Introduction (nanocluster):
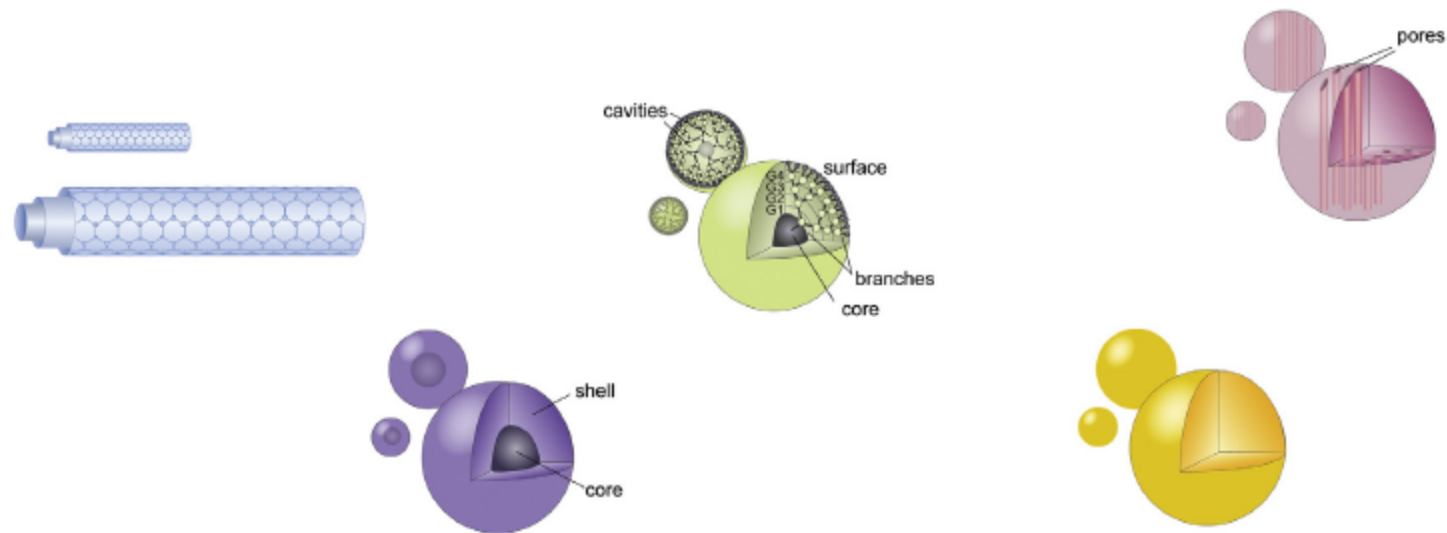
Projects on ESH Aspects of Nanomaterials

UA/UW

Tasks 425.023 & 425.024

UTD

Task 425.027

GT/ASU

Task 425.025

UNC

Task 425.035

Why is Nanotoxicity Important?

enhanced nanotoxicity ⟵ | ⟵ Increasing surface area

novel nanoproperties

toxicity ∝ SA (m²/L)

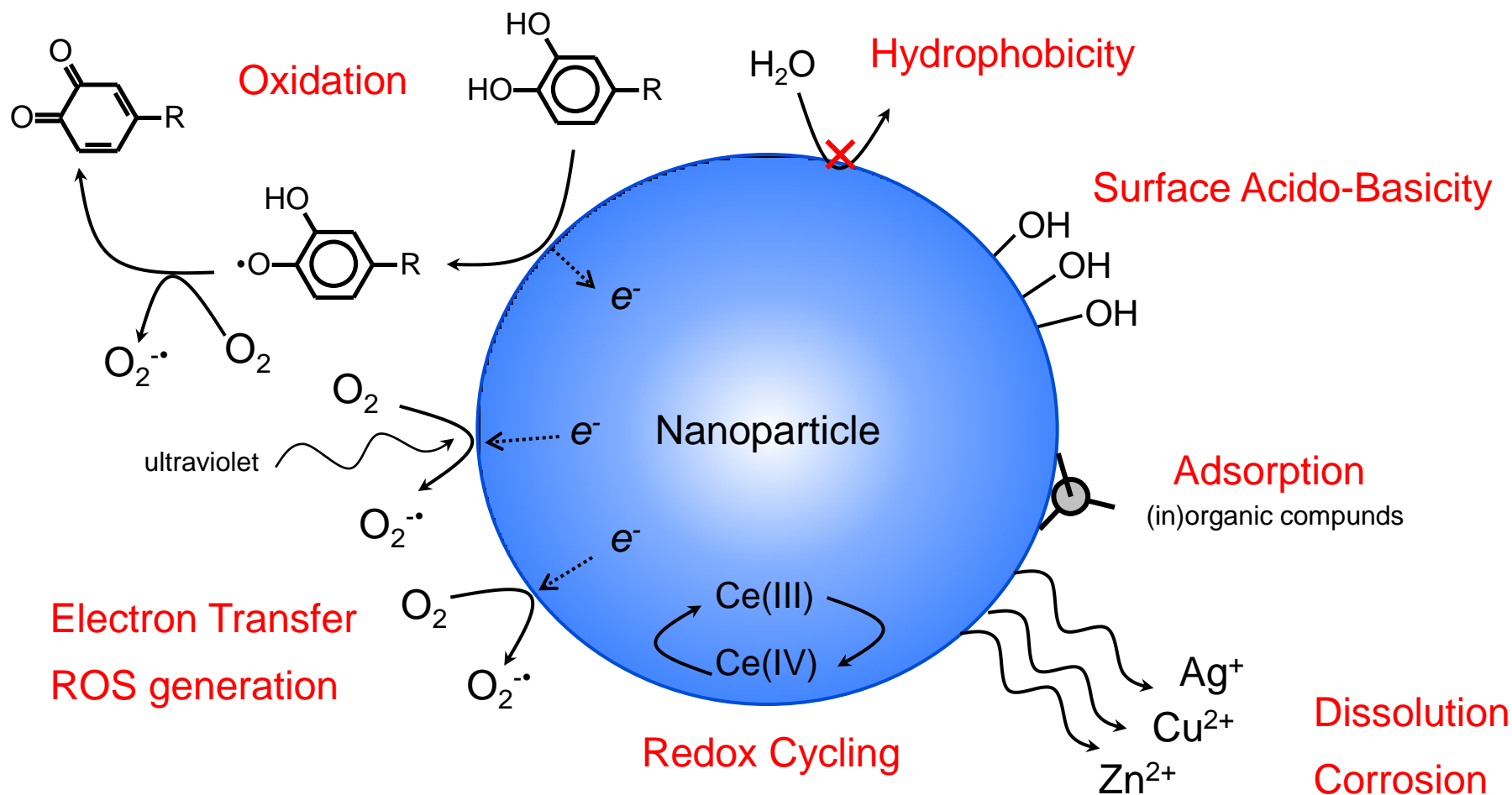Auffan et al. 2009
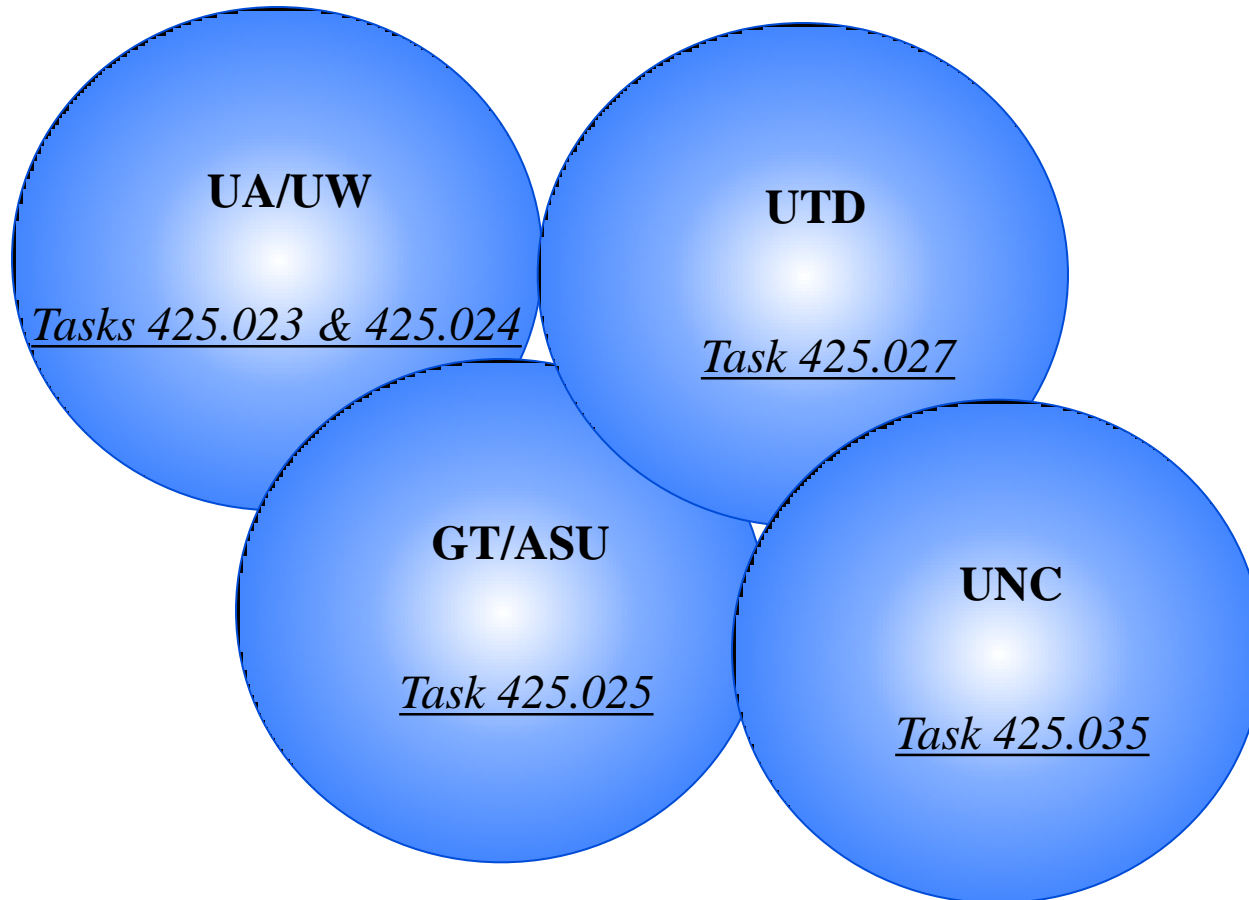
Diversity of Nanomaterials
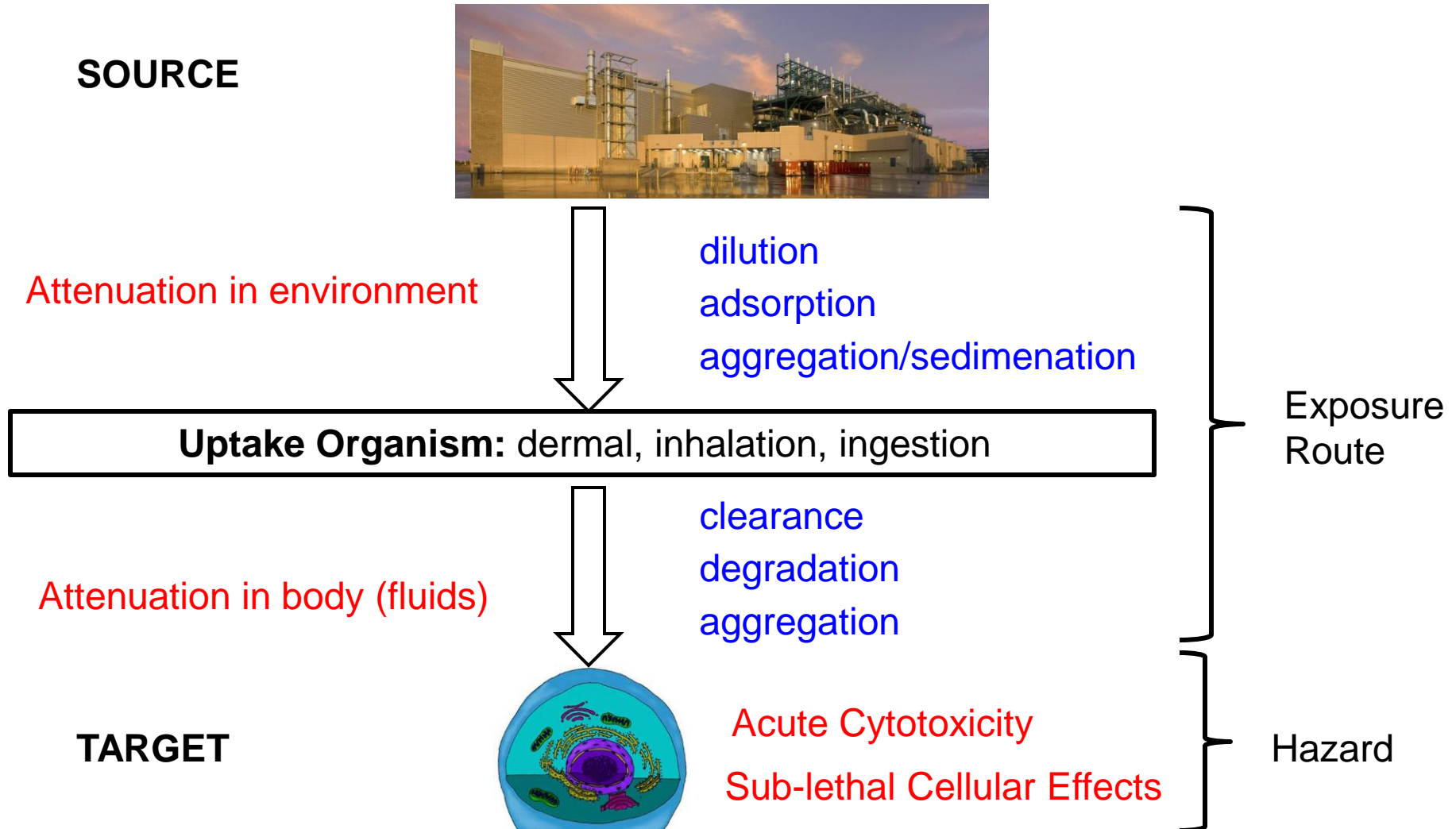# Diversity of Effects

Kunzmann et al. 2011

Examples of nanomaterials include ceramics, carbon nanotubes, graphene, metals and metal oxides, nanowires, quantum dots, polymers and more

Multiple Mechanisms of Toxicity

Auffan et al. 2009

Health Risk = Exposure × Hazard

SOURCE

Attenuation in environment

dilution
adsorption
aggregation/sedimenation

Uptake Organism: dermal, inhalation, ingestion

Exposure Route

Attenuation in body (fluids)

clearance
degradation
aggregation

TARGET

Acute Cytotoxicity

Sub-lethal Cellular Effects

Hazard

What Companies Want to Know

➤ Will nanoparticles harm employees?

➤ Will nanoparticles harm the public if released?

➤ Will nanoparticles harm the environment if released?

➤ If nanoparticles are harmful, what can be done?

➤ **These are difficult questions to answer. Why?**

Complexity of Nanotoxicity

➢ Thousands of nanoparticle types

➢ Impurities in nanoparticles

➢ Aggregation in biological and environmental media

➢ Multiple approaches to assays: cells, animals, computational

➢ Multiple mechanisms of toxicity

➢ **Need for interdisciplinary approach**