



**CSIR-INDIAN INSTITUTE OF  
TOXICOLOGY RESEARCH**



**COUNCIL OF SCIENTIFIC  
& INDUSTRIAL RESEARCH**

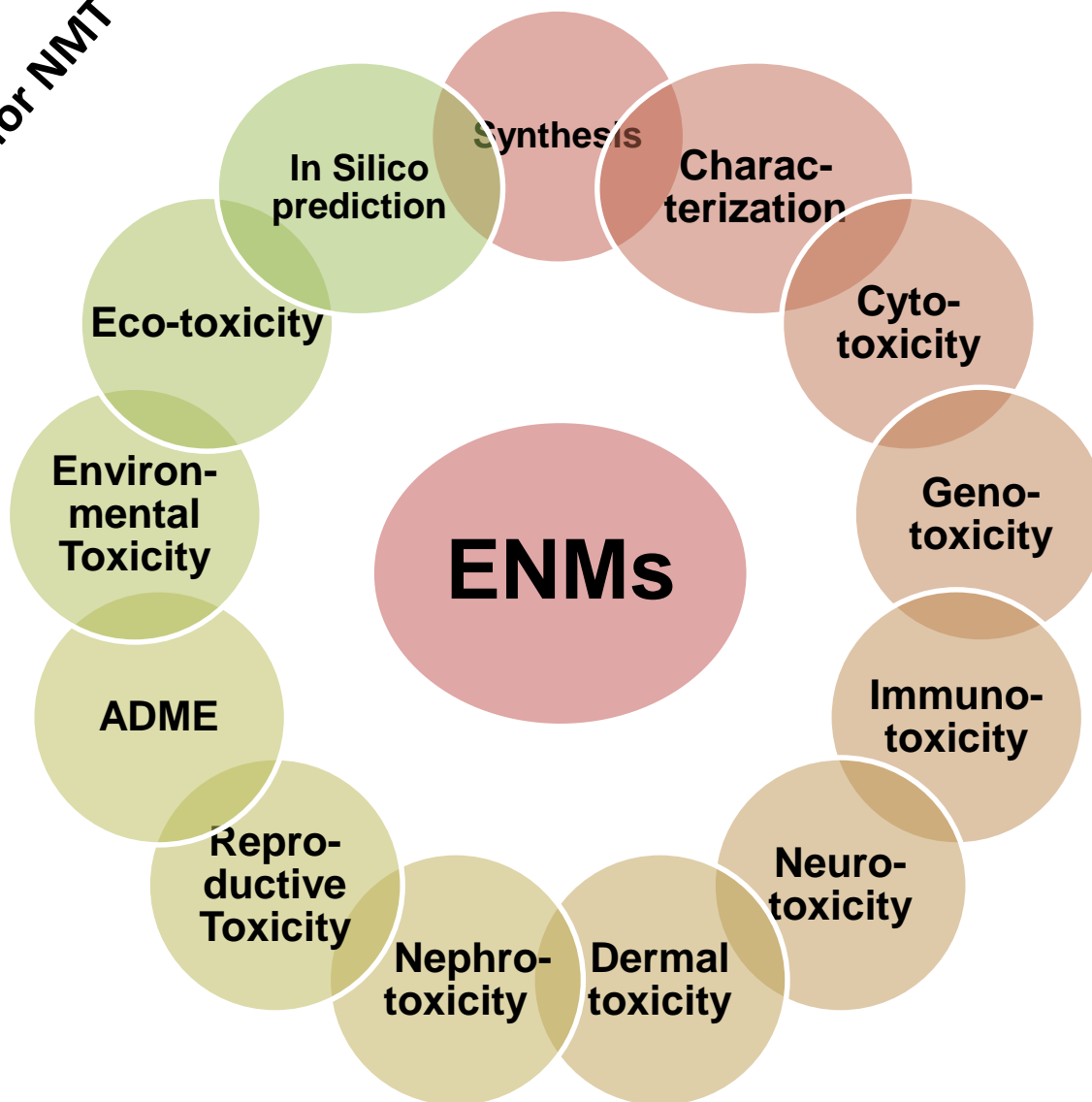
# **Safety/ Toxicity testing and Knowledge dissemination**

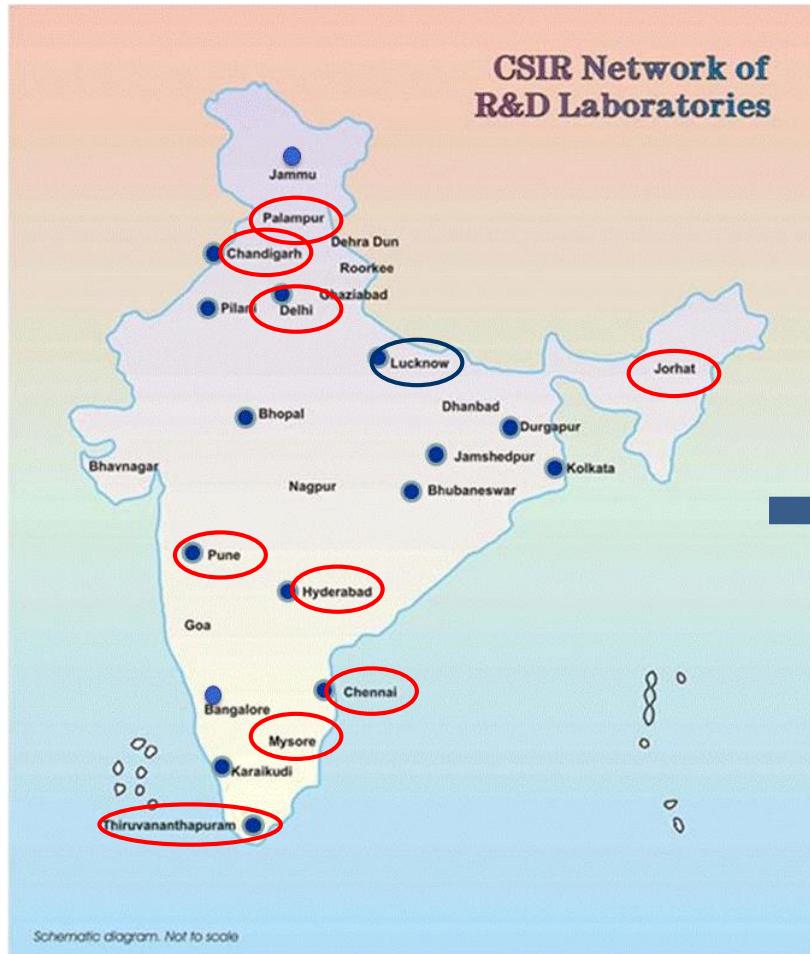


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*Enabling IITR expertise for NMT*





**Nanomaterials: Applications and Impact on Safety, Health and Environment (NanoSHE) (2012-17)**  
**NWP-35 (2007-12)**



**Fourteen laboratories across the country**

CSIR-CCMB, CSIR- CDRI, CSIR- CFTRI, CSIR- CLRI, CSIR- CSIO, CSIR- IGIB, CSIR- IHBT, CSIR- IICT, CSIR- IMTECH, CSIR- NCL, CSIR- NEIST, CSIR- NIIST, CSIR- NPL, CSIR-IITR

# Models and methods for the toxicity/safety of ENMs and products

➤ *In vitro*: 14

➤ *In vivo*: 04

➤ **Ecotoxicity: 04**

} Established and  
validated/ at different  
stages of validation  
at IITR

# Models and methods for the toxicity/safety of ENMs and products

## *In vitro* models

- ✓ Neurotoxicity
- ✓ Genotoxicity
- ✓ Immunotoxicity
- ✓ Nephrotoxicity
- ✓ Hepatotoxicity
- ✓ Neuro-immunotoxicity
- ✓ Phototoxicity

# Models and methods for the toxicity/safety of ENMs and products

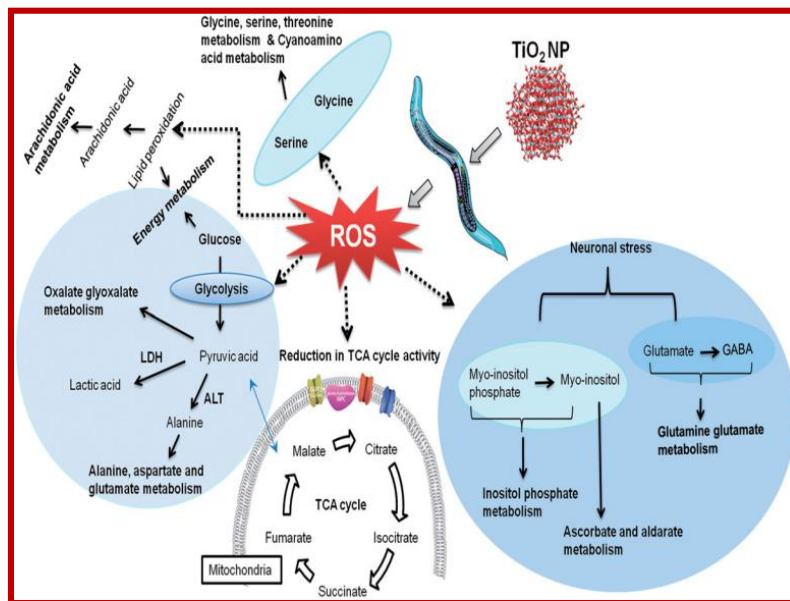
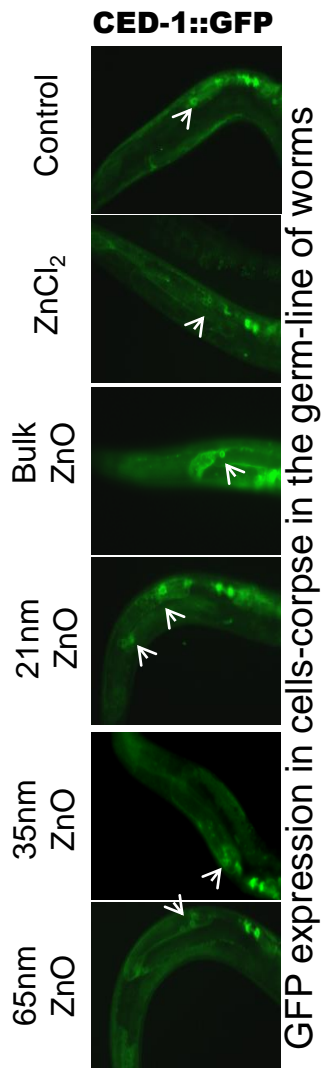
## *In vivo* models

- ✓ Immunotoxicity
- ✓ Nephrotoxicity
- ✓ Genotoxicity
- ✓ GI-Toxicity

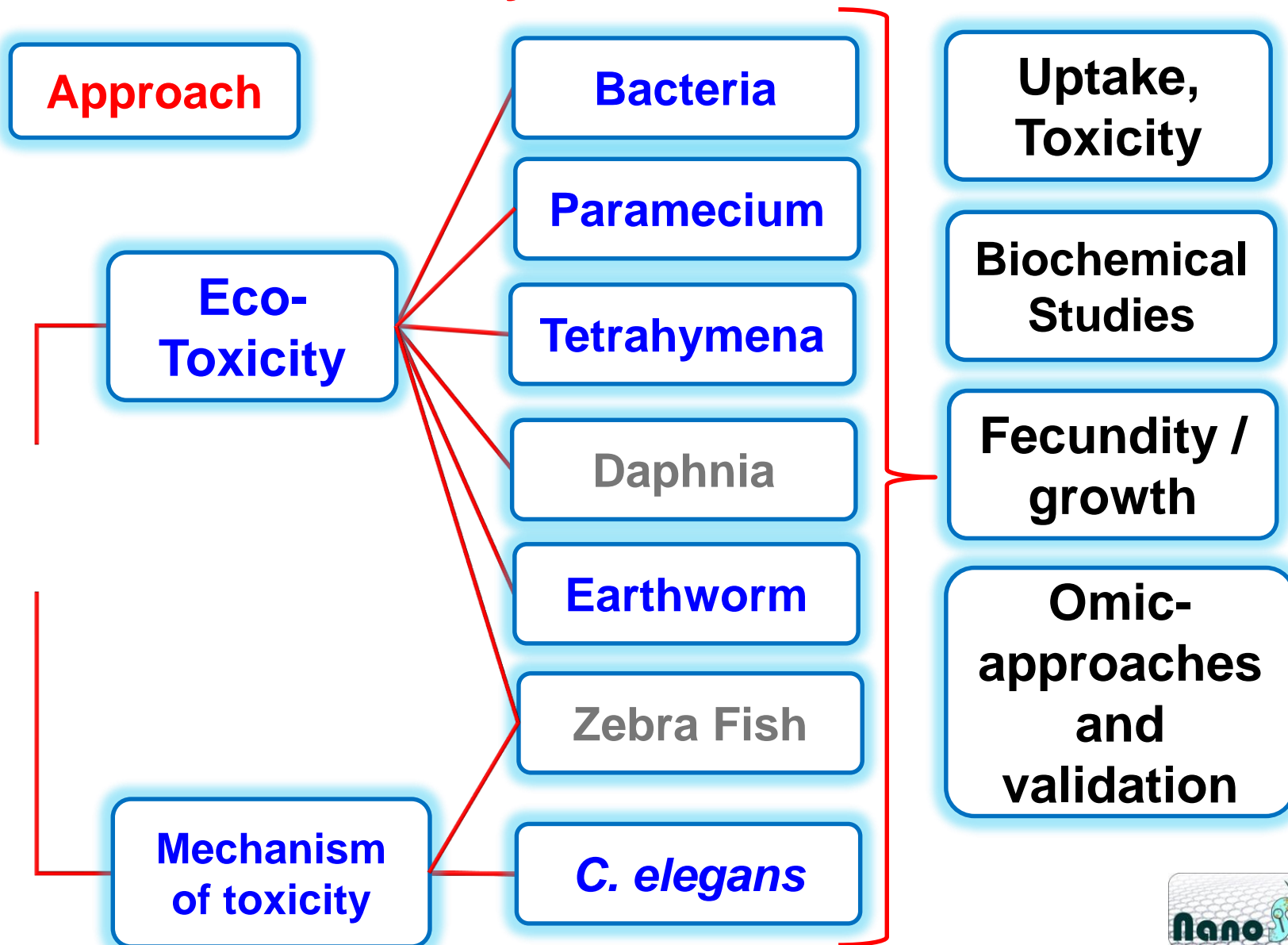
# Models and methods for the toxicity/safety of ENMs and products

## Ecotoxicity models

- ✓ *Paramecium caudata*
- ✓ *Tetrahymena pyriformis*
- ✓ *Caenorhabditis elegans*
- ✓ *Eisenia fetida*



# Ecotoxicity of nanomaterials





## Nanomaterials evaluated for *in vitro/in vivo* toxicity/safety at CSIR-IITR

Category	Nanomaterials
<b>Metal NPs</b>	Au, Ag, Pt
<b>Metal oxide NPs</b>	ZnO, TiO <sub>2</sub> , CeO <sub>2</sub> , Cr <sub>2</sub> O <sub>3</sub> , CuO, Fe <sub>2</sub> O <sub>3</sub>
<b>Quantum dots</b>	Mn-ZnS, CdTe
<b>Carbon based NMs</b>	Fullerenes, Carbon nanotubes, Graphene oxide
<b>Polymers</b>	PLGA, PEI, O-hexadecyl-dextran
<b>Nano encapsulated compounds</b>	<ul style="list-style-type: none"> <li>• Bromelain loaded PLGA nanoparticles</li> <li>• Gellan gum blended PEI nanocomposite</li> <li>• O-hexadecyl-dextran entrapped berberine nanoparticles</li> <li>• Nicotine encapsulated PLGA nanoparticles</li> <li>• Polyglutamic acid-based nanocomposites</li> <li>• Linear PEI nanoparticles</li> </ul>

# IMPACT

Nanomaterials	Publications	Citations
ZnO	12	849
TiO <sub>2</sub>	8	552
Fullerenes	1	220
CuO	1	124
Fe <sub>2</sub> O <sub>3</sub>	1	114
Graphene oxide	1	46
Cr <sub>2</sub> O <sub>3</sub>	3	20
CeO <sub>2</sub>	1	14
CNTs	2	8
Polymers, Polymer encapsulated phyto chemicals, etc.	9	110

- Publications selected as cover page articles in reputed journals
- Toxicology Letters 185; 211-218, 2009. (This article featured in the European Commission document “Science for Environment Policy- Nanomaterials, Issue 12, page 4, April 2009”)
- **Established/ validated models available for toxicity/safety assessment of ENMs**

## IMPACT

- CSIR-IITR as a Member, ISO/TC229 (nanotechnologies) was instrumental in getting **Eleven** ISO standards approved and adopted by BIS (MTD-33; CSIR-IITR as coordinator), Government of India.
- Two standards for methods in nanomaterial toxicology (Eco-toxicity methods) formulated, have been submitted to BIS for ISO approval.

# Guidelines for safe handling of nano-materials in laboratory



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## Guidance for Safe Handling of Nanomaterials

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The materials at the nanoscale can have different properties compared with same materials at the larger scale. This change in behaviour can be attributed to increased relative surface area and dominance of quantum effects. It has been shown that the nanomaterials can cause adverse effects to human and environmental health. Therefore there is need for developing guidelines for safe use of nanomaterials in the laboratory to minimise exposure to researchers and environment. The purpose of this document is to provide the guidance on proper handling and disposal of nanomaterials (NMs) for personnel involved in activities that entail handling of NMs, in order to minimize risks from exposure to NMs in a laboratory.

**Keywords:** Nanomaterials, Safety, Handling, Guidance.

➤ Updating of guidelines in progress (ICMR and DST, Govt. of India)

# Dissemination

## Conferences

- **International Conference on Nanomaterial Toxicology'** held at CSIR-IITR, Lucknow, India, February 5-7, 2008.
- **International Symposium on The Safe Use of Nanomaterials & Workshop on Nanomaterial Safety: Status, Procedures, Policy and Ethical Concerns'** held at CSIR-IITR, Lucknow, India, February 1-3, 2011.

## Workshops

- **Methods in Nanomaterial Toxicology** held at CSIR-IITR, Lucknow, India, February 4-6, 2011.
- **Applications of Flow cytometry in Nanomaterial Toxicology**, held at CSIR-IITR, Lucknow, India, January 18-22, 2010.

## Lectures to school children on safety issues pertaining to nano-materials and nanotechnologies (Under DST-INSPIRE Scheme by CSIR-IITR faculty)

- ~400 students who are among board toppers studying science (Class XI & XII) in different schools across two states (Uttar Pradesh and West Bengal, India) (2012-14).



## Dissemination-contd....

### Special issues of journals (Guest edited by CSIR-IITR faculty)

- **Nanotoxicology Jan 2008, Vol. 2, No. s1: S2–S88.** Abstracts of ICONTOX 2008, Lucknow, India, February 5-7, 2008.
- **Nanotoxicology, Volume 3, Number 1 (2009).** Selected papers presented at the International Conference on Nanomaterial Toxicology held at Indian Institute of Toxicology Research, Lucknow, India from February 5-7, 2008.
- **Journal of Biomedical Nanotechnology, volume 7, Number 1(2011)**

# Thank you