

**A REPORT OF**

**MEETING ON**

**“REVISIT OF LINEAR NO-THRESHOLD (LNT) AND  
RADIATION HORMESIS”**

**December 7, 2019**

**ORGANISED BY**

**SOCIETY FOR RADIATION RESEARCH (SRR)**

**in association of**

**SOCIETY FOR CANCER RESEARCH AND COMMUNICATION  
(SCRAC)**

*Supported by*



Society for Radiation Research (SRR) in association of Society for Cancer Research and Communication (SCRAC) organized a Meeting on “**Revisit of LNT and Radiation Hormesis**” on Dec. 7, 2019 at Sun-N-Sand, Juhu, Mumbai. The meeting was one of the events in the series of activities organized by SRR during its 5<sup>th</sup> Foundation Year in 2019. The program was attended by about 40 eminent scientists, engineers, clinicians and other professionals from various Institutes and Hospitals (like BARC, NPCIL, AERB, ACTREC, TMH, IIT, Nanavati Hospital, Nair Hospital etc.) in Mumbai.

The meeting started with a welcome note by **Dr B. N. Pandey**, Secretary, SRR. **Dr Amit Kumar**, one of the Founder Member of SRR and Scientist, BARC introduced Society for Radiation Research and its various activities after its foundation on Dec. 15, 2014. He highlighted some of the recent and upcoming activities of SRR. He mentioned that SRR has been joined by eminent scientists/clinicians and students from various parts of India and abroad. He emphasized that in last 5 years SRR has conducted various activities including 2 International Conferences and an International School on Radiation Research in addition more than 10 Public Lectures/Workshops/Discussion Meetings in various parts of India. In addition, he also describes about Journal of Radiation and Cancer Research (JRRCR), the official publication of SRR. Dr Kumar also welcomed audience for the 5<sup>th</sup> Asian Congress of Radiation Research (**5<sup>th</sup> ACRR-2021**) and 3<sup>rd</sup> Biennial Meeting of Society for Radiation Research to be held during **November 16-19, 2021** in Mumbai.

**Dr Nagraj Huilgol**, Radiation Oncologist, Nanavati Hospital, Mumbai and Ex-President, SRR during his introductory remarks highlighted about historical Muller’s radiobiological experiments using *Drosophila* at high doses of radiation, which was later used to extrapolate the effects at low doses and became the basis for LNT model for radiation risk assessment. He mentioned that such models created a fear against radiation in public and there is need to develop model, which at one side ensure safety of workers and public but should be also more rationale based on plenty of data available in low dose radiation biology.

An invited talk titled “**Linear No-Threshold Model of Radiation Risk Assessment: A Need to Balance Science Over Argument**” was delivered through Skype by **Dr Jerry Cuttler**, Cuttler & Associates Inc., Toronto, Ontario, Canada. The scientific session of his talk was Chaired by **Dr Vinay Kumar**, Head, Radiation Biology & Health Sciences Division, BARC, Mumbai. During the lucid and interesting talk, Dr Cuttler covered the historical aspects of medical treatments with low radiation doses and presented some recent case studies of low dose radiation-based treatment of ailments like cancer, inflammation and Alzheimer diseases. Dr Cuttler mentioned that threshold for malignancies was found to be 100  $\mu$ Ci for radium intake in radium dial painters in early nineteenth century. He mentioned that since discovery radiation had been used to treat various ailments (cancer, accelerated wound healing, infections, arthritis etc.) for more than 120 years, however, there was little evidence of increased cancer in these patients. In case of nasopharyngeal radium irradiation, many follow-up studies confirmed no link to any disease despite the short distance to the brain, the eyes, the thyroid. Dr Cuttler mentioned that after U.S. National Academy of Sciences recommendation in 1956 to assess risk of radiation-induced mutation using LNT model, concept of radiation induced stimulation to immune system over-weighed by risk of mutation/cancer incidence after low dose therapy. It resulted in shift of clinicians towards antibiotics and anti-cancer agents than to further explore the potential of low dose radiation. Dr Cuttler mentioned that low dose total body irradiation can suppress both artificial and spontaneous lung cancer metastasis in marine squamous cell carcinoma. He described the study showing prevention of prostate cancer metastasis after low dose total body irradiation. Some recent case studies were explained by Dr Cuttler for the prevention of breast cancer growth and metastasis when treated using alpha-emitting radon generators. Use of radon therapy for the treatment of arthritis and pemphigus, an autoimmune disease was explained by Dr Cuttler. At last part of his presentation, Dr Cuttler showed some case studies where low dose brain CT was used for treatment of Alzheimer’s

dementia and Parkinson's patients, which showed improvement in symptoms and helped lowering the routine medications.

The invited talk of Dr Cuttler followed a panel discussion on “**Revisit of LNT and Radiation Hormesis**” with eminent panellists (**Dr K. P. Mishra**, Ex-VC, NGBU, Allahabad & Ex-Head, RB&HSD, BARC, Mumbai, **Dr Nagraj Huilgol**, Chief Radiation Oncologist, Nanavati Hospital, Mumbai, **Dr Pushparaja**, Ex-Head, RHCS, BARC, Mumbai, **Dr B. S. Rao**, Ex-Head, RPAD, BARC, Mumbai, **Dr J. Sastry**, Radiation Oncologist, ACTREC TMC, Navi Mumbai), which was steered by **Dr B. N. Pandey**, Head, RSCBS, RB&HSD, BARC, Mumbai. While scientific discussion, panellists opined that existing LNT is a conservative model of radiation risk assessment. Radiation oncologists (Dr Huilgol and Dr Sastry) in the panel believed that clinical information about effects of different doses of radiation while cancer radiotherapy should be used to understand the risk of low dose of radiation. Dr K. P. Mishra opined that LNT model resulted in undesired fear against low dose of radiation especially after Fukushima Nuclear accident. It was also discussed by some panellists that LNT model overlooks some of the basic radiation biological concepts and process of carcinogenesis.

The meeting concluded with note that evidences from in vitro, in vivo and epidemiological sources suggest that there is an urgent need to revisit the existing LNT model towards a threshold-based model for radiation risk assessment for applications of radiation and radiation-based technologies without any compromise of safety of public, patients and workers.

The meeting ended with vote of thanks by Dr B. N. Pandey, Secretary, SRR.



Dr B. N. Pandey welcoming delegates to begin the Meeting

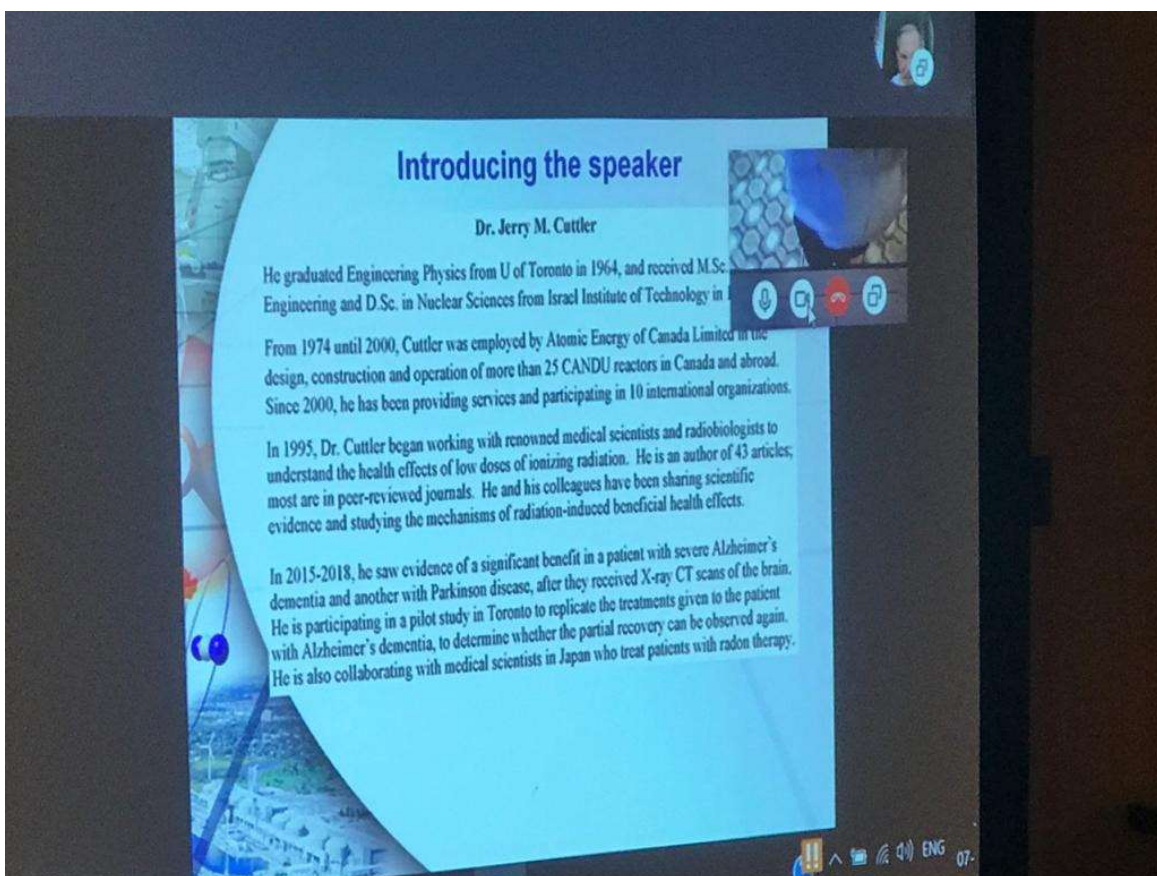


Dr Amit Kumar briefing the audience about Society for Radiation Research





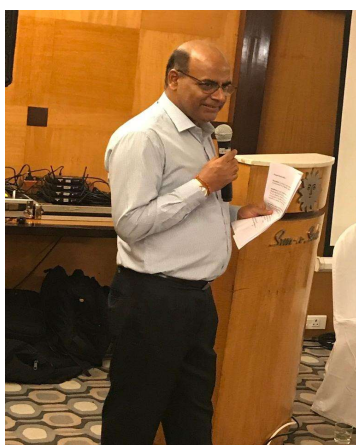
Dr Nagraj Huilgol, Chief Radiation Oncologist, Nanavati Hospital, Mumbai and Ex-President, SRR delivering “Introductory Remarks”



Dr Jerry Cuttler is being introduced by Dr Vinay Kumar, Head, Radiation Biology & Health Sciences Division, BARC, Mumbai (Chairman of Scientific Session)



(left) Dr Vinay Kumar, Head, Radiation Biology & Health Sciences Division, BARC, Mumbai Chairman of Scientific Session is being facilitated by Dr K. P. Mishra (right), Ex-Head, Radiation Biology & Health Sciences Division, BARC, Mumbai



Dr B.N. Pandey steering the Panel Discussion on “Revisit of LNT and Radiation Hormesis”



Panellists for Panel Discussion “Revisit of LNT and Radiation Hormesis” (from left) Dr J. Sastry, Dr B. S. Rao, Dr K. P. Mishra, Dr Pushparaja and Dr Nagraj Huilgol



Panellists and other dignitaries (*from left*) Dr Vinay Kumar, Dr B. N. Pandey, Shri K. Jayarajan (Chairman, BSC), Dr J. Sastry, Dr B. S. Rao, Dr K. P. Mishra, Dr Pushparaja and Dr Nagraj Huilgol







Audience Photos of the Meeting

**Society for Radiation Research (SRR)**  
in association of  
**Society for Cancer Research and Communication (SCRAC)**



**ORGANIZE A MEETING ON**  
**"Revisit of LNT and Radiation Hormesis"**  
*in the Series of*  
*Scientific Events during 5<sup>th</sup> Foundation Year of SRR*  
**Date/Day/Time: December 7, 2019 (Saturday), 6:30 pm**



**Venue: Sun-N-Sand, Juhu, Mumbai**

**TALK**

**Linear No-Threshold Model of Radiation Risk Assessment:  
A Need to Balance Science Over Argument**



Jerry Cutler, Ontario, Canada

**PANEL DISCUSSION**

**Revisit of LNT and Radiation Hormesis**



**Nagraj Huilgol**  
Chief Radiation  
Oncologist, Nanavati  
Hospital, Mumbai



**K. P. Mishra**  
Ex-VC, NGBU, Allahabad  
Ex-Head, RB&HSD, BARC, Mumbai



**Pushparaja**  
Ex-Head, RHCS, BARC, Mumbai



**B. S. Rao**  
Ex-Head, RPAD, BARC,  
Mumbai



**J. Sastry**  
Radiation Oncologist, ACTREC  
TMC, Navi Mumbai