UNIVERSITY OF CALIFORNIA

UC CEIN Center for Environmental Implications of Nanotechnology

UC CEIN: Predictive Toxicology Assessment and Safe Implementation of Nanotechnology in the Environment

Principal Investigators:

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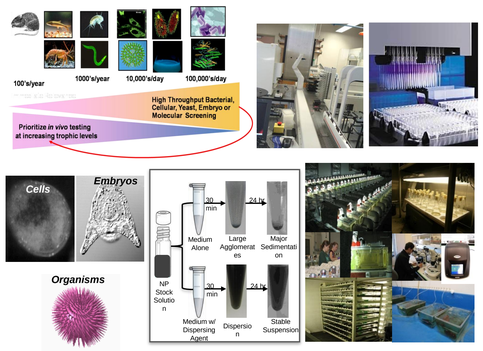
Mission

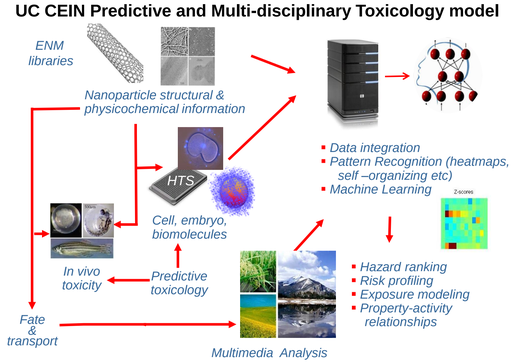


The UC CEIN was established in September 2008 with the mission to ensure that nanotechnology is introduced in a responsible and environmentally compatible manner, thereby allowing the US and international communities to leverage the benefits of nanotechnology for global economic and social benefit.

This mission is being accomplished by developing a broad-based series of decision tools based on models of predictive toxicology and risk ranking premised on selected nanomaterial property-activity relationships that determine fate, transport, exposure, and biological injury mechanisms at cellular, tissue, organism, and population levels.

The UC CEIN integrates the expertise of engineers, chemists, colloid and material scientists, ecologists, marine biologists, cell biologists, bacteriologists, toxicologists, computer scientists, and social scientists to create the predictive scientific platform that will inform us about the possible risks and safe design of nanomaterials (NMs) that may come into contact with the environment.

UC CEIN Predictive and Multi-disciplinary Toxicology model

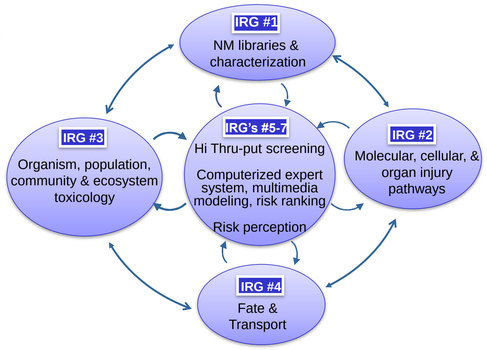


Organization

Research within the UC CEIN is carried out by 46 projects across seven Interdisciplinary Research Groups (IRGs):

- IRG 1: NM Standard Reference and Combinatorial Libraries and Physical-Chemical Characterization
- IRG 2: Studying NM Interactions at the Molecular, Cellular, Organ, and Systemic Levels
- IRG 3: Organismal and Community Ecotoxicology
- IRG 4: Nanoparticle Fate and Transport
- IRG 5: High-Throughput Screening for NM Properties and Nanotoxicology
- IRG 6: Modeling of the Environmental Multimedia NM Distribution and Toxicity
- IRG 7: Risk Perception of Potential Environmental Impacts of Nanotechnology

Interdisciplinary Research Groups (IRGs)



Education/Outreach

Education/Outreach ensures that the research performed in the UC CEIN is conveyed effectively to a broader range of stakeholders, provides growth and mentoring opportunities for students and postdoctoral fellows, and encourages interdisciplinarity and synergism within the Center.

Courses, Seminars, Symposia 2010-2011

- Nanotoxicology course, offered online and accessible via iTunesU
- Seminar speakers: Paul Schulte, NIOSH; Candace Tsai, UMASS-Lowell; Jacqueline Isaacs, Northeastern University; Piotr Grodzinski, National Cancer Institute
- Nanotechnology Symposium VI: Progress in Protection, co-sponsored with CA DTSC

Nanomaterial Hazard Ranking and Nano Regulatory Policy

- Assembled and evaluated publically-available information regarding the manufacture, sale, import, export, and use of NMs and products containing NMs in California for the California Department of Toxic Substances Control (CA DTSC).
- Reviewed & evaluated responses received under AB 289 relating to CNTs for CA DTSC.

Synergistic Activities

- The interdisciplinary Protocols Working Group is developing a "meta" protocol for dispersion of NMs in biological and environmental media.
- The Student/Postdoc Advisory Committee (SPAC) will sponsor a daylong workshop, "Communicating your science to the public," lead by Sharon Dunwoody (University of Wisconsin, Madison) in February 2011 at UCLA.

K-12 and Public Outreach Events, lead by faculty, undergraduate, graduate, postdoc volunteers:

- "Exploring your universe," UCLA campus, November 13, 2010
- Lecture series for AP science students, October 2010, January and February 2011
- NanoDays 2011, in partnership with NISENet, CA Science Center, and UCLA CA Teach
- Nanotechnology: Small is Big! public lecture, April 16, 2011, Santa Monica Public Library

Acknowledgements

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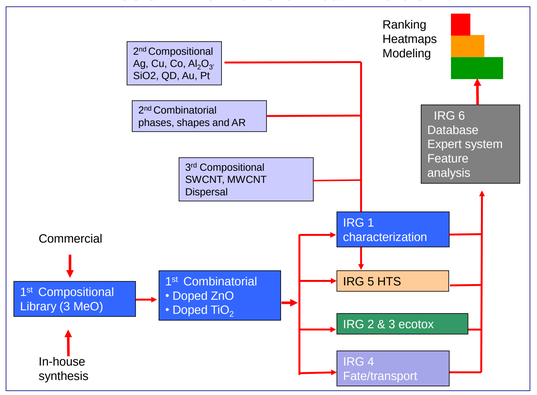
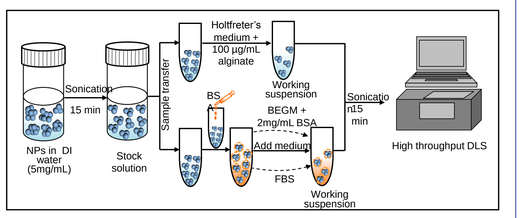
Select Accomplishments

UC CEIN: Workflow Over Initial 24 months

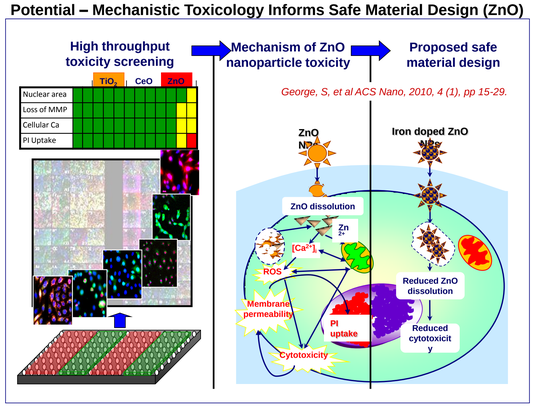


IRG 1, 2, 3, 4, 5: Development of Standardized NP Dispersion Protocols for Relevant Environmental Conditions

NP Dispersion Strategy Premised on Coating the Surface of Materials with Biologically Relevant Dispersing Agent (BSA, FBS, Alginate) Led to Stably Suspended NM in Experimental Media as Determined by High Throughput DLS.

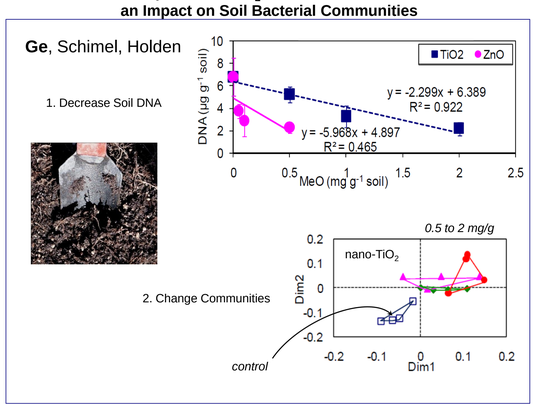


IRG1, 2, 5: Develop HTS Platform for Identifying NM with Toxic Potential – Mechanistic Toxicology Informs Safe Material Design (ZnO)

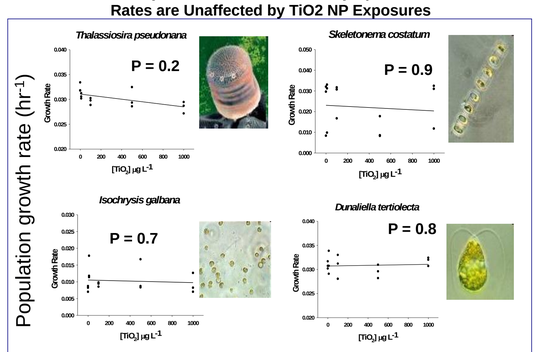


George, S, et al ACS Nano, 2010, 4 (1), pp 15-29.

IRG 2: Exposure to TiO_2 and ZnO NMs Has Shown an Impact on Soil Bacterial Communities

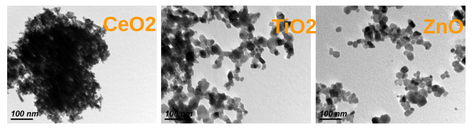


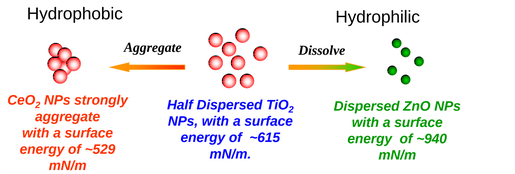
IRG 3: Toxicity Studies Show Marine Phytoplankton Growth Rates are Unaffected by TiO2 NP Exposures



TiO_2 NP have little influence on marine phytoplankton because they do not dissolve in SW (*Miller et al. 2010*)

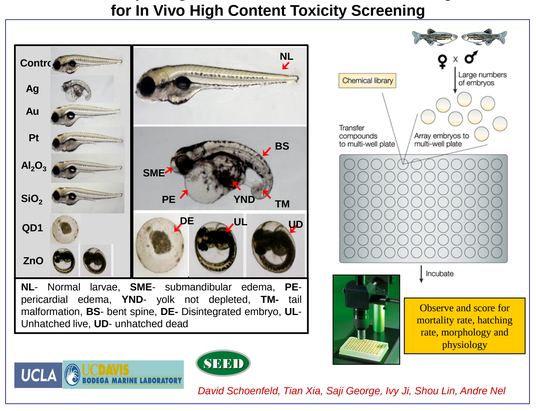
IRG 4: Material Composition That Defines the Surface Energy of MeO NPs Influences Their Dispersion Behavior in Water





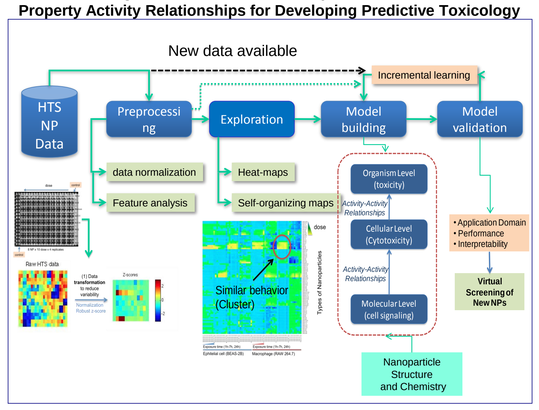
P. Somasundaran, X. Fang, I. Chernyshova , Columbia University

IRG 3 & 5: Exploring the Use of Zebrafish as a Model Organism for In Vivo High Content Toxicity Screening

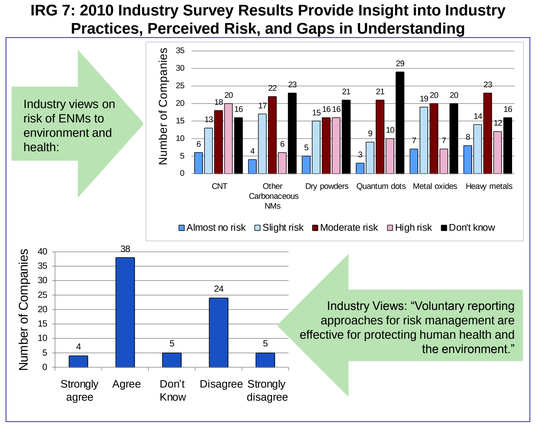


David Schoenfeld, Tian Xia, Saji George, Ivy Ji, Shou Lin, Andre Nel

IRG 6: Building State of the Art Data Analysis Platforms to Delineate Property Activity Relationships for Developing Predictive Toxicology



IRG 7: 2010 Industry Survey Results Provide Insight into Industry Practices, Perceived Risk, and Gaps in Understanding



The UC Center for Environmental Implications of Nanotechnology (UC CEIN) at UC Los Angeles (UCLA) is in partnership with UC Santa Barbara (UCSB), UC Davis (UCD), UC Riverside (UCR), Columbia University in New York, the Molecular Foundry at Lawrence Berkeley National Laboratory (LBNL), the Lawrence Livermore National Laboratory (LLNL), Nanyang Technological University in Singapore (NTU), University of New Mexico (UNM), Sandia National Laboratory (SNL), University of Texas in El Paso (UTEP), University of Bremen (Germany), University of British Columbia (UBC), Cardiff University (Wales), University College Dublin (UCD, Ireland), and Universitat Rovira i Virgili in Spain (URV).

This material is based upon work supported by the National Science Foundation and the Environmental Protection Agency under Cooperative Agreement Number DBI-0830117. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the Environmental Protection Agency. This work has not been subjected to EPA review and no official endorsement should be inferred.