Makoto Akashi, Japan	Balazs Madas, Hungary
Manuel Bardies, France	Florence Menetrier, France
Jean-Marc Bertho, France	Brian Moyer, US
Eric Blanchardon, France	François Paquet, France
Luiz Bertelli, USA	Tony Riddell, UK

Xavier Castagnet, France	Thierry Sarrazin, France
Augusto Giussani, Germany	Patsy Thompson, Canada
Laurence Lebaron-Jacobs, France	Anne Van Der Meeren, France
Jin Kyung Lee, Korea	Richard Wakeford, UK

Moreover, we warmly thank the members of the organizing committee: Céline Dinocourt, Sarah Le Hir, Caroline Salhab, Fabrice Ecrabet, Keltoum Mediana for providing a very nice welcome, organizing secretary, partnership, communication and media.

Professional Societies SFRP, SoFRa, SFMN and SFPM are thanked for their scientific or technical support, so as Cevindra Society for its grant. We would like to thank specifically the Board of the Multidisciplinary European Low-Dose Initiative MELODI for its financial support having allowed the Young Investigator Award.

Finally, we hope that you will read with pleasure these proceedings of HEIR 2018.

Jean-Marc Bertho and Florence Menetrier

Co-chair of the organizing committee



The organizing committee wishes to thank the supporting organizations, sponsors and scientific societies that bring their support to the organization of the conference.

Supporting organizations:



The French Institute for Radiological Protection and Nuclear Safety (IRSN) is the Public Expert in Nuclear and Radiological Risks. Multidisciplinary teams consisting of engineers, researchers, doctors, technicians, etc. enable IRSN to carry out its missions in several fields of activity (nuclear safety, human radiation protection, environmental monitoring). IRSN develops national and international research programs in radiation toxicology, and more broadly in radiation biology.

The Commissariat for Atomic Energy and Alternative Energies (CEA) is an actor in research and innovation in 4 areas: defense and security, nuclear and renewable energy, research technology for industry and basic research. The impact on humans or the environment of radionuclides or ionizing radiation used in the context of technologies developed by the CEA is studied. This research helps to adapt the rules of protection and develop remediation and decorporation techniques.



Sponsors :



The MELODI research platform is dedicated to low-dose ionizing radiation risk. In April 2009, five national organizations, with the support of the EC, created the initial core of MELODI with a view to integrate EU institutions with significant programs in the field, while being open to other scientific organizations and stakeholders, and to develop an agreed strategic research agenda and roadmap. In 2010, MELODI was founded as a registered association with 15 members with responsibilities in radiation protection research. MELODI financially supported the young investigator award attributed during the HEIR 2018 conference

The **CEVIDRA laboratory** produce and commercialize the only patented medical system in the world able to neutralize instantaneously the cutaneous contamination with radionuclides such as Uranium, Plutonium, Thorium and Americium, thus avoiding their transfer in the body, thus limiting the internal contamination and associated heavy medical treatments. It is a chelating dermatological nanoemulsion using the Carboxylic Calix[6]arene. It is commercialized under the patented name of **Calixarene Cevindra®** since 2018 over the world.



Supporting scientific societies:



The Société française de radioprotection (SFRP) is a non-profit organization created in 1965. It is composed of nearly 1,300 members who are professionals, specialists of radiation protection. Members include engineers, researchers, developers, technicians, physicians, inspectors, professors and educational staff, students, pensioners... engaged or having an interest in the protection of the various fields of activity concerned by ionizing and non-ionizing radiations.

SFPM is a scientific society that brings together professionals engaged in medical physics activities in public or private hospital, non-profit or liberal hospitals. The association has about 400 members. Medical physics students can join the association for free. The association develops its activities around the four orientations: scientific culture, professional relations, promotion of medical physics (including education), and professional practice of medical physics. The official scientific journal of SFPM is Physica Medica : EJMP.



The French company of radiopharmacy (SoFRa in French) is an association law 1901, created in January 2005 and recognized as a learned society by the authorities of tutelage. SoFRa aims to: promote and develop radiopharmacy in its scientific and technical aspects, promote exchanges with other scientific societies, French and international, to coordinate and harmonize studies and research in radiopharmacy, to ensure and disseminate professional, theoretical and practical information and to contribute to continuing education and teaching.

The society, named « French society of nuclear medicine and molecular imaging – SFMN », gather French speaking specialists for the promotion of nuclear medicine, molecular imaging and associated technologies. Within these fields, SFMN ensure the national organization of professional training and the evaluation of professional practices. The means of the society are publications, conferences, courses, exhibitions and working groups, meetings and congresses, prizes and awards and any means of diffusion, education and technical courses in French language.



HEIR 2018 CONFERENCE AGENDA



Monday, October 8, 2018

Opening ceremony

9:30 am to 10:00 am

F. Menetrier

J.M. Bertho

F. Jacq

J.C Niel

Epidemiology

10:00 am to 10:35 am

Chairmans: O. Laurent and L. Zablotska

Invited speaker : **David B. Richardson**

Tritium and cancer risk: incorporating informative priors from experimental research into epidemiology

M. Tirmarche : Cancer risk from exposure to alpha emitters : a view from the ICRP

E. Rage : Pooled Uranium miners analysis (PUMA) : the setting up of an International Occupational Cohort

10:35 am to 12:35 pm

T. Azizova : Risk of chronic obstructive pulmonary disease in a cohort of workers occupationally exposed to ionizing radiation

N. Fenske : Mortality from cancer (other than lung) and radon exposure in German uranium miners, 1946-2013

M. Sokolnikov : Lung, liver and bone cancer lifetime risk after intake of ^{239}Pu

12:35 pm to 14:00 pm

Lunch

Biokinetics

14:00 pm to 14:35 pm

Chairmans: L. Bertelli and A. Giussani

Invited speaker : **F. Paquet**

The new ICRP biokinetic and dosimetric models

A. Melintescu : OBT and human tritium dosimetry

14:35 pm to 15:55 pm

D. Melo : Americium systemic model for rats

S. Lamart : Influence of the physico-chemical form on americium biodistribution after wound contamination

15:55 pm to 16:25 pm

Coffee break

Biokinetics

Chairmans: F. Paquet and J. F. Angulo

L. Bertelli : A method for tracking a case under chelation using urinary excretion measurements

J. Klumpp : Mobility, solubility and biokinetics of ^{238}Pu

Young investigator award

16:25 pm to 18:05 pm

A. Van Der Meeren : From in vivo to in vitro models to assess bioavailability properties of Plutonium compounds

M. Avtandilashvili : Biokinetics of soluble Plutonium after wound injury treated with Ca-DTPA

K. Tani : Biokinetics analyses for dose assessment after an accidental inhalation of plutonium in Oarai, Japan *Young investigator award*

End of the first day

Tuesday, October 9, 2018

Dose assessment

Chairmans: E. Blanchardon and B. Madas

A. Maier :Inhomogeneous distribution of radon in different types of tissue in the human body

9:00 am to 10:20 am **J. Marsh** :Effective dose coefficients for inhaled radon and its progeny: ICRP's approach

S. Medici : In vivo screening measurements with common radiation protection instruments *Young investigator award*

M. Saily : Evaluation of internal exposure in French nuclear power plants based on whole body counting

10:20 am to 10:50 pm

Coffee break

Dose assessment

Chairmans: J. Marsh and M. Akashi

E. Ellis : Comprehensive dosimetry for seven exposure sources at the earliest US uranium processing facility

10:50 am to 12:35 pm **M. Lopez Ponte** : Dose Assessment of workers long term exposed to chronic intakes of enriched uranium

E. Davesne : Internal dose assessment for the French cohort of uranium workers

S. Tolmachev : Case studies in brain dosimetry for internal emitters: Is more detail needed for epidemiology?

V. Deffner : Uncertainties in radiation exposure assessment in the Wismut cohort: a preliminary evaluation

12:35 pm to 13:50 pm

Lunch

Biological effects

Chairmans: A. Van der Meeren and K. Tack

Invited speaker : **M. Avtandilashvili**

13:50 pm to 14:25 pm

The United States Transuranium and Uranium Registries: Fifty-year History of Actinide Biokinetic Research.

G. Carle : Effect of natural uranium on bone cells

14:25 pm to 15:45 pm

S. Toklayeva : Effect of radiotoxic effect of uranium ore dust on the reproductive system of rats

A. Bontemps: In vivo comparison between two nephrotoxic agents, sodium fluoride and uranyl nitrate *Young investigator award*

15:45 pm to 16:15 pm

Coffee break

Biological effects

Chairmans: S. Le Hir and R. Guilmette

16:15 pm to 17:15 pm

B. Madas : Radon induced hyperplasia may provide an explanation for inverse exposure rate effect

P. Ostheim : Using mRNA and small RNA gene expression changes in peripheral blood for easy detection of Ra-223 *Young investigator award*

Epidemiology

Chairmans: M. Tirmarche and Z. Carr

17:15 pm to 18:35 pm

S. Bouet : Association analysis between mortality and ionizing radiation exposure in French uranium workers

K. Kelly-Reif : Cancer incidence and mortality among uranium miners in the Příbram region of the Czech Republic *Young investigator award*

L. Tomasek : Risk of Leukaemia in Czech Uranium Miners

L. Zablotska : Analysis of histological subtypes of incident lung cancer among Eldorado uranium workers

End of the second day

Wednesday, October 10, 2018

Medical countermeasures

Chairmans: F. Menetrier and G. Phan

9:00 am to 9:35 am

Invited speaker : **O. Gremy**

Medical countermeasures against radionuclide contamination: An overview

9:35 am to 10:15 pm

L. Miccoli : Liposomal DTPA as a good strategy for enhancing Pu decorporation regardless of treatment regimen.

M. Kastl : Modelling DTPA decorporation of Am in rats

10:15 am to 10:45 pm

Coffee break

Medical countermeasures

Chairmans: F. Menetrier and G. Phan

10:45 pm to 11:45 pm

J. Wang : Solid-liquid exchange between uranium and a synthetic apatite: towards U decorporation from bone

P. Delangle: Uranyl-chelating peptides to help understanding uranium toxicity at a molecular level

G. Phan : Pharmacological study of stable potassium iodide (KI) repeated prophylaxis in adult rats

Biological effects

Chairmans: S. Le Hir and R. Guilmette

11:45 pm to 12:45 pm

D. Lebsir : Effect of repetitive potassium iodide on elderly rat's thyroid
Young investigator award

D. Cohen : Systems Biology described Sodium/Iodide Symporter mechanism during repetitive stable iodide intake

M. Mezaguer : Histological long-term effects in relevant tissues after ¹³¹I contamination of two Wistar rat models

12:45 pm to 14:00 pm

Lunch

Biological effects

Chairmans: A. Van der Meeren and K. Tack

14:00 am to 14:40 pm **V. Malard** : Toxicity mechanisms of cobalt oxide particles (Co₃O₄P) on human lung cells: impact of solubilization

S. Mokrani: Differential responses to tritiated thymidine in mouse embryonic neural stem cells and fibroblasts *Young investigator award*

Dose assessment

Chairmans: E. Blanchardon and B. Madas

14:40 pm to 15:40 pm **K. Yajima** : A reliable and robust method for monitoring large populations to assess thyroid internal exposure

K. Manabe: Development of a function calculating internal dose coefficients based on ICRP 2007 Recommendations

A. Giussani : Preliminary outcomes of the ICIDOSE exercise and impact of the new models for occupational intakes

15:40 pm to 16:10 pm

Coffee break

Dose assessment

Chairmans: J. Marsh and O. Kurihara

16:10 pm to 17:10 pm **M. Jacquemin** : Multi-cellular dosimetry of β^+ -emitting radionuclides used for cell labeling *Young investigator award*

E. Kim: Dose assessment for workers involved in an internal contamination accident with Pu at JAEA's Oarai

L. Hetrick : Localized Instantaneous Dose Rates from Inhaled Particles of Pu-239

Shuttle to the site of the Gala Giner at 18:30 pm

Gala dinner at the Pré Catelan

Thursday, October 11, 2018

Nuclear medicine

Chairmans: M. Bardies – L. Lebaron – Jacobs

9:00 am to 9:35 am

Invited speaker : **M. Bardies**

Relevance and implementation of patient-specific dosimetry in targeted radionuclide therapy

A. Forbes: 90Y glass microspheres radionuclide therapy: robustness analysis with a dosimetry software. *Young investigator award*

9:35 am to 10:35 pm

D. Broggio: Radio-iodine therapy of Graves' disease: is there a dose-effect relationship?

M. Mezaguer : Absorbed dose evaluation at different organs after ¹³¹I oral contamination of two Wistar rat models

10:35 am to 10:55 pm

Coffee break

What's next?

Chairmans: J.M. Bertho and N. Griffiths

N. Griffiths Comments on actinide radiotoxicology research and the 3Rs remit - Replace, Reduce and Refine

B. Madas: FAIRing the radiation science commons

10:55 pm to 12:40 pm

S. Tolmachev : USTUR: Expanding horizons for actinide biokinetics and dosimetry

J-M. Bertho: Internal exposure in post-accidental situations: a multi-pollution to take into account?

C. Hrdina & J. Jones: More effective use = more lives saved: MCM response strategies for radiological incidents.

Closing ceremony

Chairmans: F. Menetrier and J-M. Bertho

With J.C. Gariel and J.R. Jourdain

12:40 pm to 13:10 pm

Young Investigator Award

Poster Award

Next HEIR Announcement

Acknowledgements and Farewell

End of the meeting

POSTER Presentations

Posters will be exposed during the whole conference and presented during the coffee breaks

Medical countermeasures and decorporation

- **C. Rosique:** Impact of repeated dose of stable iodine in an in utero rat model using a metabolomic approach
- **P. Chanton:** Chelating properties of the calixarene carboxylic
- **P. Ostheim :** Decorporation therapy. The «Precautionary approach» versus the «Urgent approach»
- **L. Miccoli:** Evaluation of protracted chelation treatments to decorporate Plutonium after rat lung contamination

Biological effects, biochemistry, molecular biology

- **J-M. Bertho :** Differential effects of HTO and OBT ingestion or external irradiation on iron metabolism
- **C. Granotier-Beckers :** Effects of tritiated thymidine on human neural stem and progenitor cells
- **N. Griffiths :** Exploiting the "Rat Actinide Repository" at the Laboratory of RadioToxicology, CEA, France
- **Y. Saifulina :** Distribution of uranium in the internal organs of laboratory animals after incorporation of uranium ore dust

Epidemiology

- **S. Lamart :** Updating the French database of workers contaminated with Pu and/or Am and treated with Ca-DTPA
 - **A. Karpov:** Descriptive characteristics of the cohort of workers from the Siberian Group of Chemical Enterprises
 - **I. Martinenko :** Risk assessment of thyroid cancer incidence among population due to residence close to Mayak PA
 - **A. Meniailo:** Assessment of lifetime attributable risks from internal radiation exposure
 - **R. Lane:** Low radon exposures & lung cancer risk: joint analysis of Czech, French & Beaverlodge uranium miners
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Dosimetry and dose assessment

- **E. Blanchardon** : ICARE software for calculation of dose coefficients and retained/excreted fractions of intake
 - **M. Saily**: Evaluation of the activity of a hot particle incorporated by a worker of nuclear power plant
 - **D. Bingham** : Accounting for environmental intakes when assessing occupational exposures to uranium
 - **Y. Lecompte** : Ra-223 dichloride incidental inhalation: recommendations to estimate the committed effective dose
 - **V. Ivanov** : Current radiation risks from occupational exposure in Russian nuclear industry
 - **M. Aumalikova** : Comparative analysis of the uranium content in the urine of personnel of group A and persons not exposed
 - **S. Romanov**: Microdistribution of plutonium in human skeleton: Should we change the ICRP model?
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