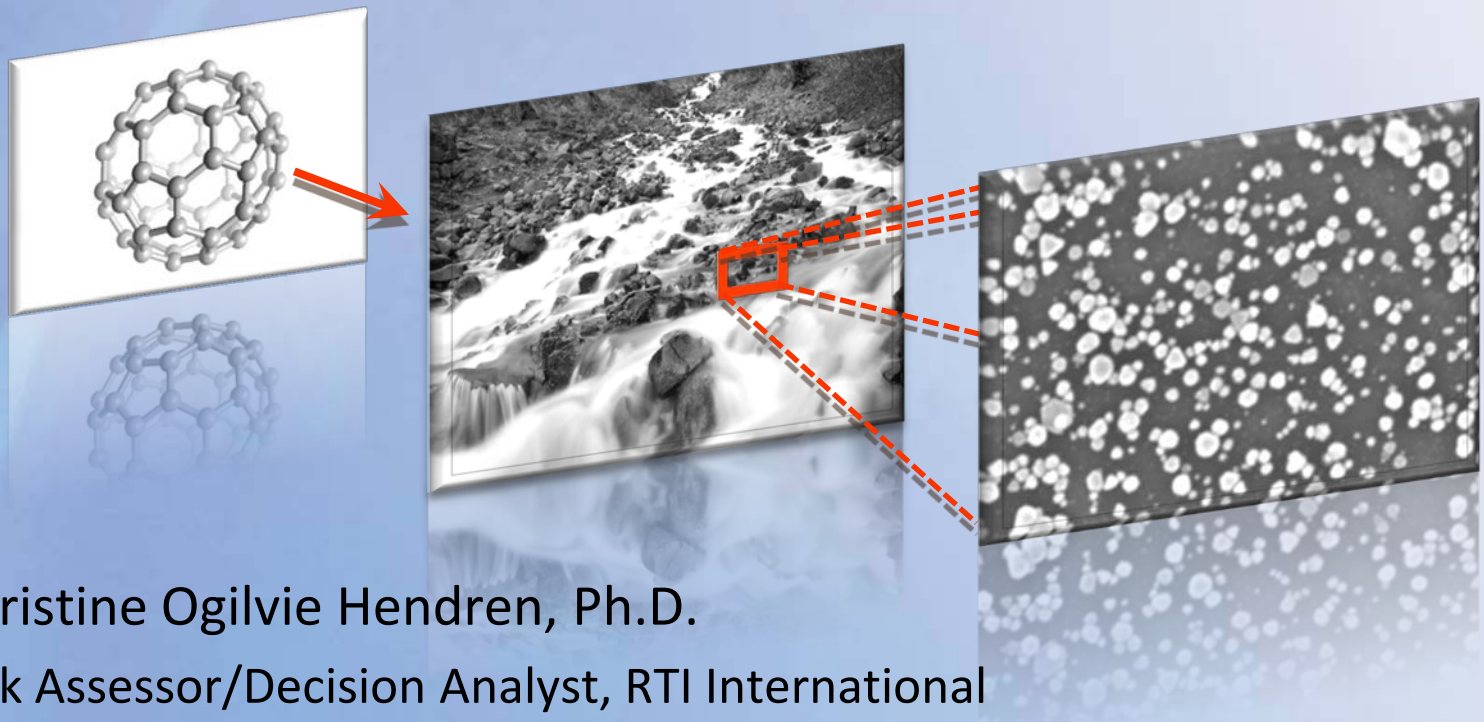
Framing the Challenges of Nano Risk Assessment



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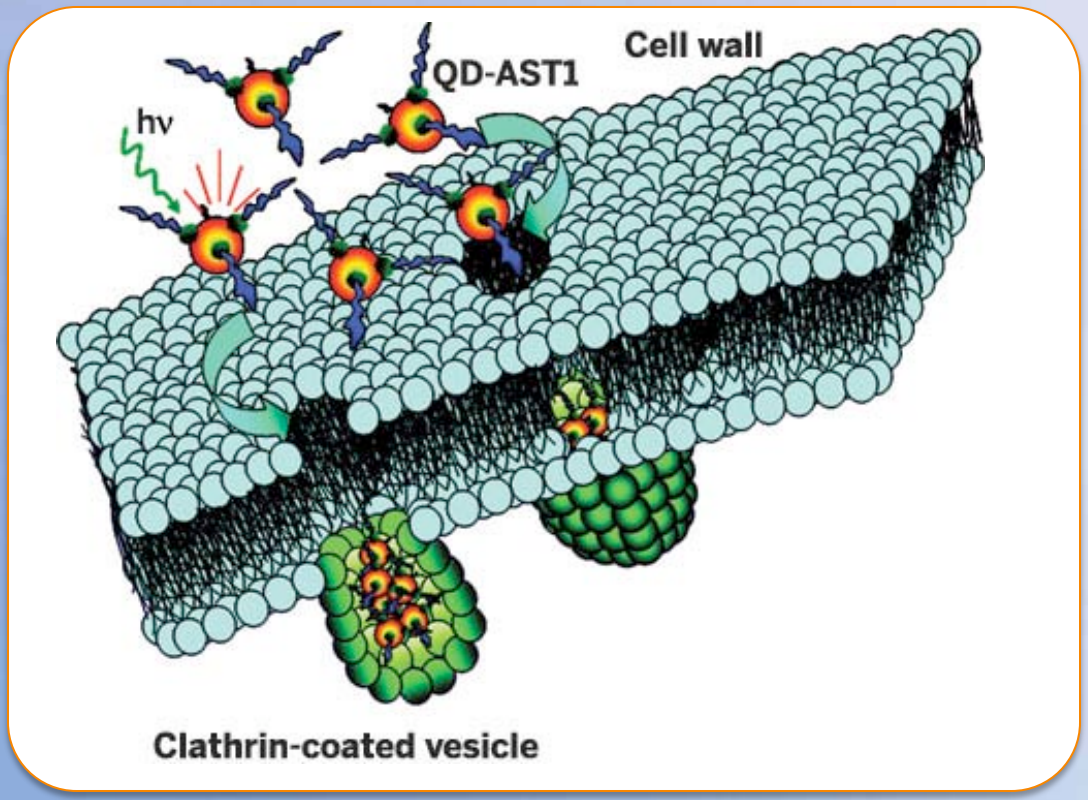
SWEP & Sigma Xi Nanotechnology Mythbusters Panel

March 1, 2011

Benefits of Nanotechnology May Bring Risks

"Peptide coatings can help nanoparticles slip into cells, a process that may prove useful for in vivo imaging or drug delivery if scientists can clear up how it works."

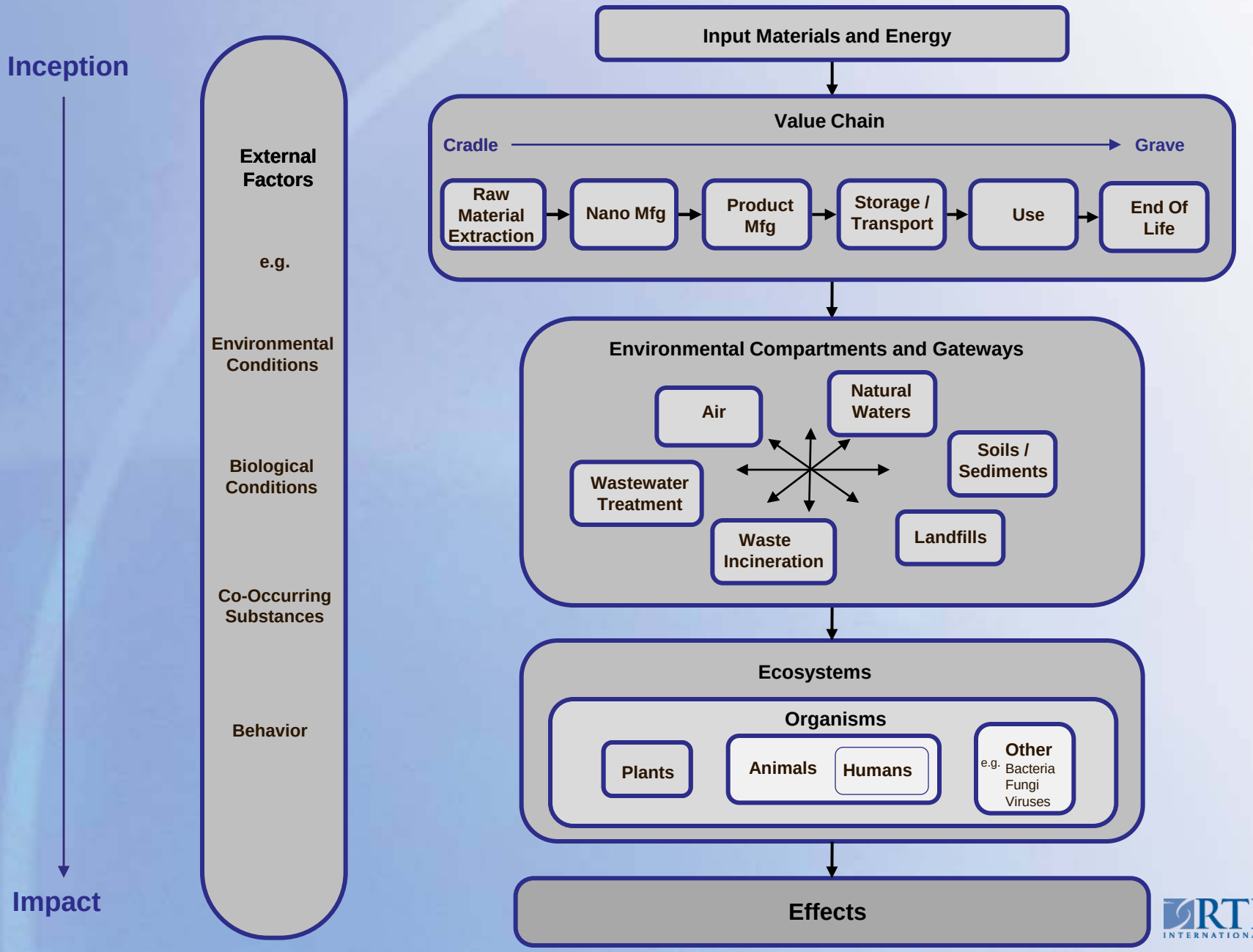


Clathrin-Mediated Endocytosis of Quantum Dot−Peptide Conjugates in Living Cells, Anas et al., ACS Nano, 2009, 3 (8), pp 2419–2429 – via C&EN News

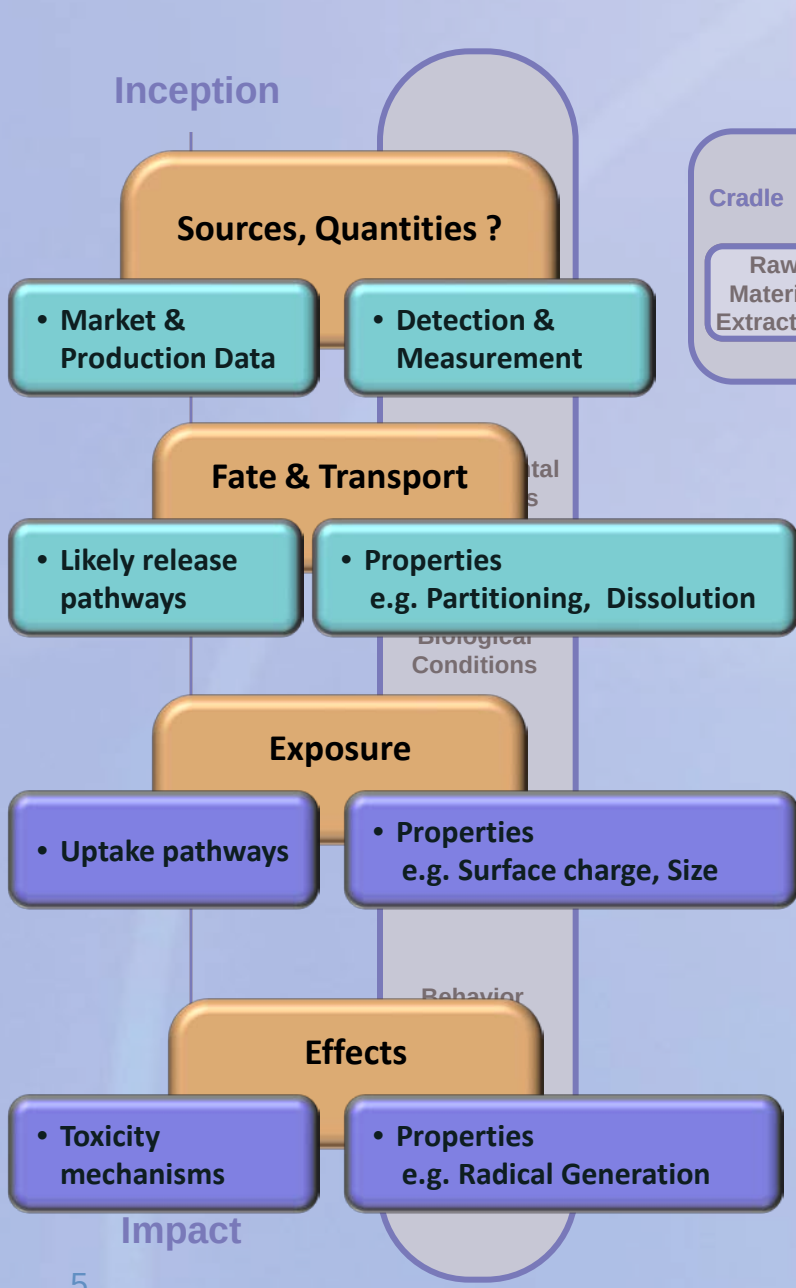
Risk Assessment Basics

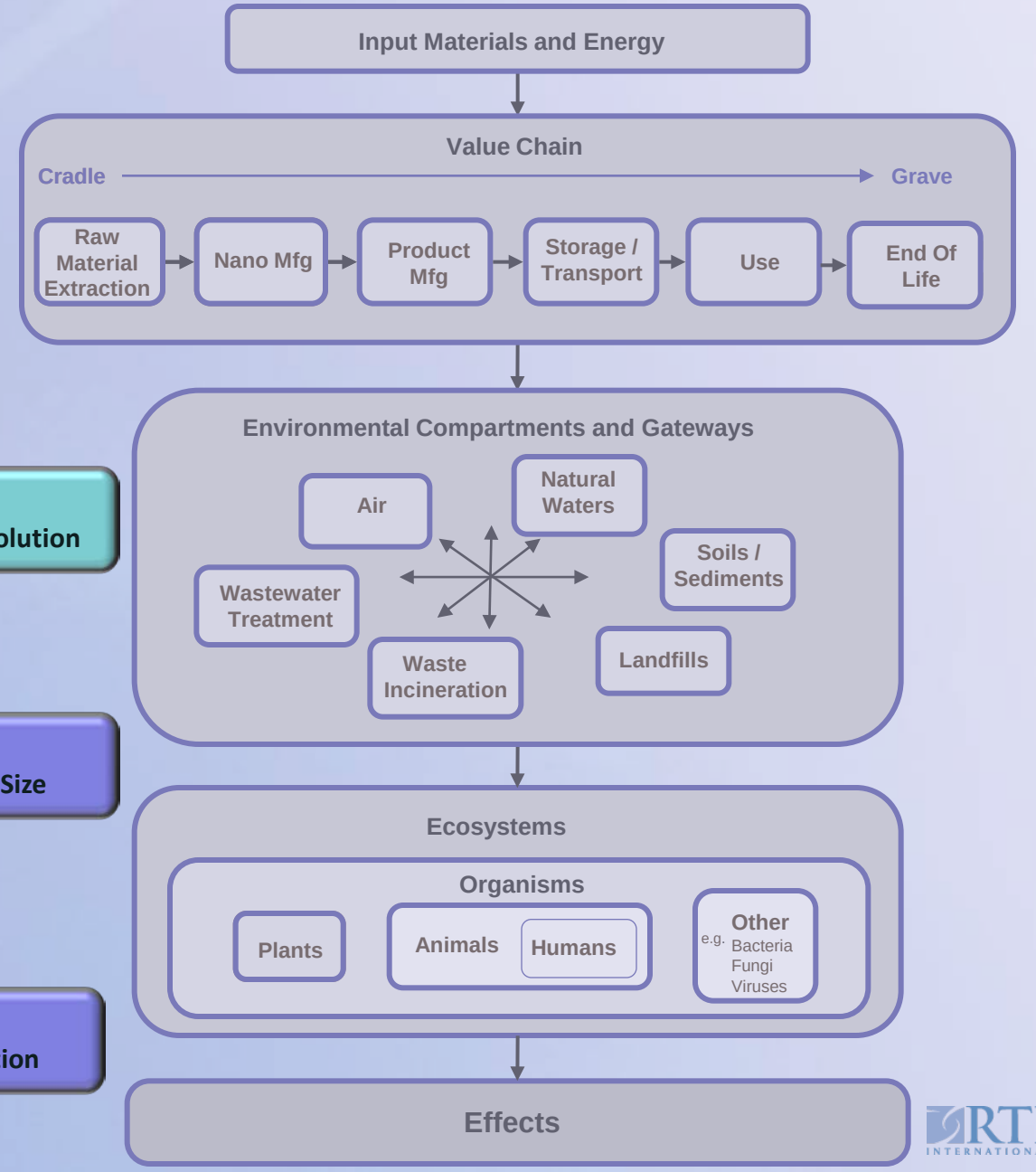
- Want to know: what negative impacts may come from nanomaterial release and interaction with the environment and biota?
- Risk = Hazard * Exposure
- Risk information is meaningful only in context:
  - What concentrations or doses are safe? At what levels do we see what health effects? (Emerging: Matson, Wang, Walker)
  - What concentrations can we expect in the environment? (Emerging: Hendren)
  - How do these concentrations compare – is there a risk of exceeding safe levels? (Don't know)
- What properties can help us determine: (Emerging: Di Simone)
  - Release and environmental behavior?
  - Exposure pathways, uptake, dose and response within biota?

Comprehensive Environmental Assessment Framework



Information Base for Traditional Risk Assessment





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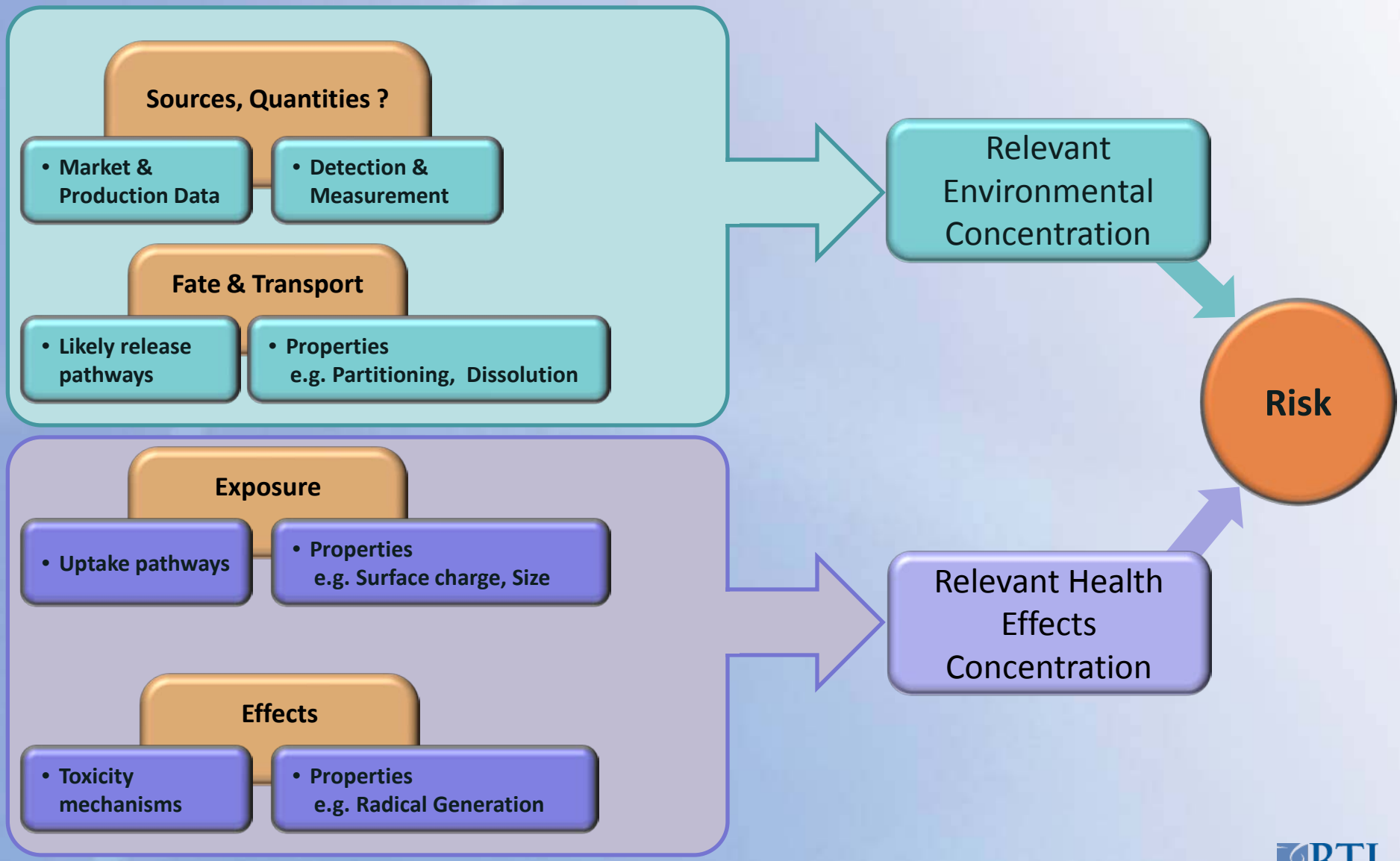
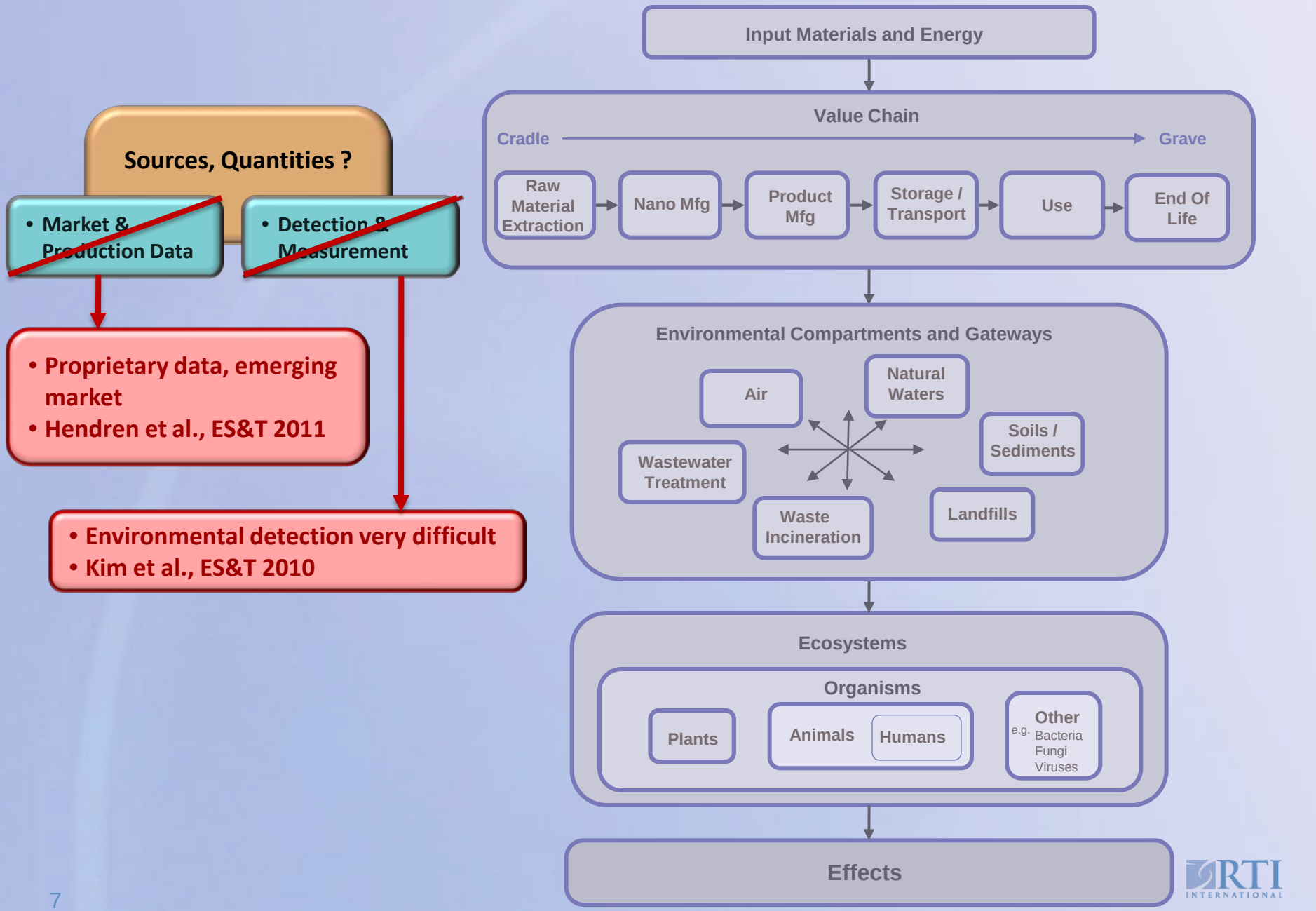


State of Nanomaterial Risk Assessment Field



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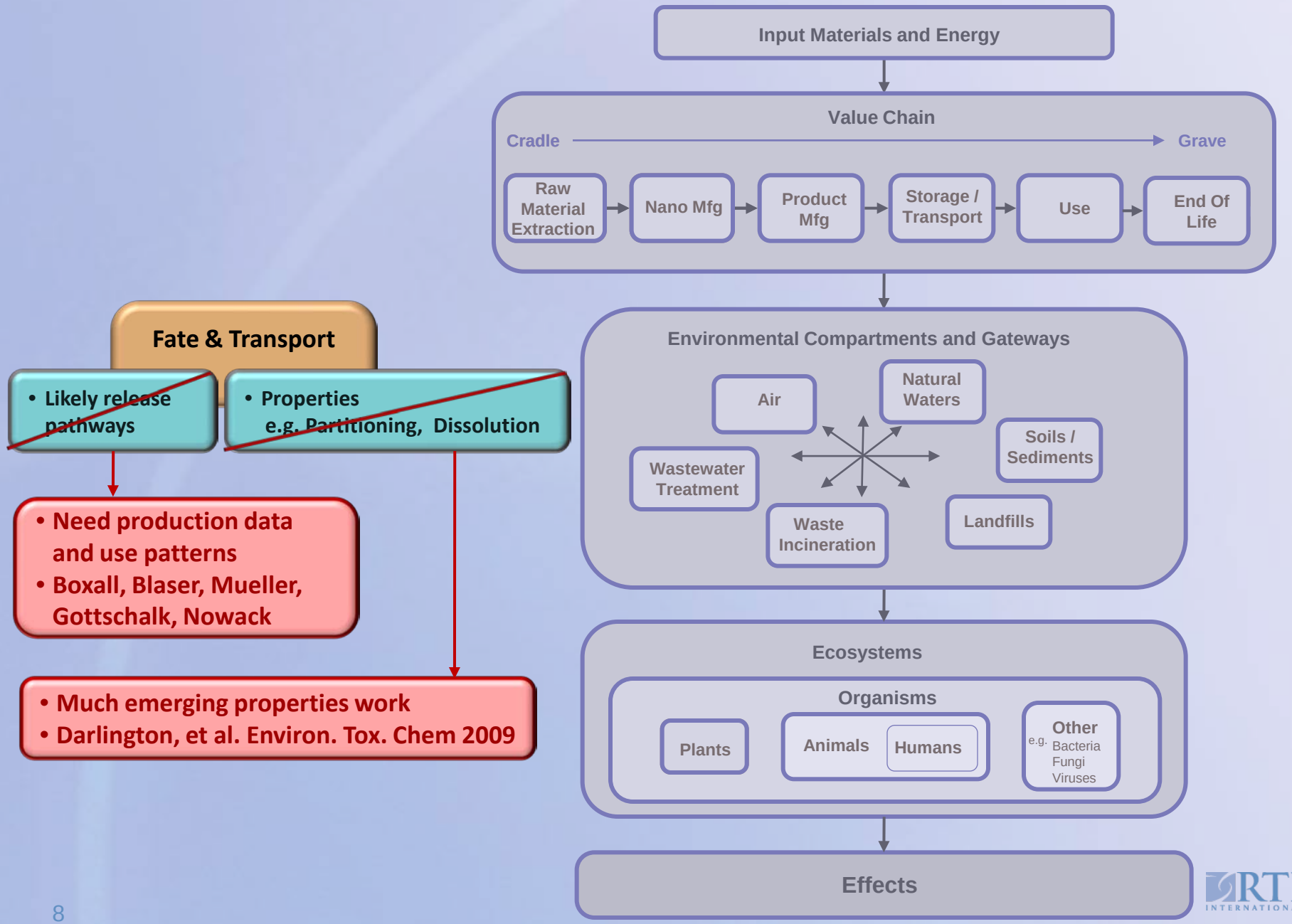

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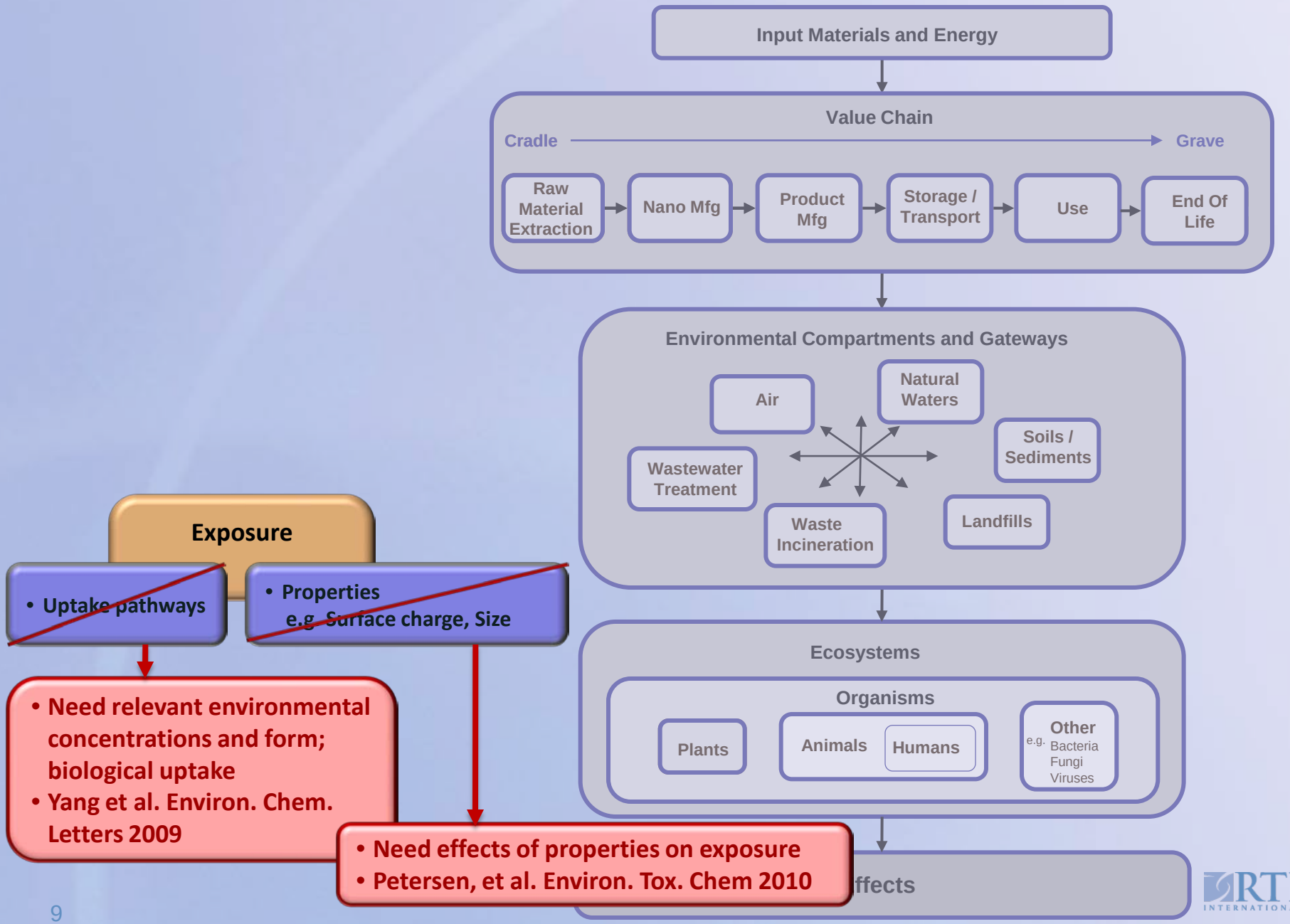

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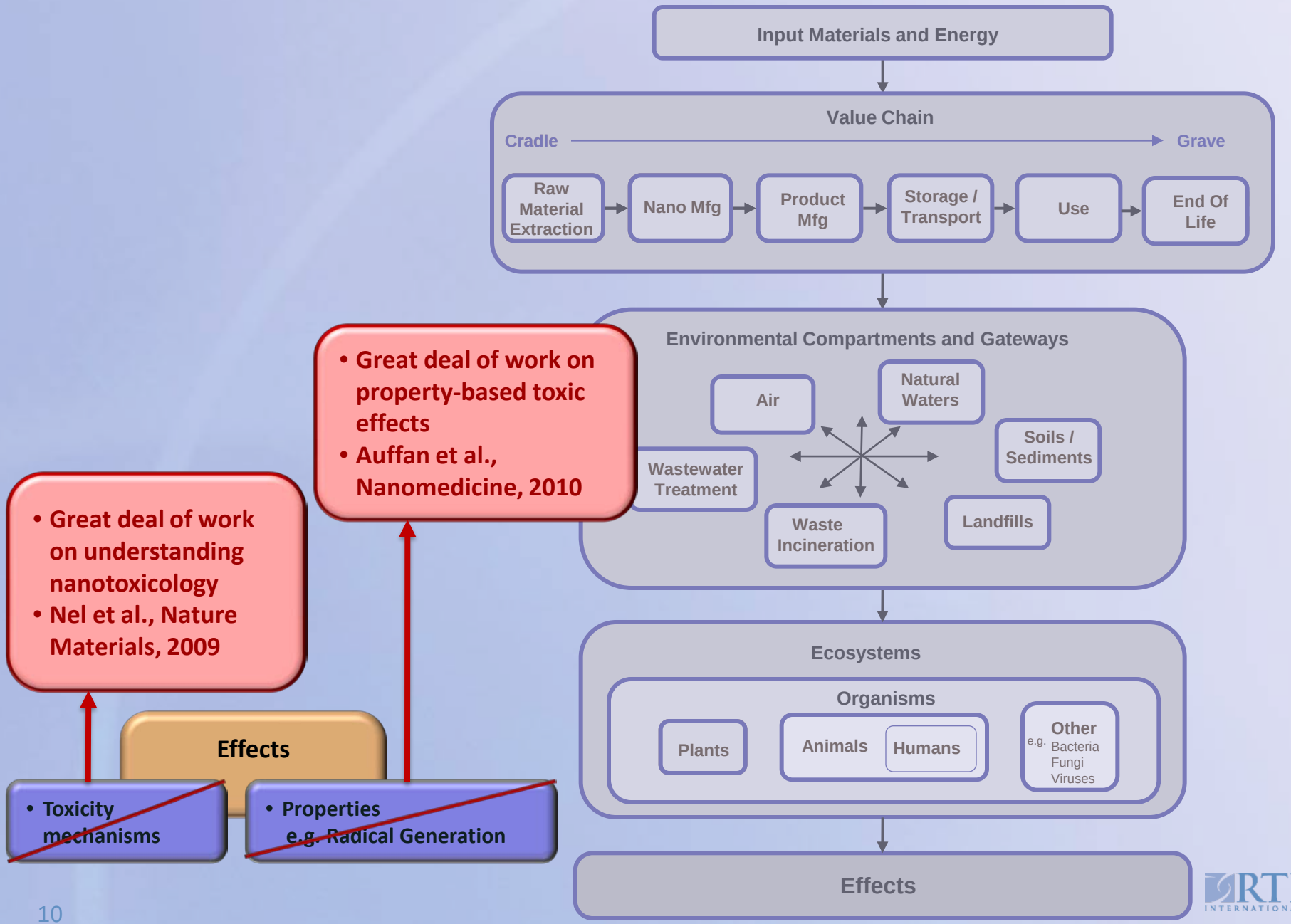

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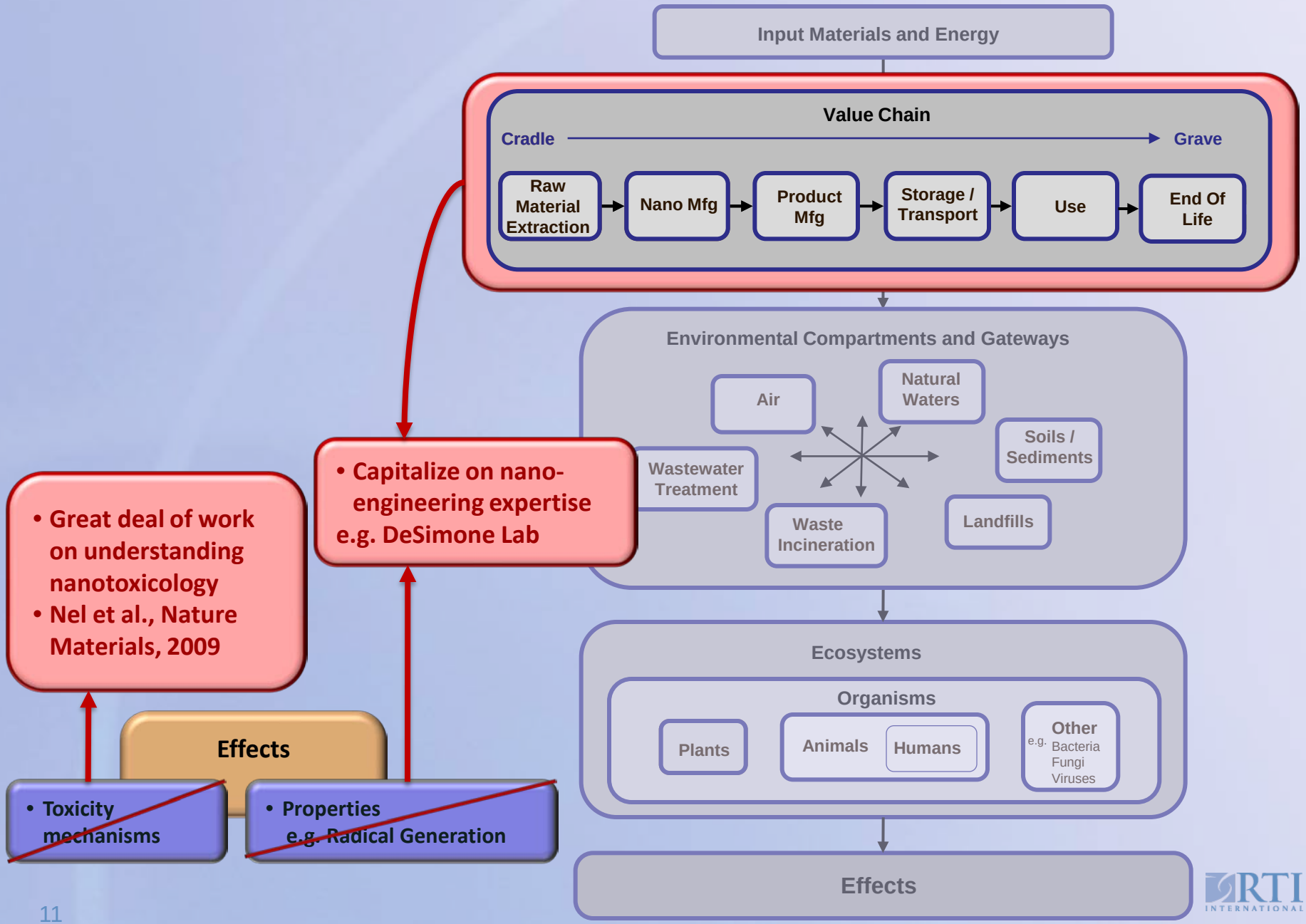

So Now What?

- Must enable decisions under conditions of uncertainty
- Cannot wait for all data to consider environmental impact
- Use emerging data to screen for most hazardous or most ubiquitous
- Prioritize research needs & integrate across disciplines
- Utilize non-linear, iterative approaches to incorporate new data at increasing resolution.

Nano Risk Assessment Efforts

- Government Programs
  - US Nanotechnology Initiative → Multi-agency research program
  - US EPA NCEA → Nanomaterial Case Studies to Support Comprehensive Environmental Assessment
  - European Commission → NanoSafe
- Academic / Public Sources of Risk Information
  - NSF/EPA Funded
    - → Duke-based Center for the Environmental Implications of NanoTechnology (CEINT)
    - → UCLA-based Center for Environmental Implications of Nanotechnology (UC CEIN)
  - European Union Funded → Risk Assessment of Engineered NanoParticles (ENPRA)
  - International Council on Nanotechnology (ICON) at Rice University
  - Woodrow Wilson Center Project on Emerging Nanotechnologies


Thank You