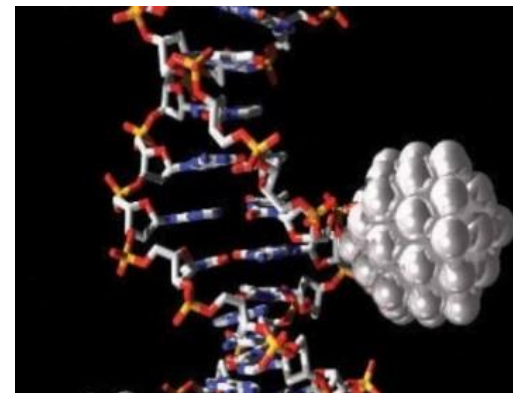


## Gabriele Windgasse, Dr.PH

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### Engineered Nano Materials – Why is it so difficult to determine potential public health concerns?

- Introduction – The Nano Scale
- Properties and Toxicity
- Product Lifecycle
- Human Health Risk Assessment
- Data Gaps and Uncertainties
- and:... Opportunities !!!



APHA Annual Meeting, November 3, 2015  
Engineered Nano Materials –  
Why is it so difficult to determine potential public health concerns?

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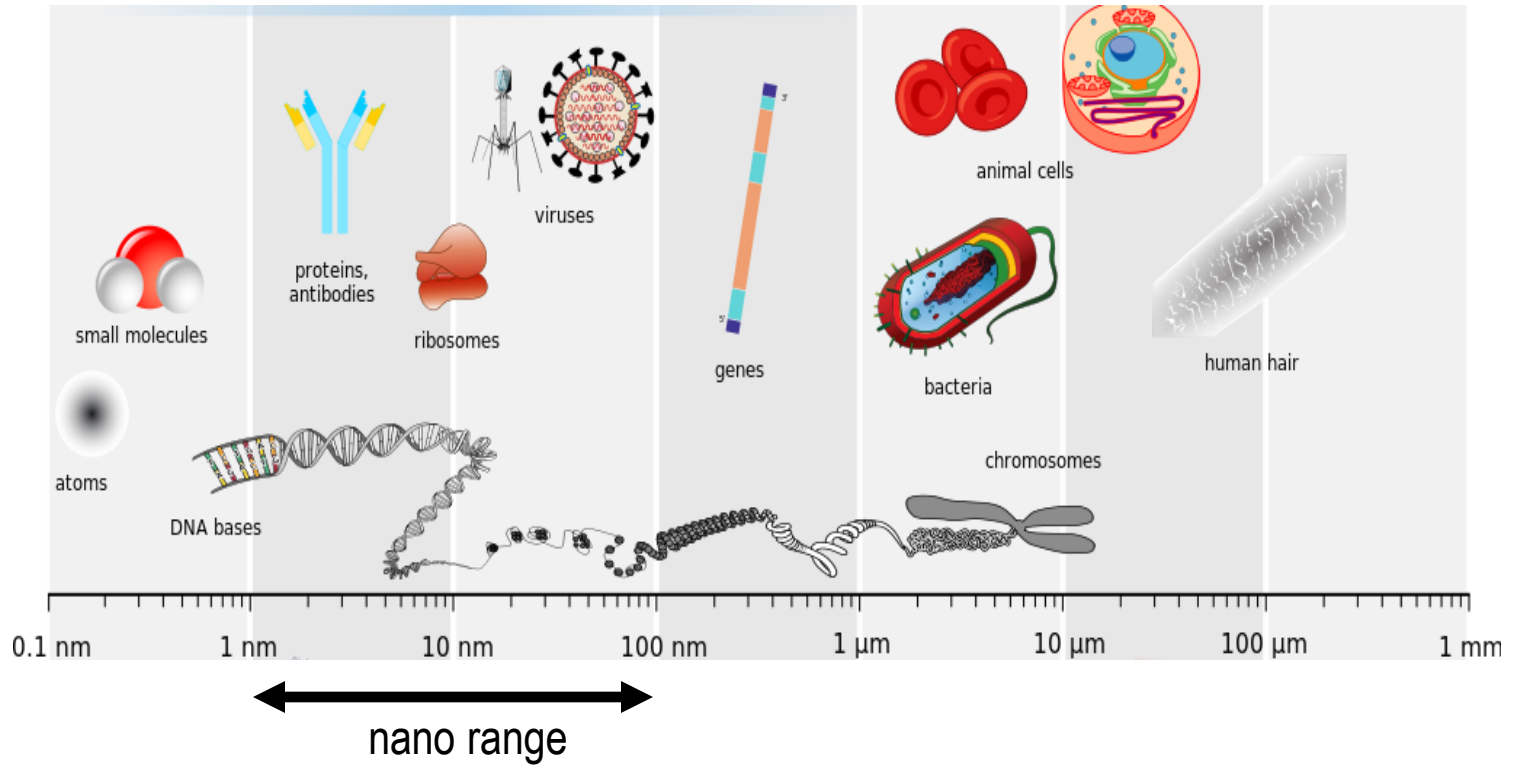


## Presenter Disclosure

Gabriele Windgasse, Dr.PH

“No relationships to disclose”

# Introduction: The Nano Scale



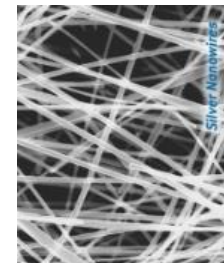
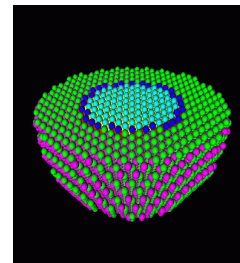
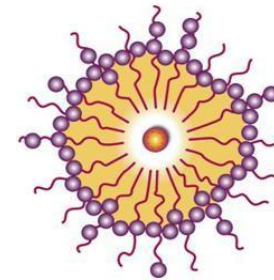
## Nano Materials (Ultrafine PM: < 100 nm)

Naturally occurring	Incidental	Engineered
ocean spray friction erosion	combustion laser printers welding fumes	designed properties/ functionalities

# ENM: Properties

## Properties

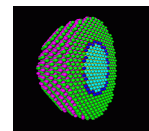
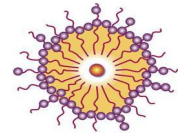
- **Surface area / gram**  
(VERY large!)
- **Size, size distribution**
- **Shape**  
(tubes, rods, wires, spheres, sheets)
- **Composition**  
(organic, metal, hybrid)
- **Surface modification**  
(charge, hydrophilic, lipophilic, magnetic,...)
- **Agglomeration**



# ENM: Toxicities

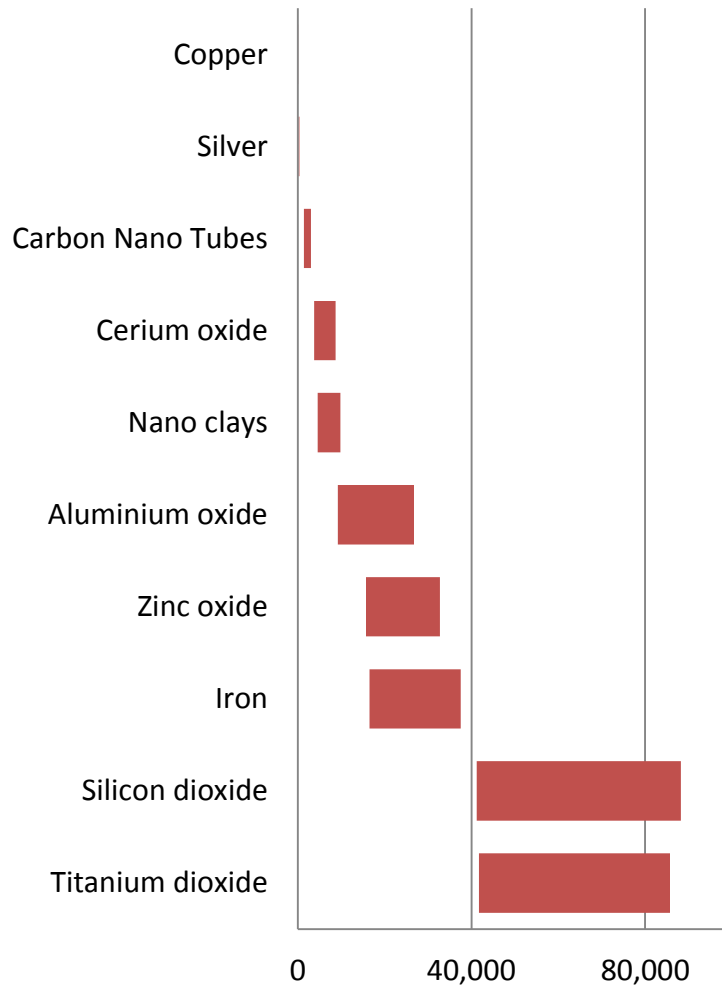
## Toxicities

- **Local**  
Absorption through membranes, accumulation
- **Systemic**  
Translocation, blood-brain barrier, placenta, reproductive effects
- **Acute**  
Reactive Oxygen Species, inflammation, mutations
- **Chronic**  
Animal studies: fibrosis (CNT), asbestos-like effects; lung tumors (TiO<sub>2</sub>); in vitro: transformation of lung cells
- **Other toxic endpoints ?**



# Engineered Nano Materials in the US (estimates!)

**Nano materials produced in US**  
(metric tons/yr, 2010, low and high estimates)



50% of world-wide production in US  
Total production is in US:  
134,000 – 158,000 tons/yr

## Major uses

> 1600 consumer products

> 487 commercial products

- Coatings, paints, pigments (textiles)
- Personal care products
- Electronics, optics
- Energy, environment
- Catalysts
- Automotive
- Medical

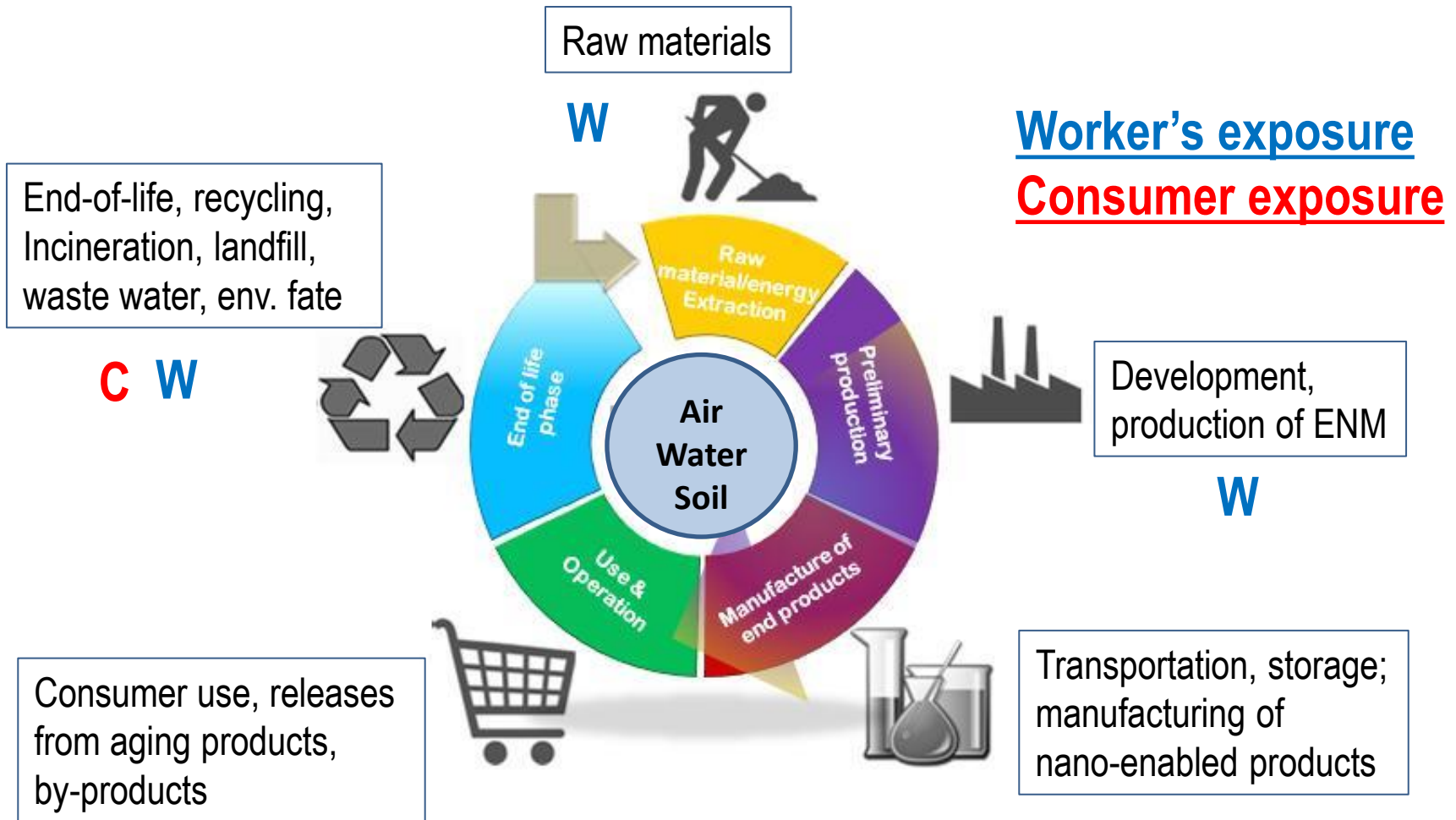
Sources:

A Keller, A. Lazareva, ES&T Lett, 2014, 1, 65-70

<http://www.nanotechproject.org/>

<http://www.nano.elcosh.org>

# Product Lifecycle



**C** Exposures to humans & releases into the environment:  
**UNKNOWN !**

# Accidental Release



Nano TiO<sub>2</sub> spill, France, 2011  
Each bag 1500 lb of nano TiO<sub>2</sub>



# Risk Assessment

**Hazard Identification:** releases of unknown ENM, lack of standard sampling methods, methods to identify and quantify ENM in environmental media

**Dose-Response:** unresolved metrics (~~mg/kg bw~~): particle number, surface area, surface reactivity; lack of toxicity data, appropriate toxic endpoints?

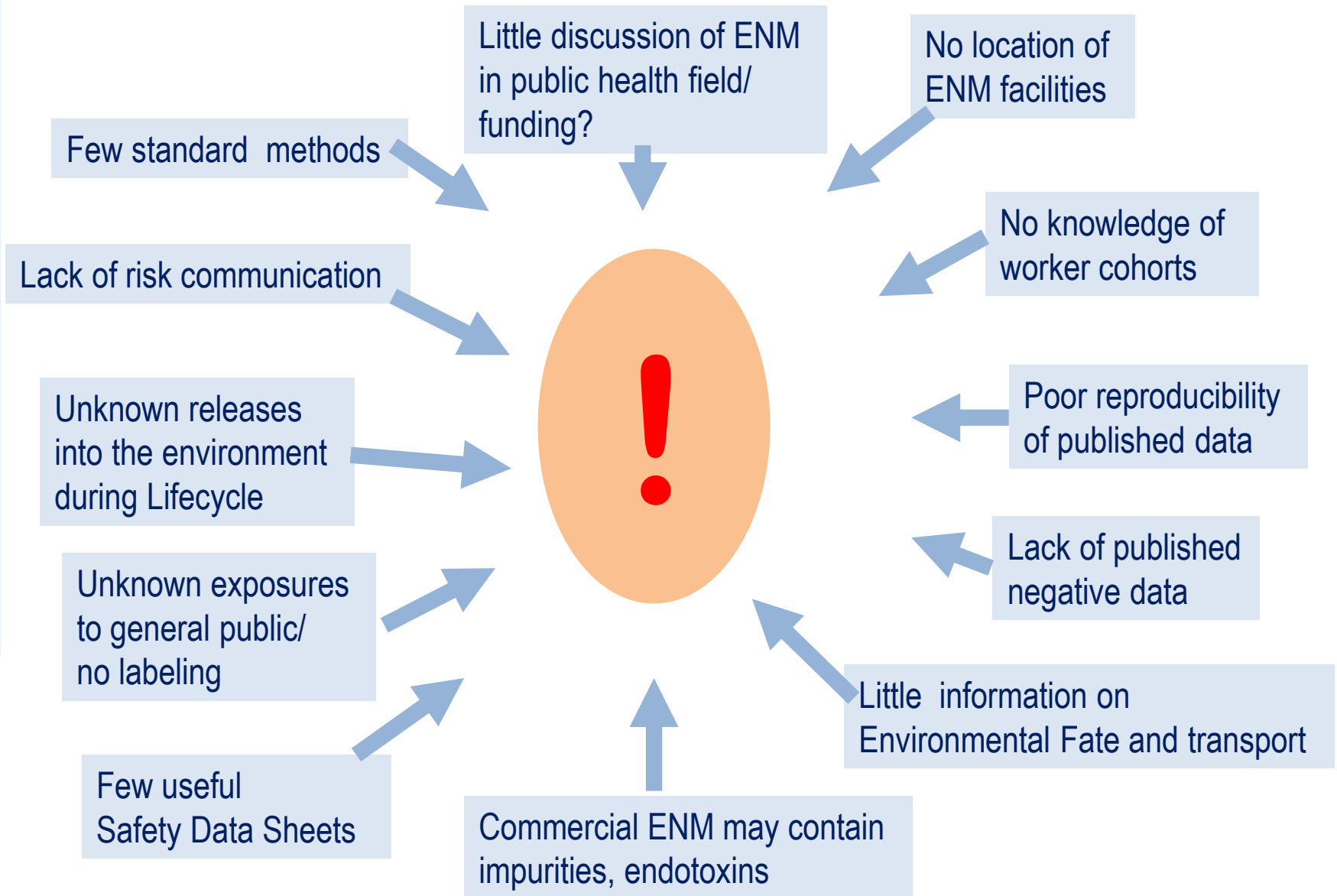
**Exposure Assessment:** routes of exposure, no knowledge of location or number of occupational cohorts, consumer exposures

**Risk Characterization:** difficulty assessing cancer and non-cancer risk, developmental and reproductive toxicity

**Risk Management:** few Safety Data Sheets, internal practice within industry?

**NIOSH Guidance:** REL nano TiO<sub>2</sub>: 300 µg/m<sup>3</sup> (potential occ. carcinogen)  
REL CNT/CNF: 1 µg/m<sup>3</sup> (effects similar to asbestos)  
IARC: MWCNT-7: poss. human carcinogen (2B)

# Why is it so difficult to determine potential public health concerns? Data gaps and uncertainties !



# !! Opportunities !!

## Needed:

- A robust discussion in the Public Health field of this emerging concern
- Get involved – ask questions!
- Connect to an existing network for nano EHS (SOT, AIHA)

Communities of Research (CORs)  
Facilitated from the National  
Nanotechnology Coordination  
Office

[www.us-eu.org](http://www.us-eu.org)



## Communities of Research:

- Exposure through Product Life
- Risk Assessment
- Risk Management and Control
- Characterization
- Databases and Computational Modeling
- Eco Toxicity
- Human Toxicity

# Summary

- Gaps in data, knowledge and infrastructure
- Increasing number of consumer products
- Unknown exposures to consumers and workers

**LOTS of uncertainties but NO discussion in Public Health**

## Acknowledgements:

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# Thank you!

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