



Bayer MaterialScience

Nanomaterials

An HSE Overview

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What *Potential!*

Below 200 to 300 nm, physical properties of particles don't just scale up or down - they *change*:

- Surface Area
- Reactivity
- Electric and Thermal Conductivity
- Solubility
- Light transmission/absorption



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What Potential?



- **Human and Environmental Exposure**
- **Mechanisms in Biological Systems**
- **Health and Environmental Effects**



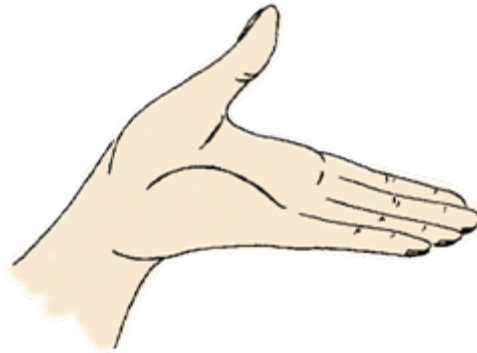
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Human Exposure Routes

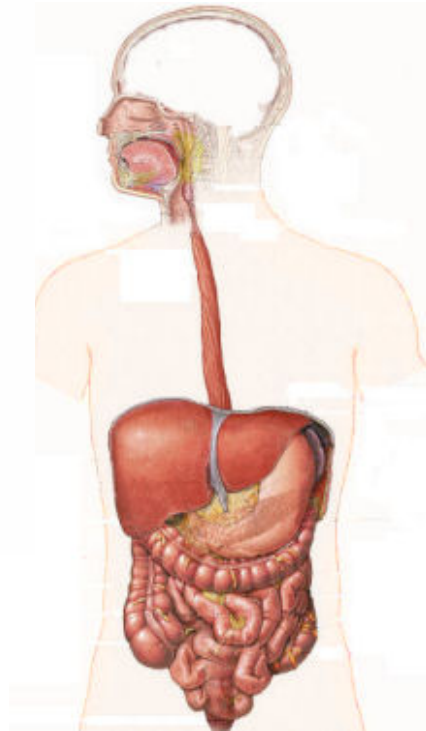
Inhalation



Dermal absorption

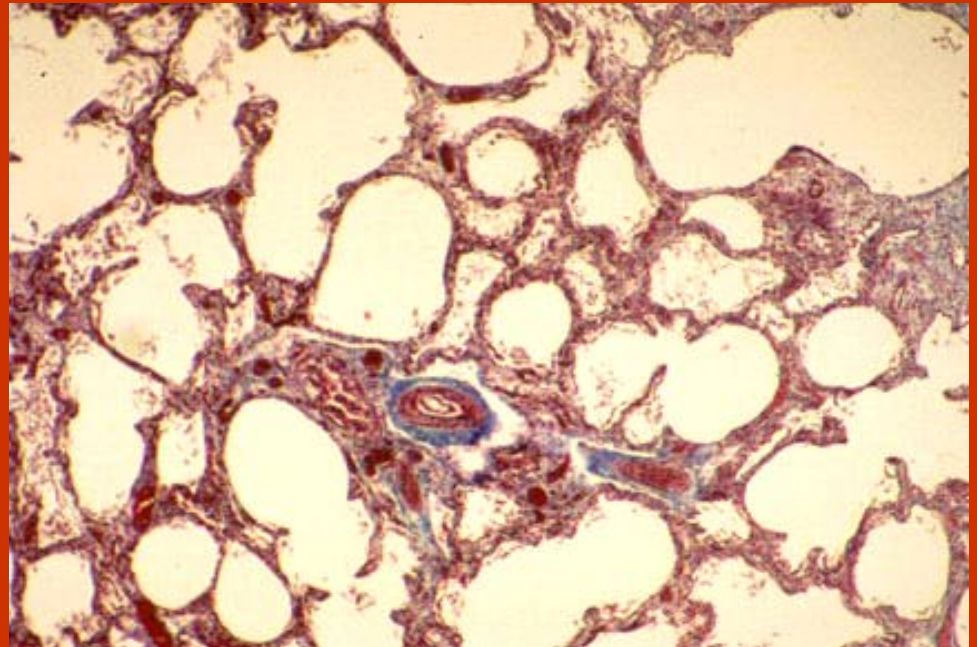
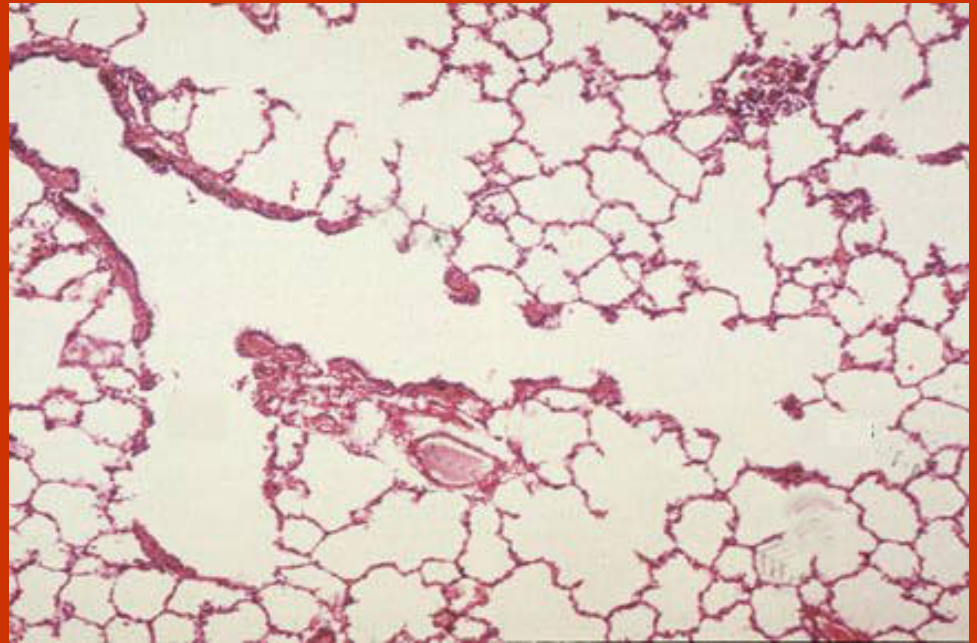
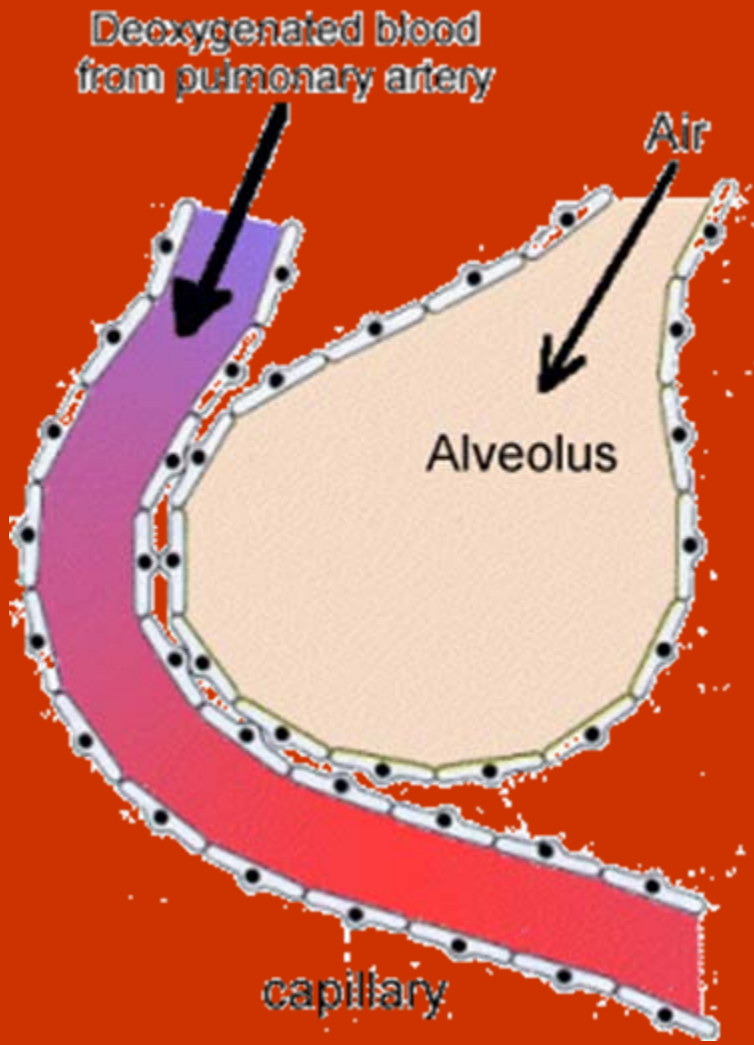


Ingestion

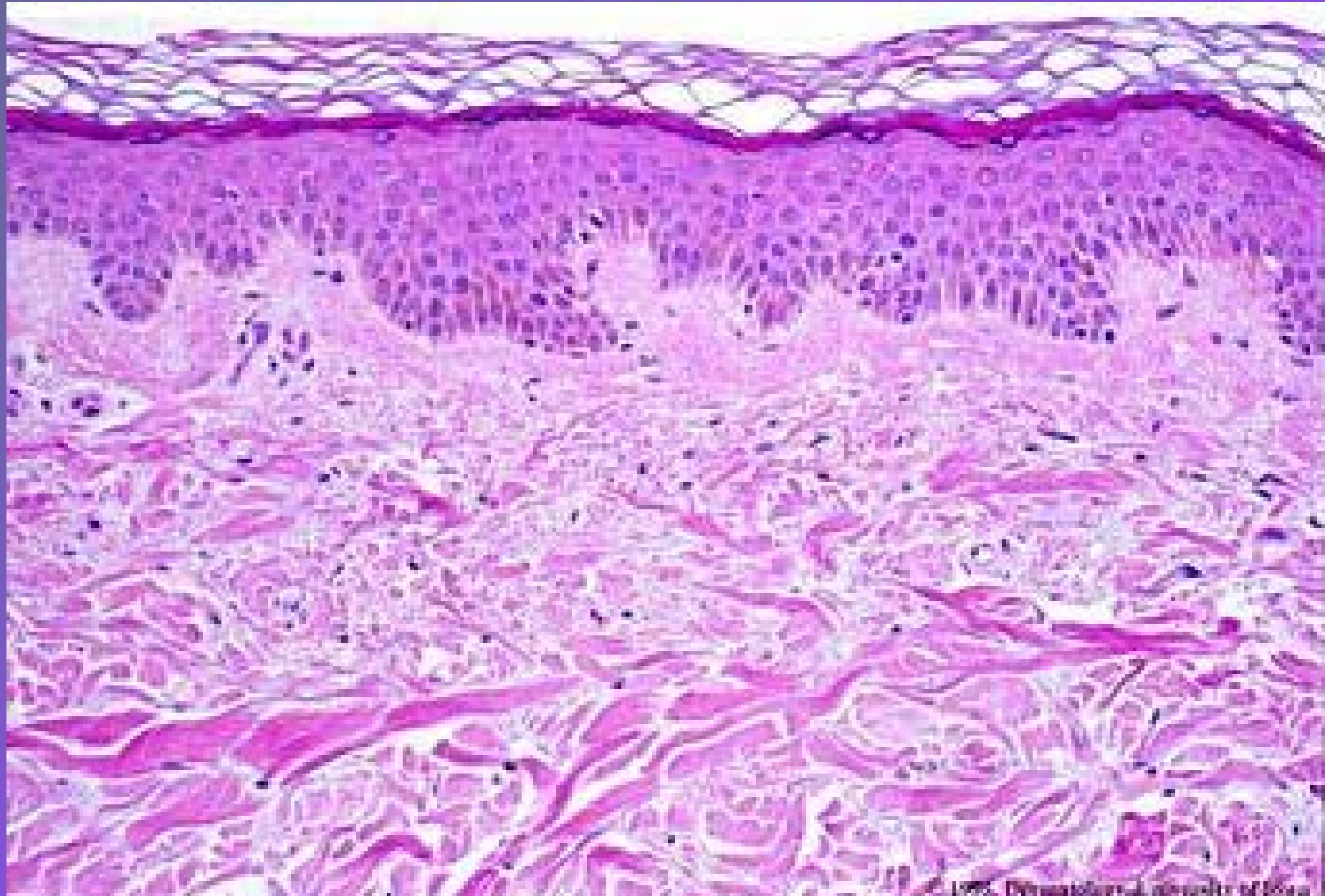


**Injection
(circulation)**

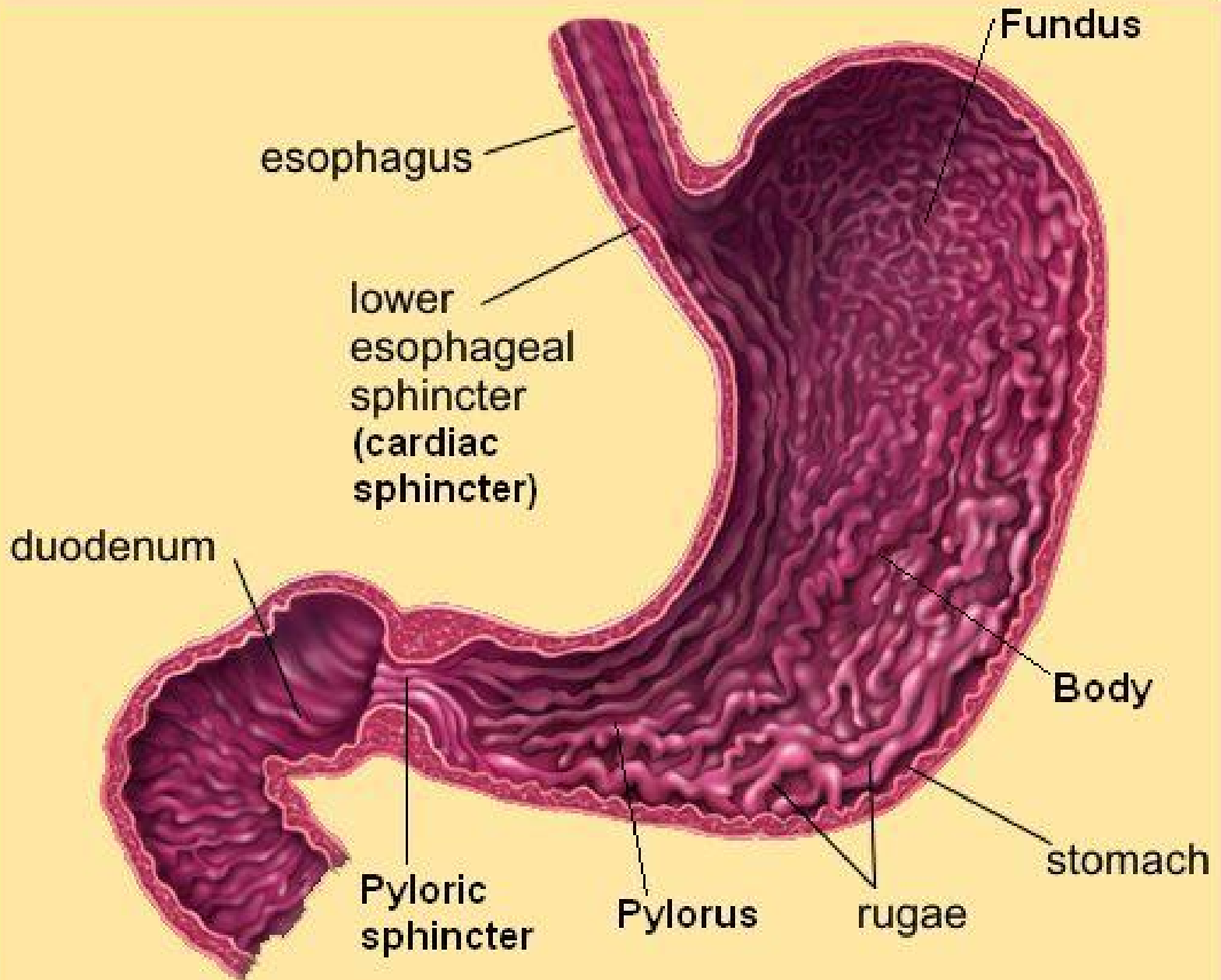




Dermal Exposure



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Particle Variation

- Size
- Structure/Surface functionalization
- Aerodynamic diameter
- Solubility
- Aggregation
- Purity

Nano-sized Particles in the Environment

Considerations

- Production - tonnage quantities
- Spills, Wear and tear, Disposal and Recovery
- Testing to determine the effects of NSPs on environmentally relevant species has not been conducted.
- Nanoparticles released into the environment may disrupt ecosystems.
- Nanosized materials may not migrate through soils rapidly enough to be valuable for purposes such as remediation.

HSE Objectives

Material Characterization

Hazard & Exposure Assessment

- Dose-response relationships
- Toxicity mechanisms
- Absorption, Distribution, Metabolism, Excretion
- Exposure routes
- Fate & transport

Exposure Prevention/limitation

- Closed production and handling processes
- Suspensions, dispersions, and matrices
- Engineering controls and PPE
- Waste management



Liz McMeekin, PPG Industries, Inc.

“Nanomaterial Production - Environmental and Industrial Hygiene Considerations”

H. Scott Matthews, Ph.D., Carnegie Mellon University

“Managing Nanomaterials with a Life Cycle Approach”

Randall Ogle, Center for Nanophase Materials Sciences of the Oak Ridge National Laboratory

“Nanomaterials Synthesis, Characterization, & Theory, Modeling & Simulation”

Keith Rickabaugh, RJ Lee Group, Inc.

“Nanomaterial Analytical & Characterization - Safety Awareness & Training in a Laboratory Environment”