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"SAFETY OF NANOMATERIALS: A JOURNEY FROM RESEARCH TO POLICY"

Prof. Alok Dhawan

Director, Centre of Bio-Medical Research, Lucknow, India

YouTube https://youtu.be/_OHqC9zt_1k

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Title: "Safety of nanomaterials: A journey from research to policy"

Speaker: Prof. Alok Dhawan

Director, Centre of Bio-Medical Research, Lucknow, India.

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Abstract

Nanotoxicology is a study of the toxicity of nanomaterials. Nanomaterials, even when made of inert elements, at times become highly active at the nanometer dimension due to their altered physical and chemical properties. The toxicology studies are intended to determine whether and to what extent these properties may pose a threat to the environment and to human beings. The same novel properties making nanoparticles attractive could make them potentially toxic too. Exposure to nanomaterials can be due to contact via skin, inhalation and oral ingestion. However, it could also happen indirectly through the environment or food chain. The former can be controlled and mitigated, while assessment of the latter is very difficult both to ascertain as well as to mitigate. While assessing the toxicity of engineered nanomaterials (ENMs), several things need to be accounted for, such as, size, shape, surface area, coatings, stability, dispersion, uptake, excretion of ENMs. Depending on the materials and its intended use, the appropriate model needs to be identified to assess the toxicity of the ENMs. Initial toxicity of ENMs is done in vitro and subsequently in vivo using various animal and alternate animal models. This allows for hazard identification as well as an appropriate risk assessment. Hazard identification of ENMs can be done in vitro and in vivo, using various models by assessing cytotoxicity, genotoxicity, immunotoxicity, neurotoxicity, hepatic toxicity, renal toxicity, cardiotoxicity etc. For assessing the environmental impact of ENMs, several models at different trophic levels have been used such as E. coli, Drosophila, Zebrafish, Daphnia, plants. Globally, an effort is being made to develop ENMs through "safe by design approach" and employ the precautionary principal for their usage. In India, guidelines have now been published both for the safety assessment of nanopharmaceuticals as well as for the nano-based agri-input and food products.

The Speaker

Prof. Alok Dhawan is currently Director, Centre of Biomedical Research, Lucknow. Previously he served as Director, CSIR-Indian Institute of Toxicology Research, Lucknow and Outstanding Professor, Biological Sciences, Academy of Scientific and Innovative Research (AcSIR), New Delhi. He also served as Director (Additional Charge), CSIR-Central Drug Research Institute, Lucknow from December 2017 -July 2018. He was the Founding Director, Institute of Life Sciences, and Dean, Planning and Development, Ahmedabad University, Gujarat. He has played an important role in building institutions of excellence in higher education and national laboratories across the country. He obtained his Ph.D. Degree in Biochemistry from University of Lucknow, India in 1991 and was awarded D.Sc. Degree (h.c.) by the University of Bradford, U.K. in 2017. He has visited several countries both for conducting research as well as to deliver lectures at scientific meetings. Prof. Dhawan developed several areas at CSIR-IITR namely, Genetic Toxicology, In-vitro Toxicology, Alternate to Animal Models in Toxicology, In-silico Toxicology and Nano-material Toxicology apart from an innovation ecosystem. He started the area of Nanomaterial Toxicology in India and published a guidance document on the safe use of Nanomaterials. He set up a state-of-the-art Nanomaterial Toxicology facility at CSIR-IITR and contributed towards framing the national guidelines for Nanopharmaceuticals and Nano-Agri products apart from others. As a Mission Director, he steered a CSIR-Mission Mode Programme on Food and Consumer Safety Solution (FOCUS) involving several CSIR institutes to provide technological solutions from "farm to fork". Apart from the National Reference and Referral Centres of the FSSAI, he has been instrumental in establishing the BIRAC-BIONEST and DSIR-CRTDH at CSIR-IITR to promote entrepreneurship. Prof. Dhawan has won several honours and awards including the INSA Young Scientist Medal in 1994, CSIR Young Scientist Award in 1999, the Shakuntala Amir Chand Prize of ICMR in 2002; Award Lecture in the field of Toxicology, by The National Academy of Sciences (India) in 2008; the Vigyan Ratna by the Council of Science & Technology, UP in 2011; Lucknow University Alumni Association Award, 2016; Professor S.S. Katiyar Endowment Lecture 2019-2020, The Indian Science Congress Association. He founded the Indian Nanoscience Society in 2007. In recognition of his work he has been elected Fellow, The National Academy of Sciences, India; Fellow, The Academy of Toxicological Sciences, USA; Fellow, The Academy of Environmental Biology; Fellow, Academy of Science for Animal Welfare; Fellow-Society of Toxicology (India), Founder Fellow, Indian Nanoscience Society; Fellow, Gujarat Science Academy; Fellow, Royal Society of Chemistry, Fellow, National Academy of Medical Sciences (2017), President, Society of Toxicology (STOX), India (2018-), Vice President-Environmental Mutagen Society of India (2006-07). He has to his credit more than 150 publications, 20 reviews/book chapters, seven patents, six copyrights and has edited eleven books.

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About PRL

The Physical Research Laboratory (PRL), known as the “cradle of space science” in India, is one of the premier research institutes founded in 1947 by Prof. Vikram Sarabhai, a renowned Cosmic Ray Scientist, a great visionary and institution builder. PRL played a seminal role in producing a highly motivated cadre of space scientists and the technologists of highest international repute. The first scientific rocket launched from Thumba on 21st November-1963 and many other rockets launched thereafter contained payloads developed at PRL. Dr. Sarabhai initiated many of these scientific and technical activities at PRL which eventually led to the formation of the Indian Space Research Organization (ISRO). Therefore, PRL is known as the “cradle of space science” in India. Further, the research in the area of Plasma Physics expanded to the formation of the Institute of Plasma Research (IPR).

As an institution PRL is unique in that it conducts fundamental research in a wide range of research areas from the Earth to the cosmos, and comprising Astronomy and Astrophysics; Solar Physics; Space and Atmospheric Sciences; Theoretical Physics; Geosciences; Atomic, Molecular and Optical Physics, Astrochemistry; and Planetary Sciences and Space Exploration. PRL is one of the rare research institutes of international repute wherein research in such diverse fields of sciences is carried out using several state-of-the-art experimental facilities that exist under one umbrella.

Along with the ongoing research, several new initiatives have been taken up during the last few years. The Multi-Application Solar Telescope (MAST) at Udaipur Solar Observatory has been operationalized. PRL initiated scientific programmes in frontier areas of research, which include a search for exo-planets, laboratory studies of interstellar grains, laboratory synthesis of cold astro-molecules and experimental studies in the field of quantum optics. PRL is also developing several scientific payloads as a part of ISRO’s larger vision and contributing to roadmap for competitive scientific exploration of the solar system and beyond. In particular, PRL has been contributing significantly not only in building instruments for space missions, such as Chandrayaan-1, Chandrayaan-2, AstroSat and upcoming Aditya-L1, Chandrayaan-3 and planetary and space missions, but also by bringing out new and insightful science results.

PRL contributes to several national and international research programmes and to human resource development through its Doctoral and Post-Doctoral Programmes, capacity building programmes, such as UN Course on Space Science, and science and engineering internship programmes. PRL contributes significantly to society through its Outreach Programmes by periodically organizing science exhibitions and Open Houses, planned visits of students of various school and college to PRL, and popular talks at various institutions to not only share the excitements of the advancements of contemporary scientific findings but also to encourage students to take up sciences as their research career.