

IONISING RADIATION AND FIGHT AGAINST CANCER: WHAT IS THE CONTRIBUTION OF RESEARCH ?

Maison Irène et Frédéric Joliot-Curie
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On the eve of the World Cancer Day, [IRSN](#) organised in partnership with [CEA](#), [Inserm](#) and [CNRS](#)⁽¹⁾, a conference dedicated to the contribution of research on the use of ionising radiation to the fight against cancer. This venue organised under the auspices of Marie-France Bellin and Jean-Christophe Niel, respectively chair of the board and director general at IRSN, took place at Maison Irène et Frédéric Joliot Curie, the Brussels base of several major French research institutions. Structured around three headlines – French strategy and roadmap, state-of-the-art research, and European and international actions – the presentations and debates among scientists, academics and representatives from government and international organisations highlighted the challenges, progress made, and future prospects of scientific research in medical applications such as imaging, nuclear medicine or radiotherapy where radiation technologies are used for diagnosis and/or therapy.

Acknowledging improvements achieved in cancer diagnosis and treatment

In France, like in many European countries, the use of ionising radiation in cancer diagnosis and treatment keeps growing with over 55% of patients being treated by radiotherapy. This constant increase raises many questions – e.g. on the benefit/risk balance of innovative radiation technologies (new radiopharmaceuticals, Proton-therapy or Flash-therapy), the development of combined treatment to cure radioresistant tumours or the adverse effects and the patient quality of life. These questions require in turn further research aimed at developing ever more efficient and less affecting therapeutic strategies. In this regard, the participants in the conference acknowledged the progress made over the past years in terms of improved benefit/risk balance, increased life expectancy and higher quality of life through reduced side effects, just to name a few.

Shaping the future of treatments

The presentations and debates were an opportunity to address major benefits expected from research projects from different perspectives:

- Enhanced therapy efficiency through innovative irradiation modalities such as hadrontherapy, spatial fractionation, flash therapy, drug-assisted targeting (using e.g. nanoparticles);
- The further improvement of the benefit/risk balance of imaging and treatments with, in particular, the contribution of artificial intelligence (AI) and machine learning to obtaining high-quality imaging with lower dose intake;

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- The prevention of adverse effects from treatments, the reduction of the toxic effects of radiotherapy on healthy tissues, or the occurrence of immunosuppressive and/or long-term effects, thanks to AI-guided dose delivery;
- The benefit from new approaches in nuclear medicine such as theranostics (the combined use of one radionuclide to diagnose and a second one to treat the tumour, main and any metastatic), or the combined use of radiotherapy with other therapies (immunotherapy, hormonotherapy ...);
- The trend towards personalised medicine based on patient-centric, cross-disciplinary approaches taking into account individual patient parameters and personalised dosimetry;
- The development of ultra-precision radio-immunotherapy using imaging-biomarkers for efficient treatment of oligometastatic patients...

Addressing challenges

Most of the prospects mentioned above require disruptive approaches based notably on the development of multidisciplinary and multi-scale approaches which entail the integration of teams working in various fields to deal with the diversity in tumour and non-tumour tissue response e.g. physicochemical, molecular, and physiological phenomena. Other challenges associated with the rapid evolution in cancer diagnosis and treatment techniques pertain for instance to the quality assurance in radiotherapy, the secured production of radioisotopes, the funding of state-of-the-art research drawing upon ever more sophisticated equipment or the equal access to radiological medicine, as well as the safety of caregivers and patients, calling for the involvement of patient associations in future developments.

Tackling such challenges is key to the success of research activities carried out as part of strategic plans at national, European and international levels, such as the French 10-year strategy against cancer, the Europe's Beating Cancer Plan or the IAEA's Rays of Hope initiative. It is for instance the sense of major research projects conducted as part of European framework programmes for research and innovation (H2020/EURATOM and Horizon Europe), such as Rocc-N-Roll, an integrated and coordinated European approach for innovation and research in the field of medical applications using ionising radiation, and PIANOFORTE, an IRSN-coordinated partnership aimed to contribute improving the protection of the public, workers, patients against environmental, occupational and medical exposure to ionising radiation. This partnership also intends to foster the management of research programmes at scientific community level through open research calls.

(1) Alternative Energies and Atomic Energy Commission (CEA), National Institute of Health and Medical Research (Inserm) and National Centre for Scientific Research (CNRS).

Source [irsn](https://www.irsn.fr)

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