DBT-TDNBC-DEAKIN–RESEARCH NETWORK ACROSS CONTINENTS FOR LEARNING AND INNOVATION (DTD-RNA) NEWSLETTER

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EDITORS:

Dr. Vibha Dhawan

Dr. Pushplata Singh

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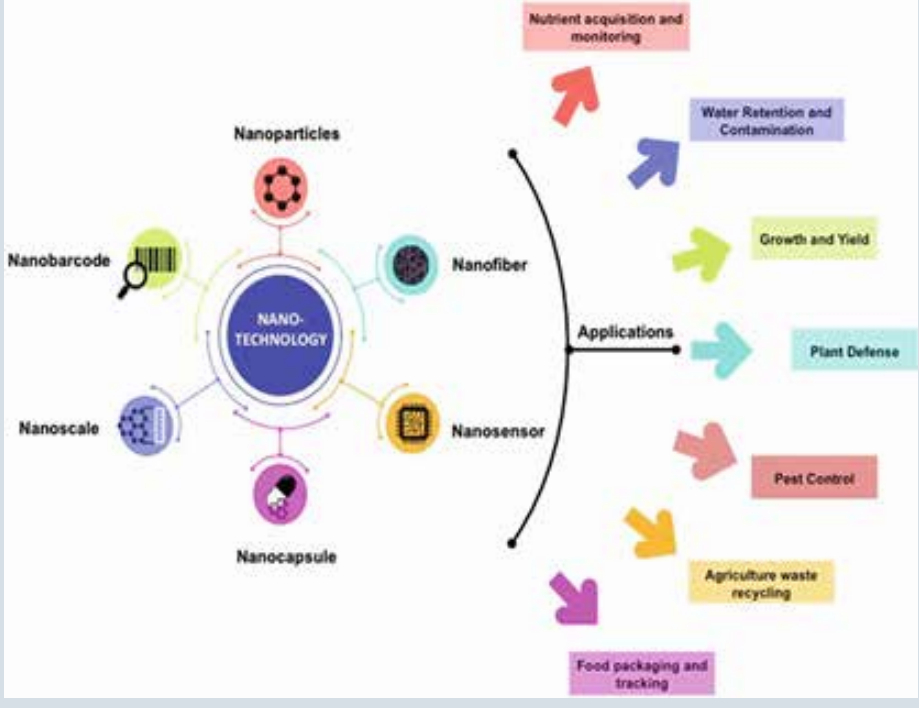
MESSAGE FROM DR PUSHPLATA SINGH, DTD-RNA INVESTIGATOR



Be the solution to soil pollution!

Throughout human history, our relationship with the soil has affected our ability to cultivate crops and influenced the success of civilizations. This relationship between humans, the earth, and food sources affirms soil as the foundation of agriculture. It is evident that to maintain and increase food production, efforts to prevent soil degradation must become a top priority of our global society. Current population models predict a global population of between 8 and 10 billion in the next 50 years and a two-fold increase in food demand. By embracing certain modern-day technologies and learning from the past, our society will continue to conserve soil resources and produce food supplies sufficient to meet current and future population demands.

Many of the negative impacts of industrial agriculture production (industrial crop production and animal production) on soil health. But an alternative exists. Sustainable agriculture is an approach to farming that focuses on producing food that can be maintained with minimal degradation of ecosystems and natural resources. The techniques can help build healthy soil, avoiding heavy synthetic fertilizer and pesticide use while protecting natural biodiversity in healthy soil. Some of the significant benefits that sustainable agricultural practices have on soil health:

- Improved carbon sequestration
- Improved water retention
- Less need for pesticides
- No need for synthetic fertilizer

Nanotechnology offers potential solutions for sustainable agriculture, including increasing nutrient utilization efficiency, improving the efficacy of pest management, mitigating the impacts of climate change, and reducing adverse environmental effects of agricultural food production. Many promising nanotechnologies have been proposed and evaluated at different scales. Still, several barriers to implementation must be addressed for technology to be adopted, including efficient delivery at field scale, regulatory and safety concerns, and consumer acceptance.

In this quarter we conducted three webinars under DTD RNA network for knowledge sharing on varied topics related to nanotechnology.

Webinar Series on "Waste-Derived Nano Materials Part-I: Industrial Wastes to Nano-Commodities: Status, Impact and Future Prospects"

Globally, around a billion tonnes of solid waste is generated every year, causing drastic losses to the environment, atmosphere and human health. This situation has motivated the development and implementation of different policy strategies, including complete bans on single-use plastics,

the reduction of hazardous substances and the treatment of hazardous wastes to reduce their toxicity. Since waste materials (such as municipal solid waste, household trash/ refuse, hazardous waste, wastewater like sewage, surface runoff, e-waste, industrial waste like radioactive waste and industrial sludges) are good sources for the recovery of metals and other elements, they have tremendous potential for the synthesis of nano-materials. In the last few decades, sufficient progress has been made for the synthesis of nano-materials from wastes using chemical or biochemical approaches, and a paradigm shift has now taken place to "create wealth from waste" rather than mere remediation of waste.

The Second Webinar was on "Waste-Derived Nanomaterials PART-II: BIO2NANO: BioResources to Sustainable Nanoproducts - Interventions, Current Status & the Future Perspective"

Nanotechnology continues to have a broad impact on nearly all sectors of the global economy, from electronics, energy to medicine, health and agriculture. In recent years, sufficient growth has been achieved in nanotechnology. However, the development of economic and environmentally benign processes for the scale-up production of nanomaterials and nanoproducts is one of the biggest challenges. The use of low cost and alternative renewable precursors like lignocellulosic biomass, algae and their residues for the production of bio (nano) products is the way forward owing to their flexibility, ease and the variety of procedures which the biosynthesis of valuable nanoproducts is implemented. Despite various advances in bio-derived nanoproducts, there is still a huge need for innovative, greener bio (nano) product synthesis to develop an economical and sustainable society. Although still burgeoning, the nano-based products from renewable natural resources may thrive and see dramatic developments in the near future.

The third webinar that we conducted was on NANOFORAGRI 2021: "Technology readiness and overcoming regulatory barriers to implement nanotechnology-enabled agriculture for sustainable future"

Nanotechnology has already brought many benefits to society, and many further opportunities to develop and implement new technologies exist, with countless more yet to be discovered. The twenty-first century is witnessing a scientific and industrial revolution due to the manipulation of matter at the nanometric level. This rising discipline (i.e. nanotechnology), is expounded to the practices for planning, fabricating, measuring and manipulating matter at the nanometre (nm) scale, grows at a thoughtless pace, and unique phenomena enable novel applications. In agriculture, nanotechnology is very relevant as worldwide demand for food has urged for an increase in production and better protection of crops, which demanded excessive use of chemicals. This creates a nutrient imbalance in soil, leaching losses, reduced productivity, and associated environmental problems. Nanobiotechnology offers state-of-the-art solutions for precision farming, targeted/ controlled delivery of inputs, improving soil and plant health, and, more importantly, need-based application of inputs for improved productivity and efficiency. Here we explored these barriers and ranked technology readiness and potential impacts of a wide range of agricultural applications of nanotechnology. We propose pathways to overcome these barriers and develop effective, safe and acceptable nanotechnologies for agriculture.

MESSAGE FROM

DR WALUREE THONGKAM,

SENIOR TECHNICAL OFFICER, NANO -SAFETY ALLIANCE SECTION, NATIONAL NANOTECHNOLOGY CENTER (NANOTEC), NATIONAL SCIENCE AND TECHNOLOGY DEVELOPMENT AGENCY (NSTDA)

A pandemic has a global influence. For more than a decade, nanotechnology has been a stride from the laboratory to the commercial market in all disciplines. During the pandemic, nanotechnology was used to develop antigen test kits (ATKs) for diagnosing infectious diseases, as well as other nano-biotechnology items that were useful during the difficult period. Safety and risk assessment, on the other hand, must evolve as technology progresses. The balance between efficacy and safety is essential for the long-term development of nanotechnology. The laboratory test and safety guidelines are essential, as is informing all stakeholders on nanosafety. A researcher, a developer, a corporation, an industry, a regulator, a policymaker, a consumer, and the general public. Stakeholders' shared understanding of nanosafety will hasten the development of a commercial product that can enter the market.

The gap in information between the reward and the danger is the supply chain's biggest roadblock. When it comes to risk assessment, it's not just about the consumer; it's also about the worker and the environment. Some national and international nanotechnology guidelines have recently been developed, however it is critical to disseminate and distribute knowledge among stakeholders. One of the most effective strategies for expanding information and mutual agreement among members is networking. Working together as a network among all stakeholder's aids in the more effective implementation of nanosafety and serves as a starting point for overcoming barriers between us.

The seminar and workshop are excellent methods for communicating not only among academics, manufacturers, developers, and regulators, but also with consumers and the general public in order to better understand the technology, which is also an indirect means of promoting it to the market. Thailand National Nanotechnology Center (NANOTEC) and The Energy and

Resources Institute (TERI), as well as members from Australia, Austria, Iran, Japan, Korea, Malaysia, Philippines, Taiwan, and Vietnam, are members of the Asia Nano Forum (ANF). As a worldwide network collaboration, ANF's objective is to encourage nanotechnology development that benefits each member in terms of education, economy, and environment. To communicate, exchange, and establish knowledge that will lead to the development of nanotechnology that is both safe and sustainable for the local and global communities. Despite the fact that travel between the countries has grown more restricted, we have been able to keep in touch via virtual meetings to deepen our international ties. Working together and sharing expertise will enable us to develop and promote nanotechnology products that are both user-friendly and environmentally beneficial. The pandemic is still ongoing, but we will soon be able to overcome it, and we will have the opportunity to engage in more collaborative action as a network. Let us look forward to future opportunities while appreciating our achievements thus far.

I wish all of you and your families the best for the year 2022!

MESSAGE FROM
PROF AMITAVA MUKHERJEE,
SENIOR PROFESSOR AND DIRECTOR, CENTRE FOR NANOBIOTECHNOLOGY, VIT UNIVERSITY

When we were thinking that the world has started limping back to normalcy after a two-year spate of COVID-19, the ending days of 2021 brought another shocking wave of COVID with a newer strain; a grim reminder that the battle is not won yet. When I am writing this message, the different parts of the world are grappling with another onslaught of the demonic disease. We in India are in the midst of another wave right now. But if we think deeply every crisis comes with opportunities. The research in biotechnology and nanobiotechnology came to the forefront and scientists hogged the limelight in this battle against the pandemic, be it vaccine development or diagnostics.

Borrowing a few lines from a famous poem by Swami Vivekananda, "Kali the Mother",

"Who dares misery love,

And hug the form of Death,

Dance in Destruction's dance,

To him the Mother comes."

In this moment of death and destruction, the researchers have been tirelessly working to discover the "solution", often running against time. I find this as one of the greatest examples of translating research from the labs to the masses. Research and innovation were never so important as they are now. The common man was never so bogged down with scientific jargon as they were in COVID times. There was a frenzied race to develop medical interventions against this pandemic disease. The race is not over yet and we are still in the middle of the battle of against this tiny demon.

Paraphrasing Charles Dickens' words about the events in the last couple of years, "It was the best of times, it was the worst of times, it was the age of wisdom,……, it was the season of light, it was the season of darkness, it was the spring of hope, it was the winter of despair". This despair gave rise to a change in mindset, reminding us of the need for innovation, product development and translational research. Be it oximeter, ventilators, or test kits the researchers took up the challenge and delivered.

In India, with ample support from the Government departments and scientific wings innovation has become a buzzword. Transcending the barriers of elite institutes, it has reached the corridors of small colleges, and finally touched upon ignited minds of school kids in remote corners across of the country. During the last few years, innovation and ideation were given a big boost by the authorities and even the new education policy recommends a shift from rote learning to innovative thinking. So innovative ideas, product-oriented and socially relevant research outcomes have become extremely important in the current state of affairs.

In this context, the interfacial domain of nanobiotechnology opens up a new vista of applications in disease diagnostics and therapeutics, agriculture, food preservation, and antimicrobials to name a few. Nano-enabled products and applications have already invaded our lives; we cannot think of day-to-day life without a bit of " nano" in it. To borrow a catchy phrase from an advertisement of SAIL, which was a huge hit a few years back, "There's a bit of nano in everybody's life" now.

So, time is ripe for the excellent networked groups like DTD-RNA that are devoted to delivering research outcomes across continents to wake up to the opportunities. This can only happen through effective collaborations, opening up to ideas from various cross-cutting domains, generating awareness about innovation, IPR and product-oriented research, working hand-in-hand with the industries, and finally achieving a cohesive bonding between divergent ideas. The power lies in knowledge and it is our turn now to grab it to change the world of tomorrow. I strongly believe that DTD-RNA is already moving ahead towards delivering us a better tomorrow with help of ground-breaking ideas in nanobiotechnology.

WEBINAR SERIES ON: WASTE-DERIVED NANO MATERIALS' PART-I INDUSTRIAL WASTES TO NANO-COMMODITIES: STATUS, IMPACT AND FUTURE PROSPECTS

A plethora of nanoparticles have been produced through various methods in past several decades and utilized to advance technologies for environmental applications, including water treatment, detection of persistent pollutants, soil remediation and fertilizer to enhance the crop productivity, amongst many others. The field of materials science and engineering is increasingly interested in increasing the sustainability of the processes involved in the production of nanoparticles, which motivates the exploration of alternative inputs for nanoparticle production as well as the implementation of green synthesis techniques. This webinar focused on the general aspects of nanoparticle synthesis from industrial, electric/electronic, plastic waste and different governing mechanisms involved in the production of nanoparticles. Further technologies demonstrating the utilization of waste-derived nanoparticles for applications in food safety, water quality and agriculture were highlighted. In this context, TERI-Deakin Nanobiotechnology Centre (TDNBC), Gurugram, India and Deakin University, Australia, in association with Department of Biotechnology, Govt. of India under "DBT-TDNBC-DEAKIN-Research Network" across continents for learning and innovation (DTD-RNA)" project organized a webinar series on "Waste-Derived Nanomaterials. Under this series, the first webinar held on 7th October, 2021 emphasized on Industrial Wastes to Nano-commodities: Status, Impact and Future Prospects".

The program aimed to spread advanced knowledge for the utilization of industrial waste as suitable input for the production of nanoparticles as added-value products. We concluded with some remarks from the sustainability viewpoint the critical aspects necessary for scale-up manufacturing and deployment of waste-derived nanomaterials. The webinar had participations from national leading scientists, graduate students, and technocrats to share their knowledge.

The webinar began with the welcome address by Dr. Vibha Dhawan, Director General, TERI followed by a virtual tour of TDNBC showcasing various national and international flagship projects and the nano research facilities at the center. The opening speech was given by Dr. Pushplata Singh and the sessions were moderated by Dr. Ruchi Agrawal and Dr. Suneeti Singh, TDNBC, TERI.

Eminent scientists from various renowned national and international institutes who contributed as speakers in the event were:

1. Dr Prakram Singh Chauhan from Israel institute of technology, Haifa, Israel
2. Dr. Manashi Das Purkayastha from Assam agricultural university, Jorhat, Assam, India
3. Dr. Deepesh Bhatt, from Dept. of Biotechnology· SRK Institute, Veer Narmad South Gujarat University, Surat, Gujarat, India

Various lectures discussing about the green synthesis of nanoparticles from various wastes and their future applications, synthesis of antimicrobial and functional ingredients from industrial waste derived nano particles and their applications were made by the speakers. After each session, an interactive Q&A session was held amongst more than 100 participants and researchers.

WEBINAR ON: WASTE-DERIVED NANOMATERIALS' PART-II 'BIO2NANO: BIORESOURCES TO SUSTAINABLE NANOPRODUCTS- INTERVENTIONS, CURRENT STATUS & THE FUTURE PERSPECTIVE'

A virtual webinar on "Waste-Derived Nanomaterials' PART-II "BIO2NANO: BioResources to Sustainable Nanoproducts- Interventions, Current Status & The Future Perspective" organized by TERI-Deakin Nanobiotechnology Centre (TDNBC) through DBT -TDNBC - DEAKIN – Research Network Across continents for learning and innovation (DTD-RNA) network. The half a day webinar with more around 100 participants was chaired by Dr. Vibha Dhawan, Director General, TERI and the sessions were moderated and successfully organized by Dr. Pushplata Singh, Acting Director, Dr. Ruchi Agrawal, Dr. Amritpreet Kaur Minhas, TDNBC on 20th October 2021.

The webinar aimed to spread advanced knowledge on the some of the most recent trends, challenges, and applications in the field of bio (nano) products derived from sustainable resources. There was an overwhelming response from the budding and middle-level scientists, faculties from the various regions of the world, who participated actively in the event and has gained valuable learnings that would help them in achieving their research goals. The webinar provided a platform for the knowledge advancement and to communicate/ collaborate with other experts working in this area.

Eminent speakers from various renowned national institutes discussed about the challenges, concerns and prospective solutions to use low cost and alternative renewable precursors like lignocellulosic

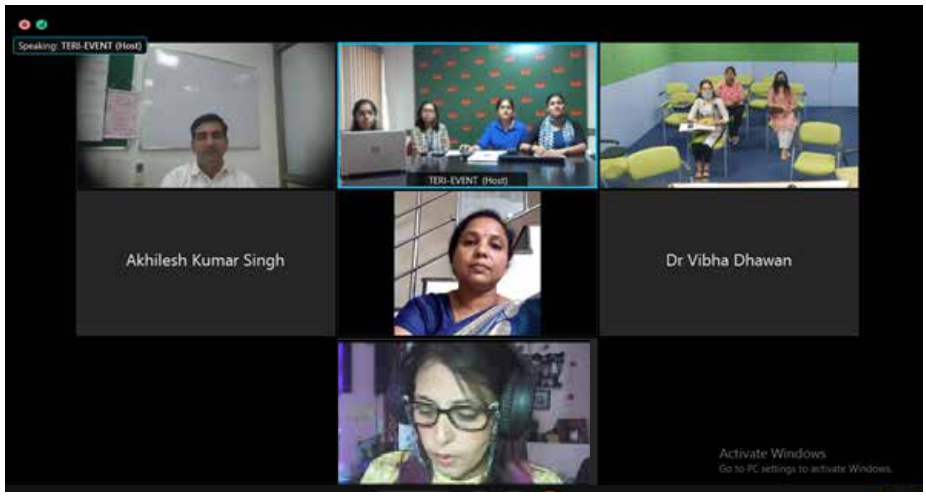
biomass, algae and their residues for the production of bio (nano) products.

The following were the speakers:

1. Dr. Reshmy R. Department of Chemistry, Bishop Moore College, Mavelikkara, Kerala, India
2. Dr. Akhilesh Kumar Singh Department of Biotech, School of Life Sciences, Mahatma Gandhi Central University, Motihar, Bihar, India
3. Dr. Sudesh Kumar Yadav Center of Innovative and Applied Bioprocessing (CIAB), Mohali, Punjab, India
4. Dr. Vandana Vinayak Diatom Nano-engineering and Metabolism Laboratory (DNM), School of Applied Sciences, Dr. Harisingh Gour Vishwavidyalaya, Sagar, Madhya Pradesh, India

After each session, an interactive Q&A session was held.

The webinar was attended by more than 100 participants across the globe.



INTERNATIONAL CONFERENCE – NANOFORAGRI 2021

The manipulation of matter at the nanometric scale has revolutionized the scientific ideas for advancement of several fields including medicine, electronics and agriculture. In past, there has been liberal use of chemicals to enhance agricultural productivity which resulted in detriorated soil health and the environment at large. As the population grows, there is a surge in worldwide demand for food and thus nanotechnology based interventions are very relevant for agriculture. The nano-products such as nanofertilizers, nanopesticides and smart delivery nanovehicles are promising to increase the production and ensure better protection of crops. In this regard, TERI-Deakin Nanobiotechnology Centre (TDNBC), Gurugram, India and Deakin University, Australia, in association with Department of Biotechnology, Govt. of India under "DBT-TDNBC-DEAKIN-Research Network" across continents for learning and innovation (DTD-RNA)" project organized an international conference NANORFORAGRI 2021 with a theme as "Technology Readiness and Overcoming Regulatory Barriers to Implement Nanotechnology-Enabled Agriculture for Sustainable Future". The conference was conducted on 8th and 9th December 2021 at TERI Gram, Gurugram, Haryana, India.

Due to the current global situation with the COVID-19 pandemic, this conference was a unique platform where the sessions were organized in hybrid mode – attendees both

in person and virtually. The conference was exclusively dedicated to applying nanoscale science and technology in re-engineering the quality, quantity and safety of agricultural and food systems.

The conference began with the welcome address by Dr Pushplata Singh, Director TERI Deakin Nanobiotechnology Centre. This was followed by the inaugural led by Dr Vibha Dhawan, Director General, TERI. The inaugral included eminent dignitaries from government, academia and industry.

- Dr Namrata Pathak, Technology Mission Division (Nano Mission), Department of Science & Technology, India
- Prof Julie Owens, Deputy Vice-Chancellor Research and Alfred Deakin Professor, Deakin University, Australia
- Prof Bas Baskaran, Pro Vice Chancellor International Research Partnerships, Deakin University, Australia
- Mr Mathew Johnston, Minister-Counsellor (Education & Research) for South Asia, Australian High Commission, India
- Mr Rakesh Daultabad, MLA, Chairman of Haryana Agro Industries Corporation, India
- Dr Rashmi Sharma, Department of Science & Technology, Technology Bhawan, India
- Mr. Kanwal Singh Chauhan, Padma Shri Awardee, Haryana, India

The conference brought together highly accomplished experts with diversified backgrounds across the globe and focussed on the different thematic sessions.

- **Advances in Nano-fertilizers and Nano-pesticides**

o Dr Pushplata Singh, Director, TERI-Deakin Nanobiotechnology Centre (TDNBC), TERI, Gurugram Haryana, India
o Prof. David Cahill, Personal Chair, Deakin University, Australia
o Dr J C Tarafdar, Former ICAR Emeritus Scientist, Central Arid Zone Research Institute (CAZRI), Jodhpur, India
o Dr Maan Singh Sidhu, Science and Technology Counsellor, Royal Norwegian Embassy, New Delhi, India
o Dr Tarunendu Singh, Head (Agriculture Services), IFFCO Sadan, New Delhi, India
o Shri Sagar Kaushik, UPL Limited, Mumbai, India
o Dr Anand Gole, GM R&D - Fertilizers & Speciality Nutrients, Coromandel International Limited, Secunderabad, Telengana, India

- **Smart Delivery, Sensing and Precision Engineering**

o Prof H.B. Bohidar, TDNBC,TERI, Gurugram, Haryana, India
o Dr Dhruba Jyoti Sarkar, Scientist, ICAR-Central Inland Fisheries Research Institute, Kolkata, India
o Prof Norberto Masciocchi, Università Degli Studi dell'Insubria, Italy
o Dr Erwann Guénin, Professor, Université de Technologie de Compiègne, ESCOM, France
o Dr Lingxue Kong, Professor, Institute of Frontier Materials, Deakin University, Australia
o Prof Neena Mitter, Director, Centre for Horticultural Science at Queensland, Alliance for Agriculture and Food Innovation, University of Queensland, Australia
o Dr Arun Banerjee, Team Lead, Reliance Industries Limited, Mumbai, India

o Dr Sarabjot Singh Anand, Co-founder and Chief Data Scientist, TATRAS, New Delhi, India
o Dr Manoj Varma, Indian Institute of Science, Bangalore, India

- **Perceptions amongst farmers, Industries and Field Trials**

o Dr Mandira Kochar, TDNBC, TERI, Gurugram, Haryana, India
o Shri Dhananjay Edakhe, Senior VP-Sales & Marketing (Agri Solutions), Zydex Industries, Pune, India
o Dr P S Vijayakumar, Scientist, INST, Mohali, India
o Dr Naresh Prasad, Deputy General Manager, Chambal Fertilizers & Chemicals Limited, Ghaziabad, India
o Dr Jim Rookes, Deakin Univeristy, Australia
o Dr Sandeep Lal, Senior Scientist, IARI
o Ms Nidhi Mathur, Investment Professional (Venture Capital), Axilor Ventures, Pvt Ltd, Bengaluru

- **Advances in seed treatment**

o Dr Arvind Kapur, MD, ACSEN HIVEG, Pvt Ltd, Haryana, India
o Dr Udaya Bhaskar K., Senior Scientist, Seed Science and Technology, ICAR , MAU, India
o Mrs Ranita Das, Chief Technical Officer-International Business, Geolife Agritech India Pvt. Ltd., Maharashtra, India
o Dr Manish Patel, Executive Director, Incotec India Pvt Ltd., Gujarat, India

- **Regulatory Aspects of Nanotechnology**

o Dr Waluree Thongkam, Director, Nanosafety Alliance Department, National Nanotechnology Center (NANOTEC), Thailand
o Dr C. Anandharamakrishnan, Director, National Institute of Food Technology, Entrepreneurship & Management (NIFTEM), Thanjavur, India
o Dr Rai S. Kookana, Chief Research Scientist, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
o Prof Amit K Dinda, Professor and Chief Coordinator, Centre for Medical Innovation and Entrepreneurship, AIIMS, Delhi, India
o Prof Amitava Mukherjee, Director, Centre for Nanobiotechnology (CNBT), VIT, Vellore, India
o Dr Namrata Pathak, Associate Head and Scientist, Technology Mission Division (Nano Mission), Department of Science & Technology, New Delhi, India
o Dr Paul Wright, FIUPAC FACTRA, Associate Professor in Toxicology and Head of RMIT Nanosafety Research Group, School of Health and Biomedical Sciences, RMIT University, Melbourne, Australia; Co-chair of the Asia Nano Forum (ANF) Working Group on Nanosafety & Risk Management; President of the

Australasian College of Toxicology and Risk Assessment
- o Mr Vipin Saini, CEO-BASAI, Haryana, India
- o Dr Richard Williams, Associate Professor, Deakin University, Australia
- o Mr A. Kulandaivel, Rallies India Limited
- o Dr Aaron Schultz, Deakin University, Australia

- **Bio derived nano-Agri inputs products**
- o Dr Gunjan Mukherjee, Additional Director, Institute of Biotechnology, Chandigarh University
- o Prof Colin Barrow, Deakin University, Australia
- o Dr T. Rangarajan, Technical Director, Nualgi Nanobiotech, Bengaluru, India
- o Dr Pallavolu Maheswara Reddy, Senior Scientist, TDNBC, TERI, Gurugram, Haryana, India
- o Dr Shruti Shukla, Senior Scientist, TDNBC, TERI, Gurugram, Haryana, India
- o Mr Dhirendra Kumar, Director of Research and Development, Natural Plant Protection Limited, Bangalore

This conference also involves thought-provoking panel discussions with inventors, industries and regulators. Eminent speakers and invited panellists from various renowned national and international institutes discussed disruptive ideas from food and agriculture nanotechnology.

An interactive platform for young and established researchers was also provided by showcasing posters and selected oral presentations in the focused thematic sessions to understand the innovation space and scope for nanobiotechnology interventions to address issues in food and agriculture areas. Ms Ayushi Priyam, a student of TERI-Deakin Nanobiotechnology Centre, Haryana, India and Ms Mahima Chandel, Institute of Nano Science and Technology, Punjab, India, got the best Oral presentations by young researcher's award. Ms Arshi Gupta, a student of TERI-Deakin Nanobiotechnology Centre, Haryana, India got the best poster award during this conference.

DTD-RNA PARTNERS THAT HAVE JOINED DURING DECEMBER 2020-MARCH 2021

Network Partners

BioNanonet (BNN), Austria

Institute Partners

International Fertilizer Development Centre (IFDC), USA

Industry Partners

- KLR Green Biologicals Pvt. Ltd (KLRGB), Nagarjuna Fertilizers & Chemicals Ltd., India
- DCM ShriRam Ltd, India
- Coromandel International Ltd, India
- Adventz Group (Zuari Agro Chemicals Ltd.), India
- Croda India Company Private Limited, India
- Nuziveedu Seeds Ltd and Global Agrigenetics, India
- Smart Farming Technologies, Netherlands

Upcoming events of DTD-RNA network during October–December 2021

Website: https://www.teriin.org/projects/dtd-rna/events.php

- E -Winter School - 15th Feb, 2022 - Advanced Applications of Nanotechnology for Food and Environment
- Hands on Training Module - 22nd Feb, 2022 -
  Hands on Training for Synthesis and Characterization of Nanomaterials
  Hands on Training for Seed coating for Climate Smart Agriculture
- Hands on Training Module - 3rd March, 2022 - Quality Control analysis of mycorrhiza based biofertilizers