Strengthening Biological Dosimetry in Member States of the International Atomic Energy Agency

Biological dosimetry or biodosimetry is a tool/technique for quantitative assessment of dose of exposure to radiation of an individual or a group of people by nuclear/radiation accidents/incidents and/or as a result of their profession/work. This assessment of dose of exposure is a critical requirement for appropriate medical interventions, which greatly influences the clinical outcome. Since dicentric chromosomal aberration assay was the first one to be used in radiation biodosimetry, biodosimetry has essentially remained restricted to different cytogenetic assays, which shows a clear dose–response relationship to dose of exposure to radiation. These technologies include assays of micronuclei in cytokinesis-blocked binucleated cells, premature chromosome condensation, and fluorescent *in situ* hybridization, among others. Each of these cytogenetic assays offers unique advantages as well as disadvantages, which clearly indicates that the last word on biodosimetry has not been pronounced as yet.

A consultancy meeting on “Strengthening Biological Dosimetry in IAEA-Member States” was held on 10–12 November 2010 (Ref. 10CT10291) at the International Atomic Energy Agency (IAEA) Headquarters in Vienna, Austria, to address the issue in totality. The consultants deliberated on the past experiences on biodosimetry, the state-of-the-art of biodosimetry science in the postgenomic era, as well as on the increasing need of biodosimetry in context of preparedness to deal with radiological incidents of large magnitudes with national and regional perspectives. Based on these recommendations, the Coordinated Research Project (CRP) E35008 entitled, “Strengthening of ‘Biological Dosimetry’ in IAEA Member States: Improvement of current techniques and intensification of collaboration and networking among the different institutes” was formulated to address the issue. It was decided to involve a number of laboratories/institutes in low-, middle- and high-income Member States (MSs) with wide arrays of expertise in the application of cytogenetic assays to perform biological dosimetry immediately and retrospectively in normal individuals as well as in patients. The aim of the CRP was to increase the preparedness of biological dosimetry laboratories/institutes in IAEA-MSs in respond to radiation/nuclear accidents/incidents nationally and in the region. It was also envisioned to establish, improve, and harmonize the cytogenetic assay techniques in different laboratories across MSs, to optimize the existing technologies and methods, to develop new technologies and approaches to perform biodosimetry in high-throughput mode, and to establish networking – both locally and regionally. The collaborators of the CRP included the representative laboratories from the following countries – Canada, China, Cuba, France, Georgia, Ghana, India, Indonesia, Japan, Republic of Korea, Lithuania, Malaysia, the Netherlands, Philippines, Poland,

Russia, Singapore, Sri Lanka, Thailand, UK, Ukraine, Uruguay, and Vietnam. The CRP established links with the Incident and Emergency Centre, World Health Organization BioDoseNet, Coordination Action “Realizing the European Network of Biodosimetry,” Japanese National Institute of Radiological Science (currently, the National Institutes for Quantum and Radiological Science and Technology), and Hiroshima International Council for Health Care of the Radiation-Exposed. The CRP was started in February 2012 and concluded in March 2016. Project Officers Jan Wondergem (2012–2013) and Oleg Belyakov (2013–2016) in their capacity of staff IAEA Radiation Biologists were in charge of the CRP. IAEA awarded research contracts and research agreements to participating institutions depending on the type of support it was allowed to provide to the MSs. Each Chief Scientific Investigator (leading work in participating institution) made sincere attempt to raised funds from their own resources to establish or strengthen their biodosimetry laboratories extending full cooperation to the success of the CRP. During the course of the CRP, three Research Coordination Meetings were held in 2012, 2014, and 2016 at the IAEA Headquarters in Vienna to jointly monitor the progress of work. All participating laboratories made significant progress during this period in the domain of biodosimetry covering the entire spectrum – from establishing a very basic biodosimetry laboratory starting with DCA assay to advanced cytogenetic assays as well as developing/establishment of new technologies for biodosimetry in the future with an emphasis on high-throughput technologies.

This special issue of the journal “Genomic Integrity” was conceived to present a record of the efforts made by the participating laboratories, their Chief Scientific Investigators, and their research associates in the domain of biodosimetry. A total of 18 research articles were submitted for inclusion in the special issue. Participating institutions summed up their efforts of the last 4 years in the form of research papers describing their results with supporting data and figures. In the process, the expertise has either been strengthened or, at least, established in different MSs. The interaction during the CRP also provided opportunity to develop regional and local networks and cooperation in the domain of biodosimetry between different laboratories. In light of this, these articles appearing in this special issue should be considered as the testimony of efforts to report what each MS has done to establish and/or strengthen the biodosimetry facility in their respective country. Therefore, we urge upon the readers to appreciate the efforts rather than novelty and/or comprehensiveness in all these articles. We, as editors of this special issue, are promoting the research articles more as the outcome of IAEA support to low- and middle-income countries to set up and/or strengthen biodosimetry laboratories.

It was a unique experience for us to serve as the Guest Editors of this special issue. This open access platform is the most appropriate medium of dissemination and sharing of information on biodosimetry not only among the participating MSs but also with other stakeholders in biodosimetry across the globe. The entire spectrum of conventional low-throughput biodosimetry to advanced and modern high-throughput biodosimetry techniques, including development of newer technologies and approaches for futuristic molecular biodosimetry, has been covered in this issue. The Editors are thankful to all authors for their contributions and cooperation as well as for their continuing cooperation during the editorial process, including responding to referees' comments and revision of their manuscripts in good time. We are also thankful to all Reviewers who were very kind to review the submissions in shortest possible time. We acknowledge the generous contribution of the IAEA toward the open access fee and other charges for this publication.

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