2nd Annual Patricia Durbin Memorial Lecture

"Toxicology and Dosimetry of the Short-Range Radionuclides"

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Wednesday, March 16, 2011
Reception at 3:30 pm
Seminar 4:00 - 5:00 pm
Bldg. 66 Auditorium (66-317)

The toxicity and dosimetry of the short-range radionuclides[1] after incorporation are poorly described. Many studies have been performed on radium, plutonium, thorium, uranium and radon, but efforts remain to be done on most of the other radionuclides. Recent studies have shown that some of the Auger and beta radionuclides may deposit in the cell nuclei and deliver all their energy in the vicinity of the DNA. This point was used by many authors to conclude that these radionuclides are more toxic than previously stated and to ask for a revision of their dosimetry and of the general radioprotection system.

The dosimetry of these radionuclides is very complex because of the short-range of the alpha particles and Auger and beta electrons in the organic matter. This leads to a heterogeneous distribution of the energy at the cellular level that is not included in the usual ICRP[2] dosimetric models. Despite this particularity, the dosimetry and therefore the assessment of risks resulting from internal contamination with the alpha, Auger and beta emitters is included in the general ICRP system, mainly based on the Hiroshima and Nagasaki survivors, who were irradiated by external acute exposure to gamma and neutrons.

New tools have been recently developed, that allow the calculation of energy deposition in any part of the cells. However, to be useful for radiological protection, these tools need to be associated with the knowledge of the precise location of the radionuclides in the cells, their residence time, the nature and location of the target cells in the tissues and all the antagonistic or synergistic mechanisms that are responsible for the final development of deterministic or stochastic effects.

Information on these latter points is not available yet. That validates the default use of the current and simplified ICRP system for the assessment of risks but also encourages new studies aimed at better defining the toxicology and biokinetics of these particular, although widely used, radionuclides.

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[1] Short-range radionuclides means here the alpha, beta and Auger emitters
[2] ICRP : International Commission on Radiological Protection

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