

Potential „new area“  
such as  
Nanotechnology

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# Essential Condition: Food Safety

Risk = Exposure x adverse effects

- exposure
  - external
  - internal
- adverse effects
  - reversible
  - irreversible
- severity code
- probability of an occurrence

# Nanomaterials: exposure scenarios

„natural“ – soil, dust, aerosols, volcanic activity

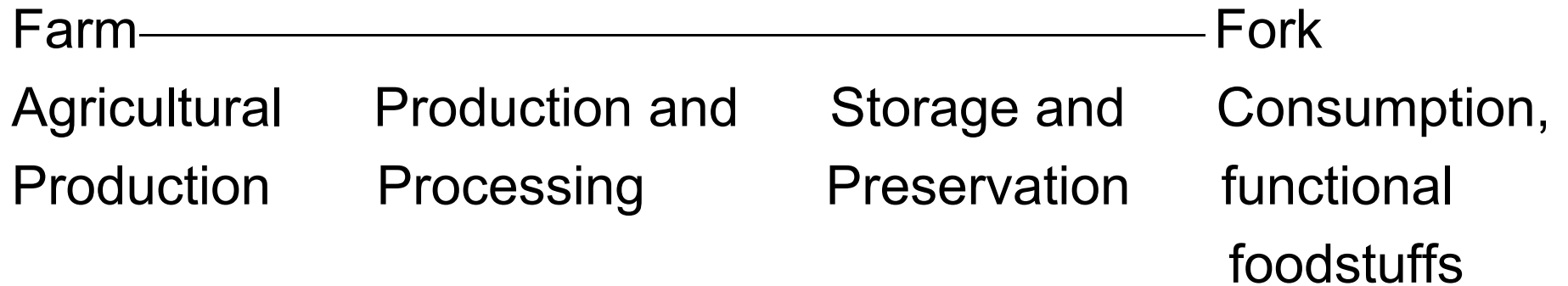
unintentionally

„man made“ – eg. ultra fine dust (combustion product,  
car-tyre abrasion, waste processing)

intentionally

„man made“ – eg. additives, „Canola Active Oil“ (Phytosterol 30 nm)  
„Tip-Top Up Bread“ (Australia Omega 3),  
LycoVit (BASF),  
 $\beta$ -Carotin (The Carotenoid Company)

# Safety concept



Use of nanomaterial / exposure to nanomaterial:  
to facilitate / enable / optimise (economically) the process

Consequence: of interest are those effects due to  
„new“ nanoscalic properties

# Nanotechnology / Nanomaterial

## Elements of a definition

- engineered / man made / manufactured  
(intentionally produced)
- dimensions - in the order of 100 nm
  - SSA (increasing with decreasing particle  $\emptyset$ )  
example: spheres of 100 nm  $\emptyset$ , unit density:  
60 m<sup>2</sup>/g
- properties (characteristic to nanoscale vs bulk)

# Forms of nanomaterials

- free particles
  - aggregated / agglomerated
  - embedded (in a matrix)
  - coated
  - colloidal systems
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- emulsions
  - micelles
  - liposomes
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- degradability, solubility

# Relevant (adverse) effects

## Important: Particle Toxicology

- oral exposure (discussing food)
- **ADME** (Absorption, Distribution, Metabolism, Excretion)

# Absorption

## Gastro-intestinal

unknown:

free particles or - transformation

- binding with components

being present in the GI-tract

- Size of particles  
the smaller the better (Polystyrene, Latex)
- pass through epithelial cells
  - transcytosis (enterocytes / normal digestion)
  - transcytosis (M-Cells in Peyer's patches)
- Pore size at tight junction: 0.3 – 0.1 nm



# Distribution

- lymphatic system
- blood stream
  
- Liver, spleen, kidney,...
- interactions with proteins
- smaller-sized Particles: high widespread tissue distribution

Limited oral studies

# Metabolism / Biotransformation

little knowledge

## Excretion / Elimination

- urine, faeces,
- macrophages (lungs)

## Oral studies are missing

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in vitro

- generation of reactive oxygen species

consequence: damage to nucleic acid bases

membrane lipids

proteins

to question: physiological relevance (high doses applied)

in vivo

chronic studies are missing

# Nano-Carrier systems

- to carry intended macromolecules into the body / cells

Concern: - carry unintended contaminants

➡ immune reaction?

- particles in GI-tract

speculation: inflammatory responses

# Conclusion

## Toxicity (special : particles)

- Inflammatory responses
- Genotoxicity (?)
- Paracelsus: Dosis sola venenum facit

## Exposure

- Routine analytical methods are missing to detect, characterize and measure Nanoparticles in biological matrices (food, feed)

At present Risk Assessment: high degree of uncertainty

Thank you for your attention

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