

EMERGING RISKS

Nanotechnology and What Good it Brings

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Emerging Risk Identification



“There’s always an element of risk. No one has a crystal ball. OK, I have one, but no one knows how it works.”

Emerging Risk Identification

Why Emerging Risk Identification?

- Important tool for a timely recognition of critical situations;
- Offers an increased number of options for action to the risk management.

Consequently emerging risk identification is a crucial part of any coherent, effective and dynamic food policy.

(In Europe: Article 34 of Regulation (EC) No. 178/2002)

**Competent Authority
on Community level:**



Present Limitations of Risk Analysis

- **Long- term consequences and impacts of factors outside the food chain are usually neglected, assuming that the food supply production chain is self-contained in operation, space and time;**
- **Models are usually based on recording of past occurrences, setting boundaries and levels rather than a formal evaluation of various cross-cutting upstream interacting processes (driving forces) influencing the evolution of a risk;**
- **Risk assessment methods often ignore the human factor or use simplistic or standardised schemes of behaviour.**

‘Risk’ means a function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard;

‘Hazard’ means a biological, chemical or physical agent in, or condition of, food or feed with the potential to cause an adverse health effect;

Article 3 of Regulation (EC) No. 178/2002

‘Emerging Risk’:

A potential food or feed borne or diet-related hazard that may become a risk for human health in the (near) future.

Periappt 2004

Characteristics of an Emerging Risk Identification System

**Anticipatory approach instead of responsive systems;
different from, but not a replacement of Early Warning
Systems:**

**Early warning or rapid alert systems like the European
RASFF, the Canadian ‘Global Public Health Intelligence Network’
(GPHIN), or the WHO network INFOSAN;**

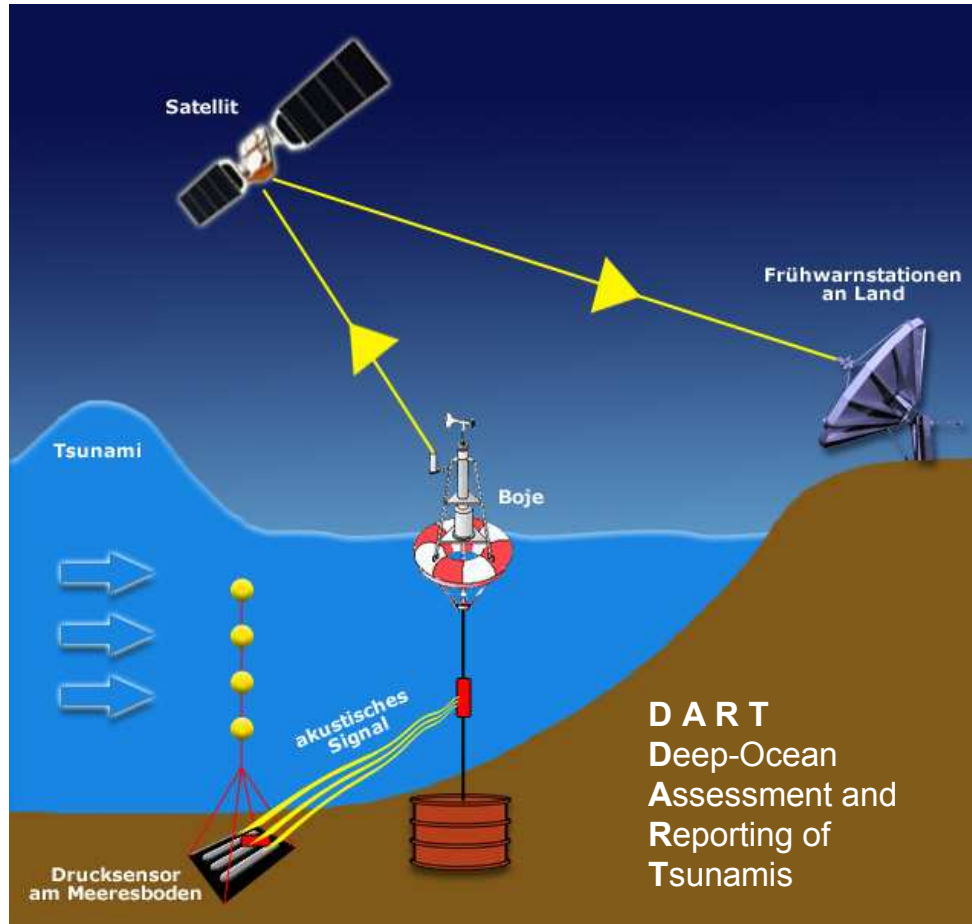
**Shields in case of cyber- /food-terrorism and anti-tampering
including task force systems like EU-BICHAT.**

Early Warning System: AWACS



The detected *indicator* (signal) is the hazard itself

Early Warning System: Tsunami



Again, the detected *indicators* (signal) is the hazard itself!

Pro-active Methodology: Climate Forecast

Risiken erkennen – Gesundheit schützen



Meteorological Station (Bavarian Alps)



Weather Balloon (Antarctica)



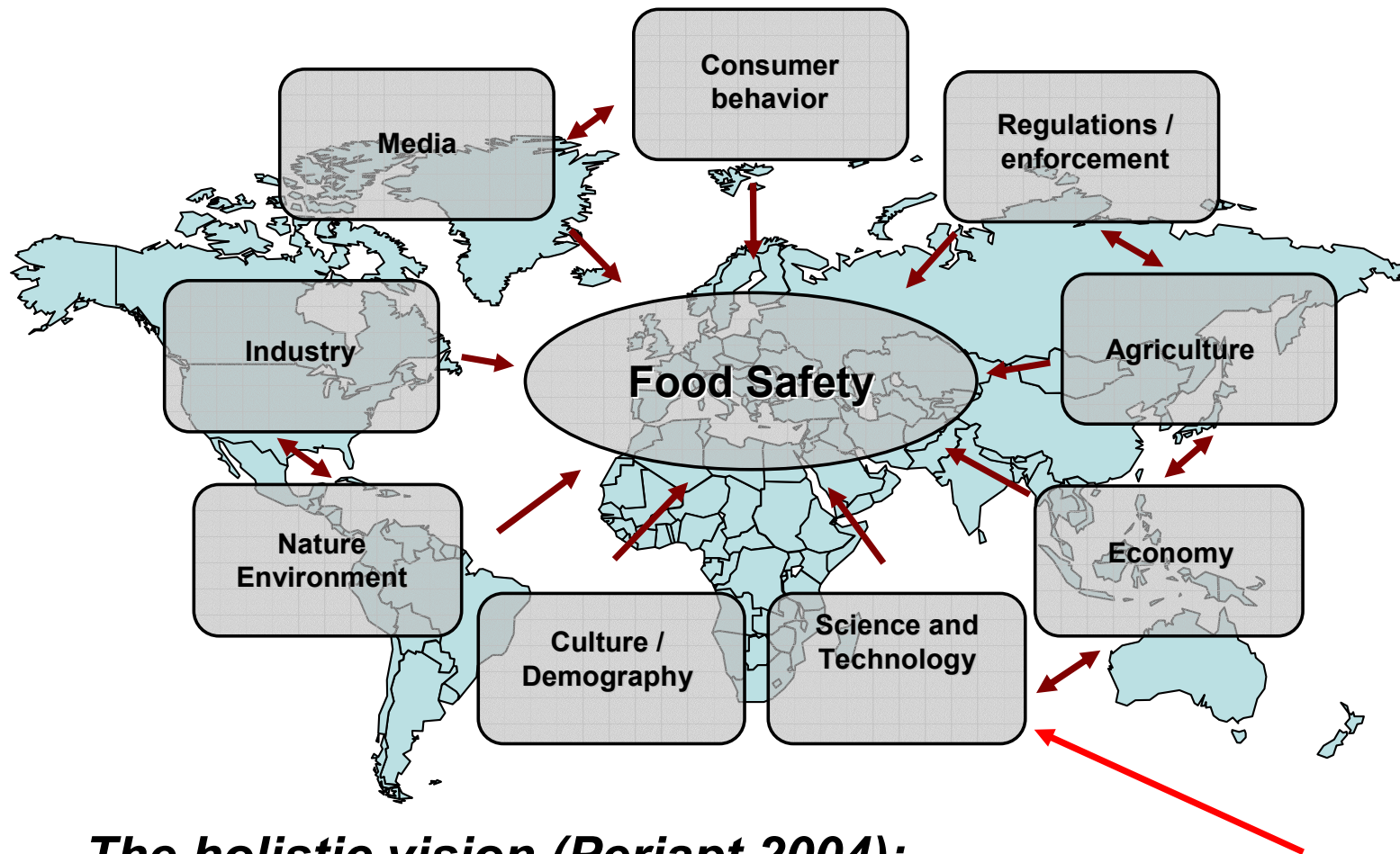
Drought (Africa)



Flooding (Prague)

Observed *indicators* are not part of the hazard but (possibly) suitable to detect a risk proactively.

Emerging Risks: The Holistic Approach



The holistic vision (Periap 2004):

Analysing the *host environment* of the food supply chain.

Flow diagram holistic approach



PERIAPT 2004

Example (short term forecast):

Emerging risk of contamination of crop by mycotoxin-producing moulds:



”The holistic vision“ : Examples

Economy: Globalisation

Globalisation makes the food production chain increasingly complex. Hence, reliable information on the history of food is hard to get (limitations in traceability).

Nature & Environment: Climate

A climate change may lead to a modification of the behaviour of microorganisms leading to new or different biological food risks.

Science and Technology: Nanotechnology

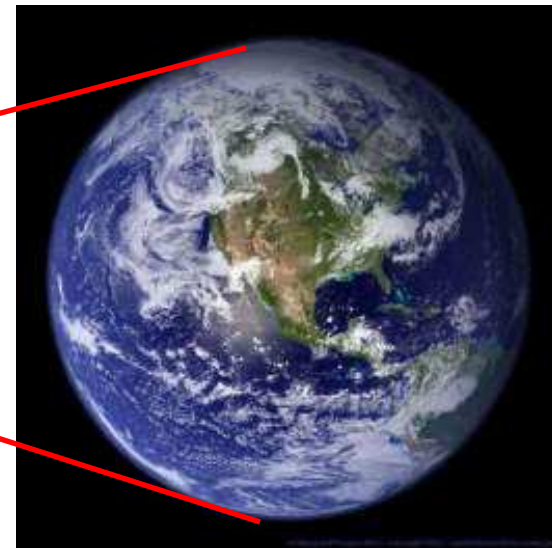
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How „big“ is nano?

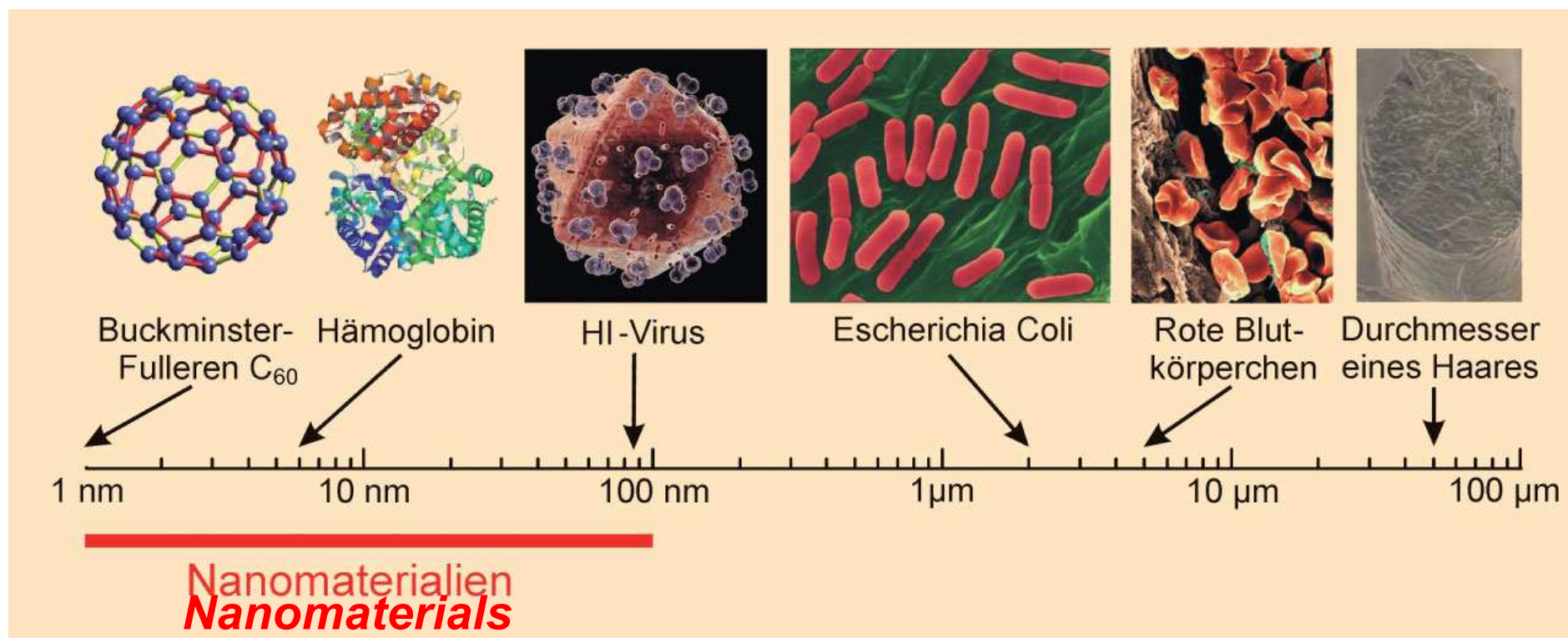


How „big“ is nano?

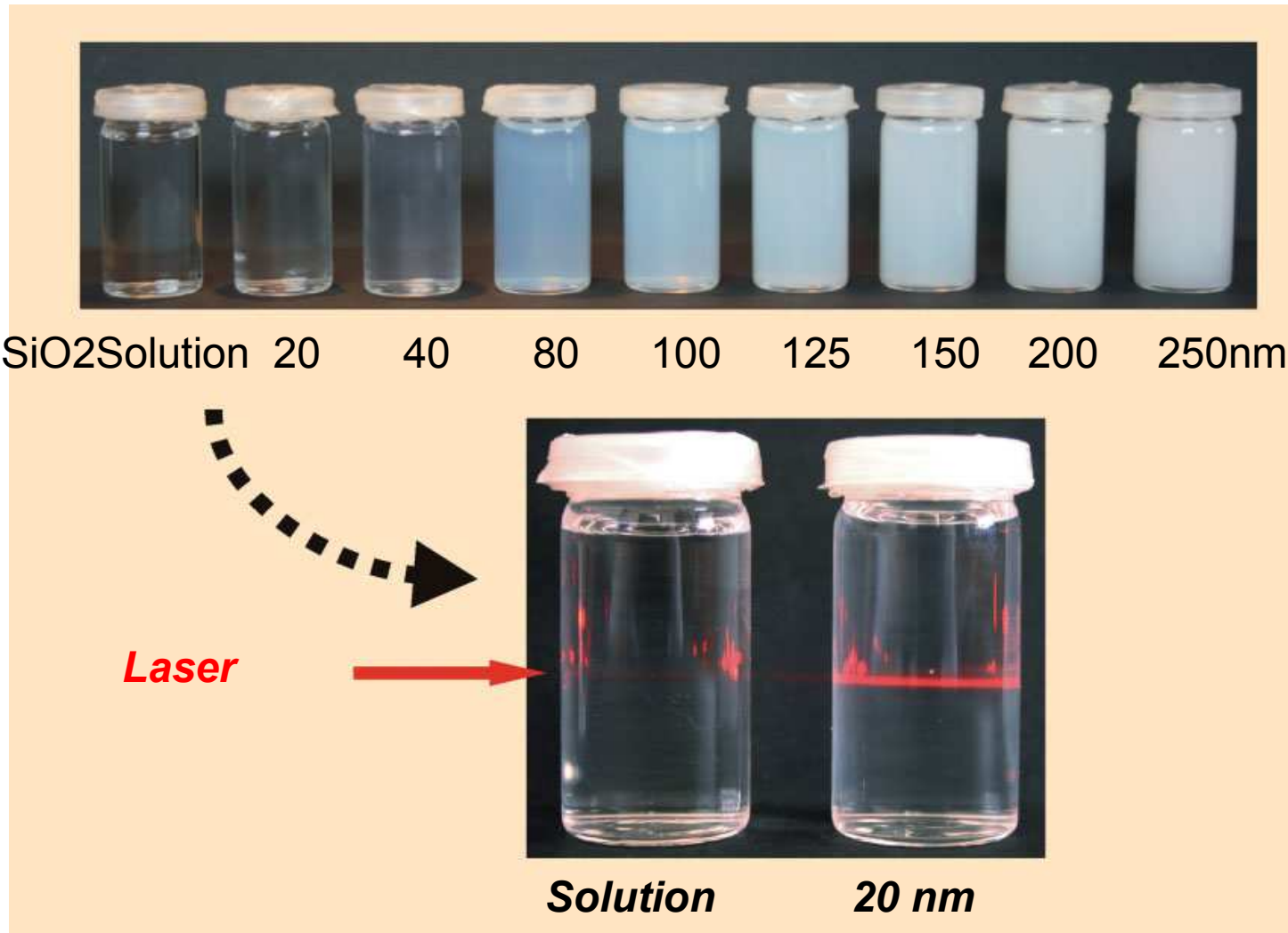
- Prefix “Nano” derived from the Greek word “nanos” = Midget
- One Nanometer is one Billionth of one meter (=0,000 000 001 m)
- In comparison: One Nanometer compared to one Meter is equal to the size of a hazel nut compared to our Earth



Nanotechnology



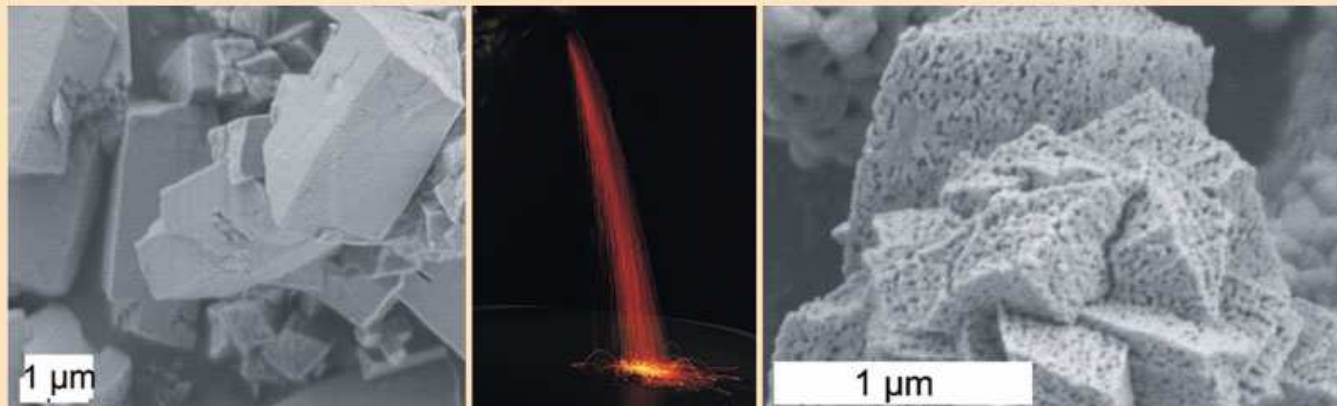
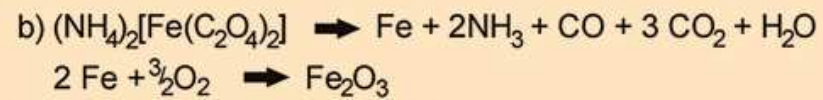
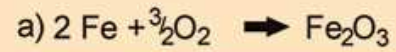
Properties of Nanoparticles – light scattering



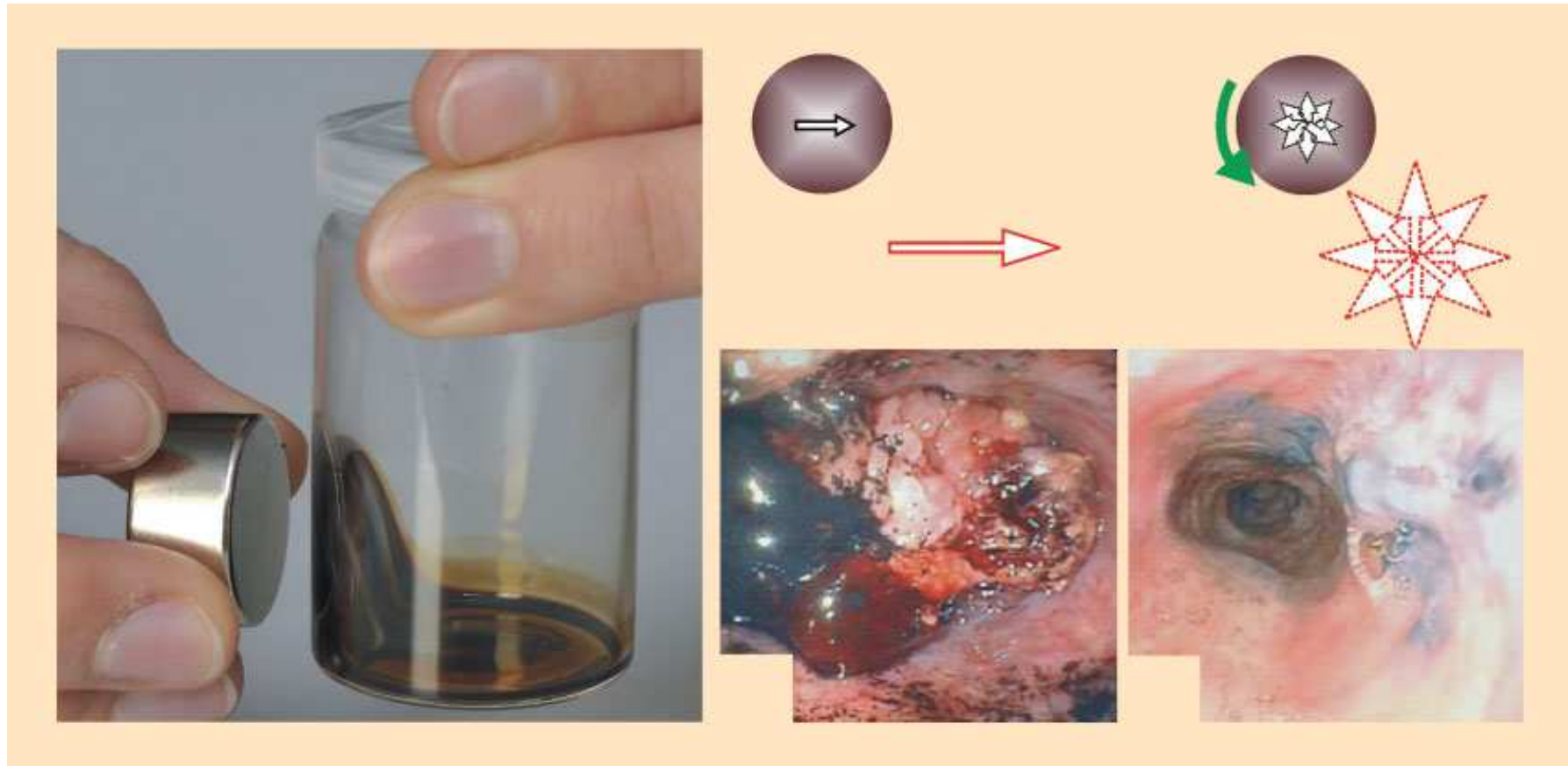
Properties of Nanoparticles – Gold



Properties of Nanoparticles – Iron



Properties of Nanoparticles – Magnetic Liquid



- Commodities
- Biocides
- Chemicals
- Cosmetics
- Foods
- Pesticides

Search Search term [Advanced Search](#)

Deutsch 



[Product Safety >>>](#)

Biological and Chemical Safety of Food & Consumer Products

Enjoyment with unpleasant consequences

The Shiitake mushroom (*Lentinus edodes*) is popular in Germany as an edible mushroom. It is grown and eaten in large quantities. However, in the case of particularly sensitive people this culinary enjoyment may be somewhat dampened later by striated, lash-like reddening of the skin. The trigger of this rare, in some cases severe, skin reaction is probably a natural ingredient in this kind of mushroom. [more >>>](#)

More important information

- ▶ [2-Ethylhexanoic acid in baby food and fruit juices packed in glass containers \(BfR Opinion of 2004-07-20\)](#)  58 KB



Europeans work together on controlling zoonoses

The green light has been given to the European Network of Excellence for Integrated Research on the Prevention and Control of Zoonoses, MED VET NET. 300 leading scientists from 10 countries and 16 scientific institutions have joined forces in order to develop joint strategies to control diseases transmitted from animals to humans. [more >>>](#)

Animal welfare and consumer protection are reconcilable!

The new European chemicals legislation leads to a noticeable improvement in health protection. BfR determines in a new study, that this improvement is not necessarily linked to considerably higher numbers of experimental animals as feared by various sides. Precondition is that the alternative methods to

Stage of Nanotechnology Development

Technological Complexity
increasing

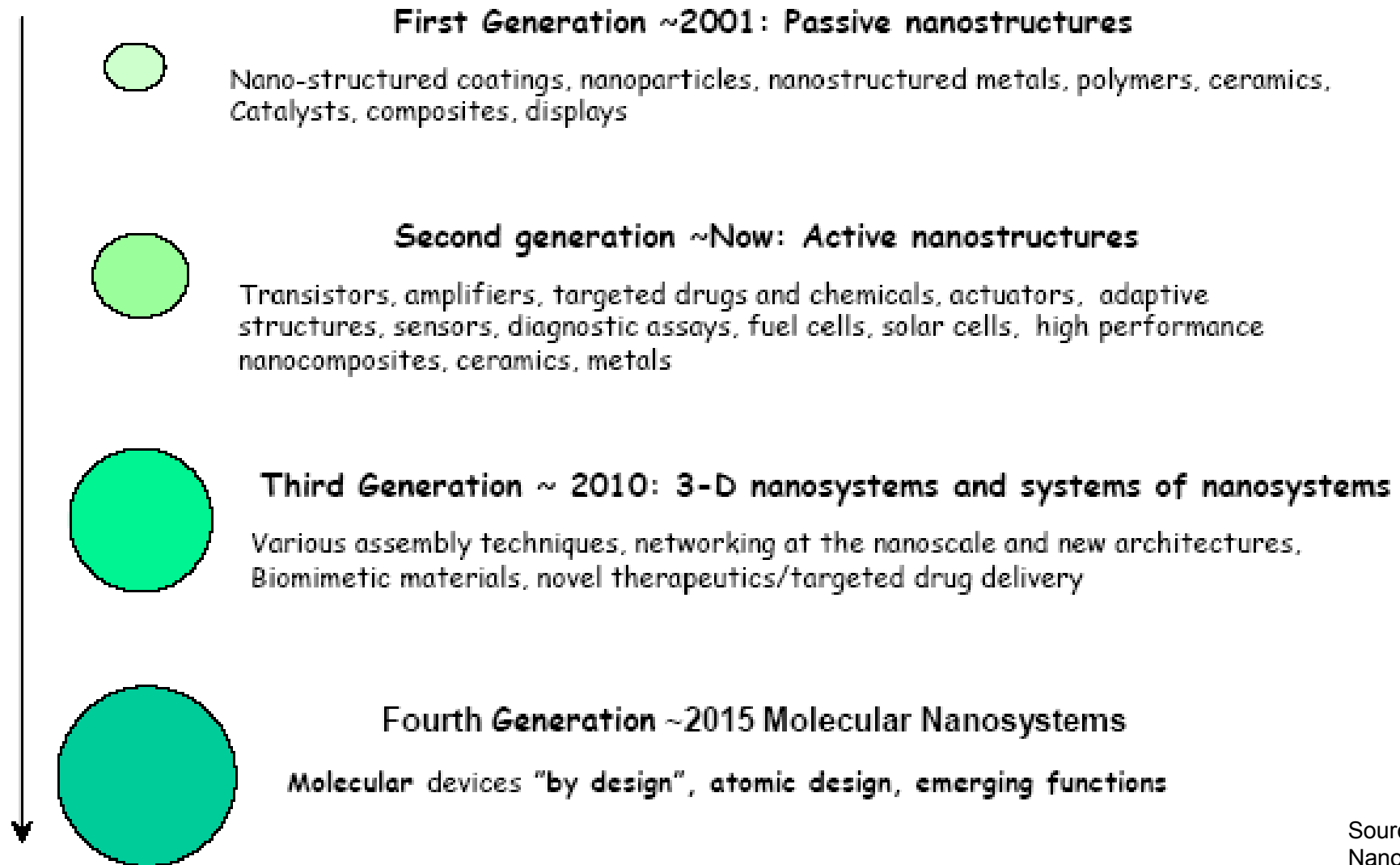
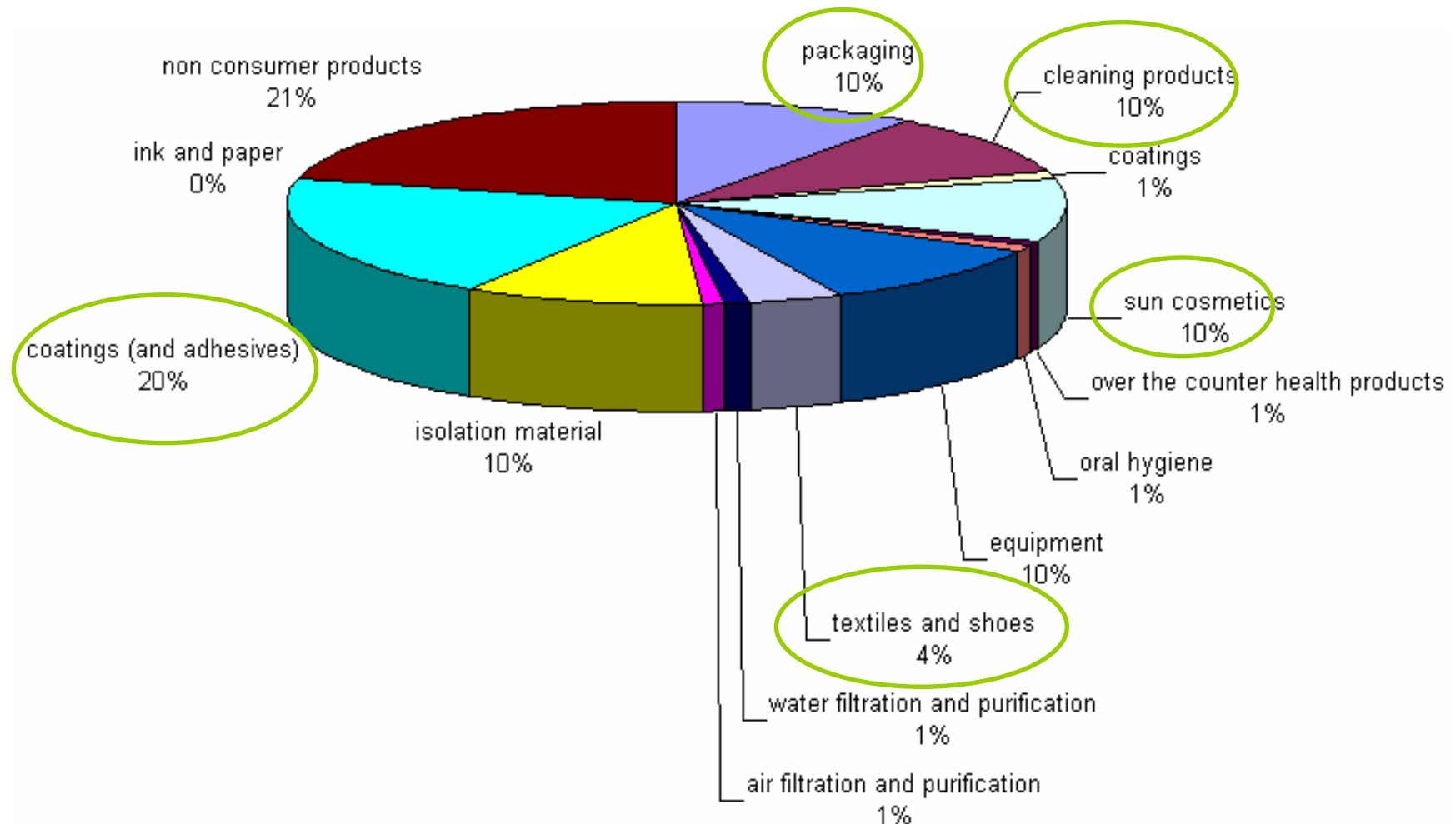
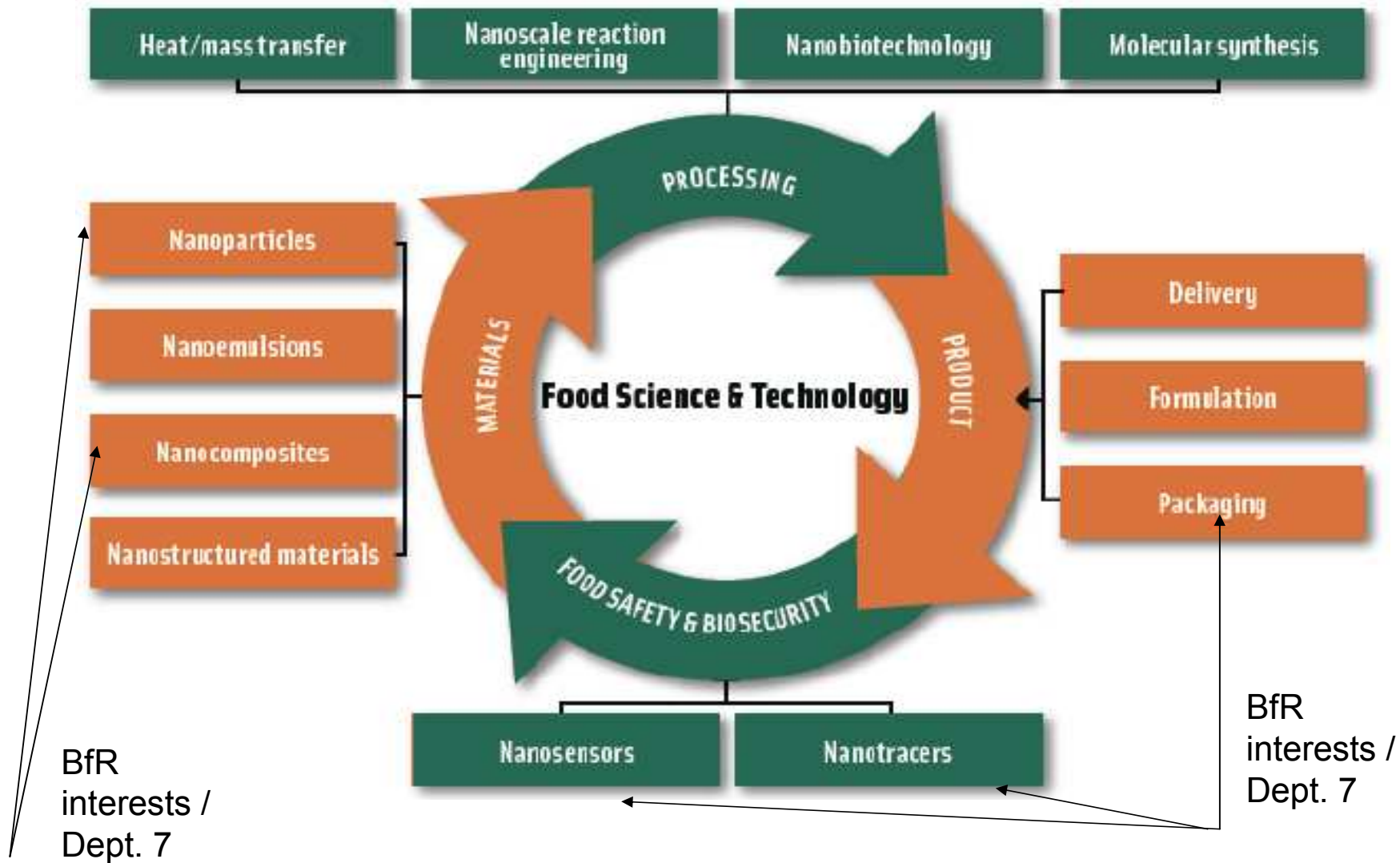


Figure 2. The stages of nanotechnology development

Source:
Nanotechnology
White Paper 2005
EPA

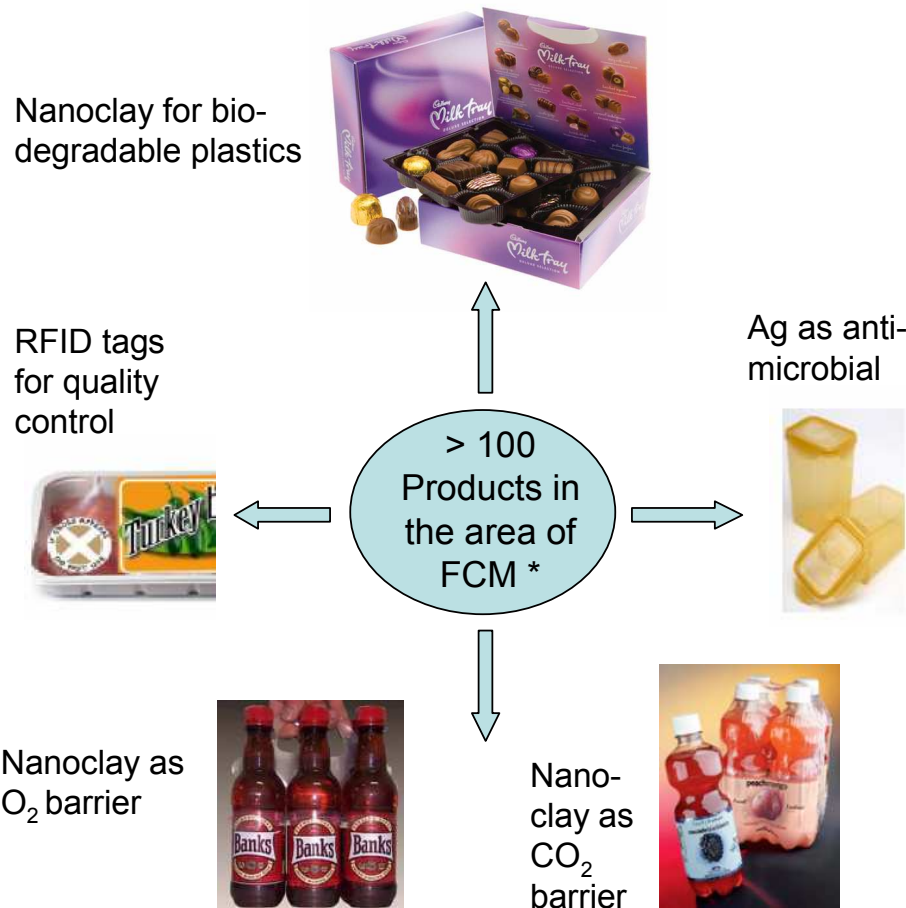
Relevant Areas of Application – Overview (European Data)





Nanotechnology in the Area of Food Packaging – Examples

Nanotechnology in the Area of Food Packaging – Examples



Market share: ~10 %

Source: Q. Chaudhry, CSL

- ◆ better exploitation of resources
- ◆ guarantee of quality and freshness in the area of food and feed
- ◆ „intelligent“ and possibly „active“ packaging

* Source:
www.nanotechproject.org/inventories/consumer/

Related potential nanotechnology applications

- New and more effective drug compounds
- Nearly perfectly targeted drug delivery
- Diagnostics, sensors, and assays
- DNA sizing and sequencing
- Bioelectronics
- Bio-warfare protection
- Antibacterial dressings and coatings



Nanotechnology: Energy generation

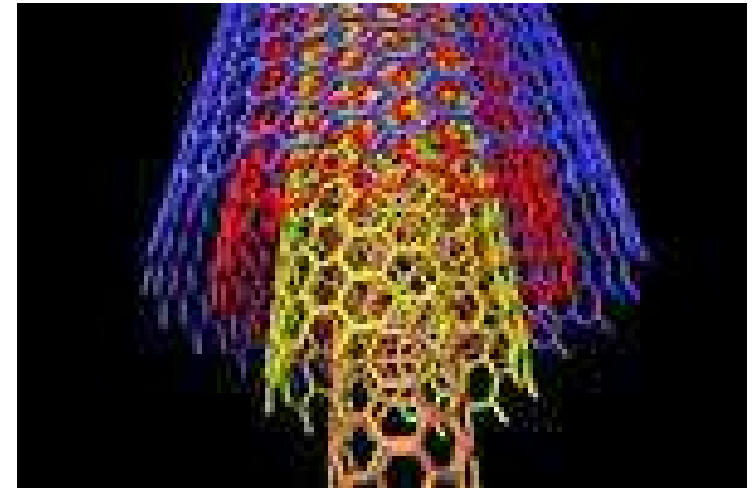
- Thin film photovoltaics for cost effective solar energy
- Cost competitive fuel cells for automotive applications
- Micro fuel cells for portable power applications
- High capacity, rapid-charge batteries



Related potential nanotechnology applications

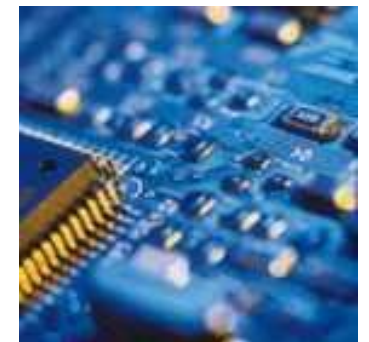
Nanotechnology: chemicals and basic nano-structured materials

- Ultra-lightweight, high-strength, precision-formed materials;
- Nano-composite polymers for structural and electronic applications;
- Membranes and filters for cost-effective desalinization of water;
- Thermal and optical barriers;
- Ink jet materials;
- High efficiency and novel catalysts;
- Resistant textiles;



Nanotechnology in electronics and computing

- Miniaturized supercomputers;
- Terabit non-volatile memory;
- Pervasive computing;
- Low voltage and high brightness displays;
- Faster semi-conductors and micro-processors;



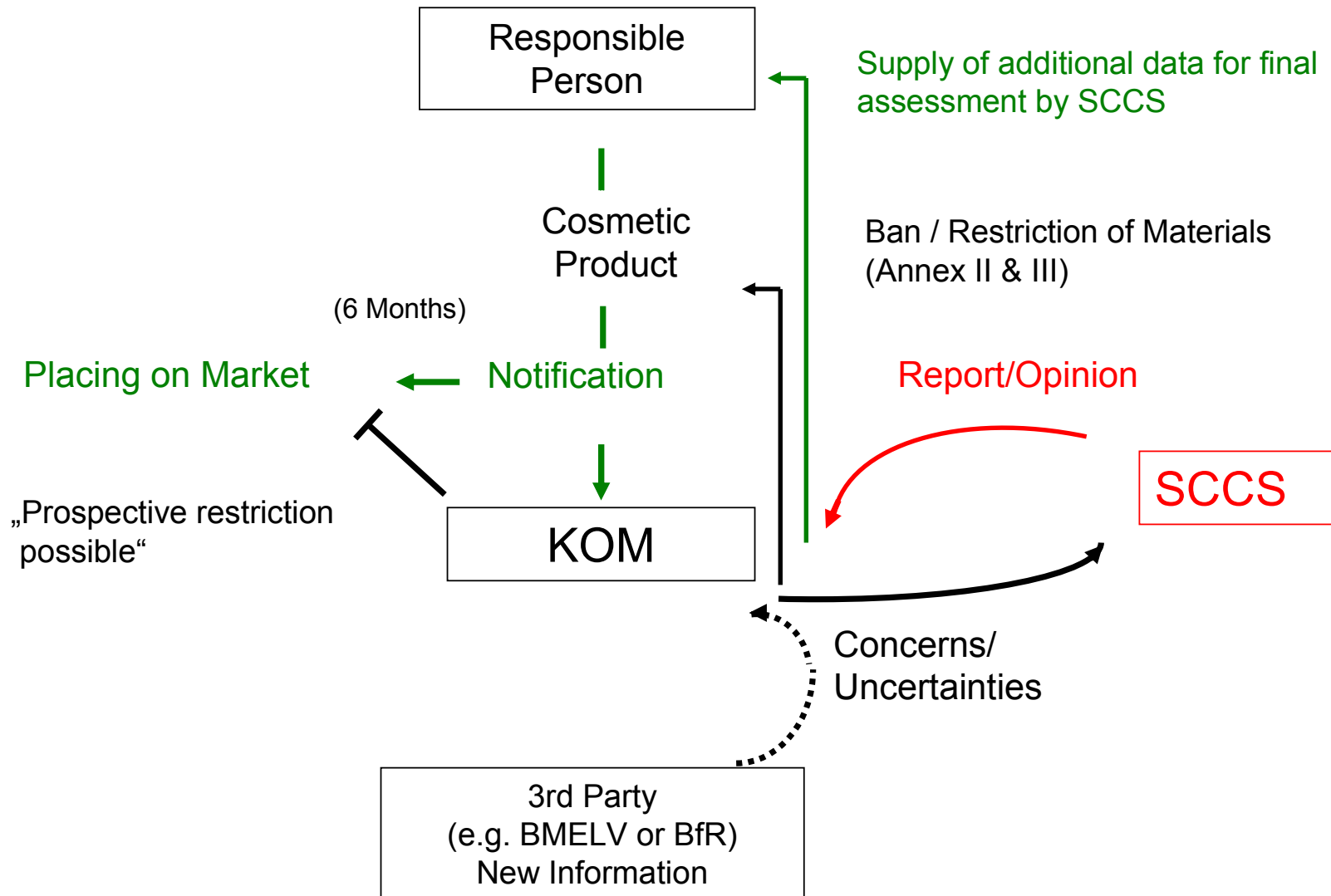
Nanotechnology in the Area of Cosmetics – Examples

Nanomaterials in the service of beauty, care and protection:

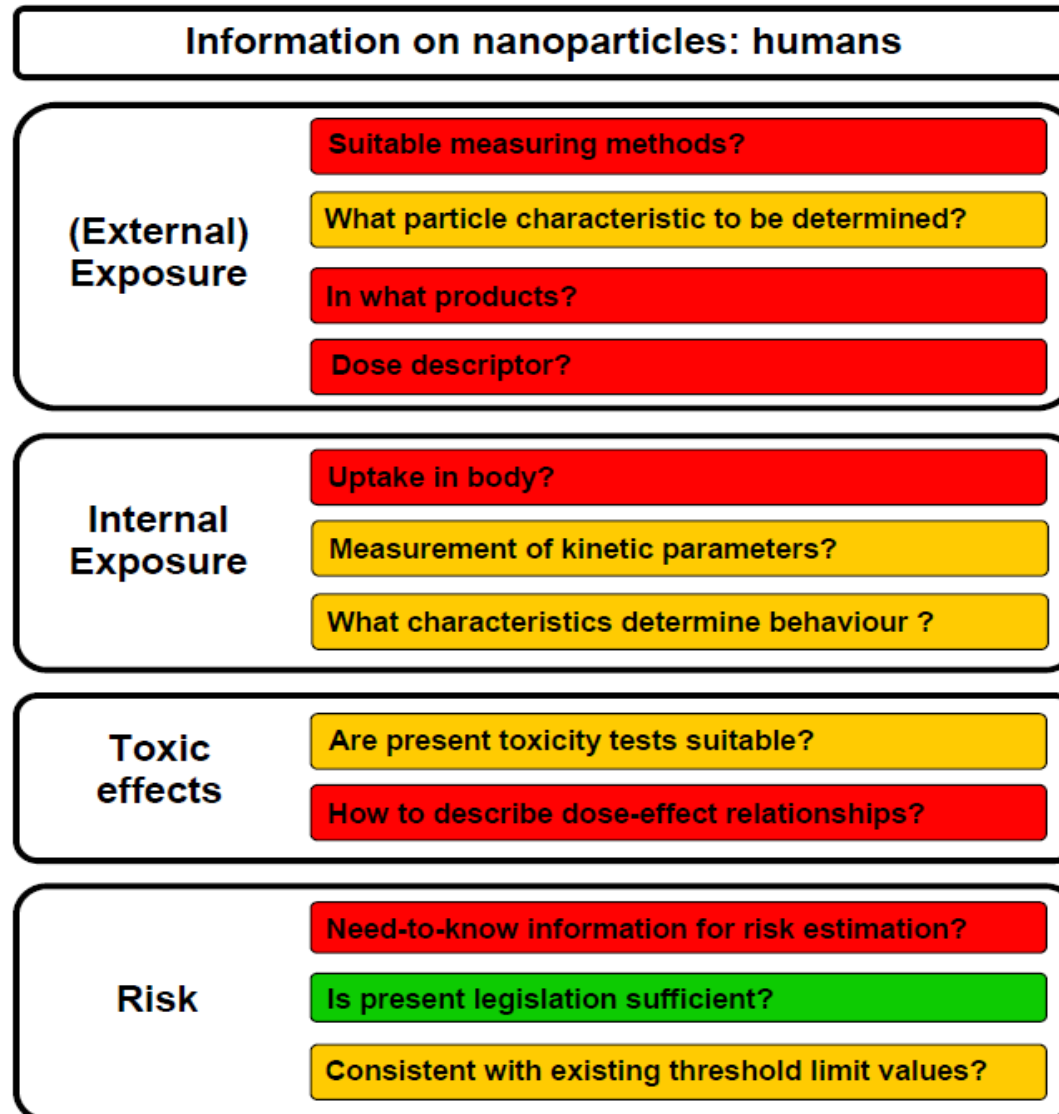
- ❖ Sun creams and lotions
- ❖ Tooth paste (Hydroxyapatite / Calcium peroxide)
- ❖ Nano formulations
- ❖ Decorative cosmetics
- ❖ Anti-aging products (Liposomes)
- ❖ Fullerenes in lip sticks, mascara and perfumes



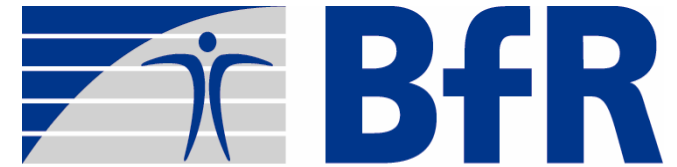
Procedures: Cosmetics containing Nanomaterials (EC 1223/2009)



NM in Products: Overview on most significant Knowledge Gaps



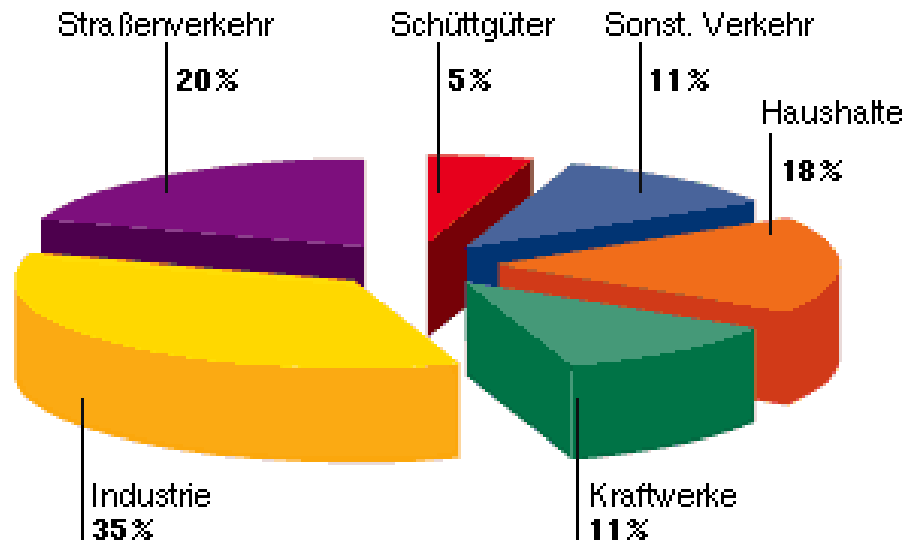
Potential Risks from Nanotechnology



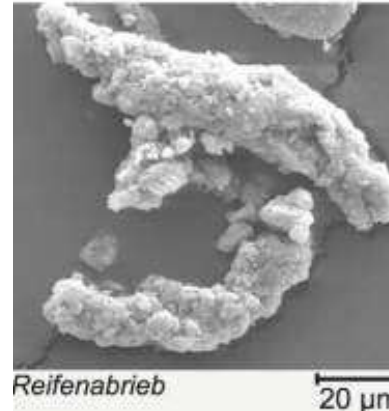
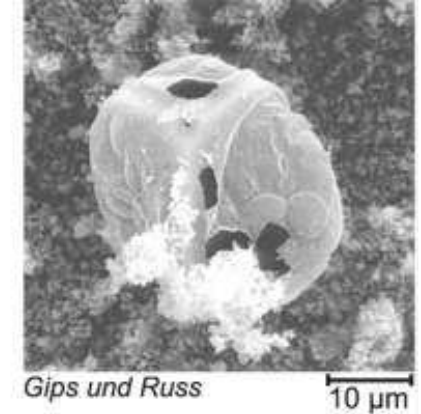
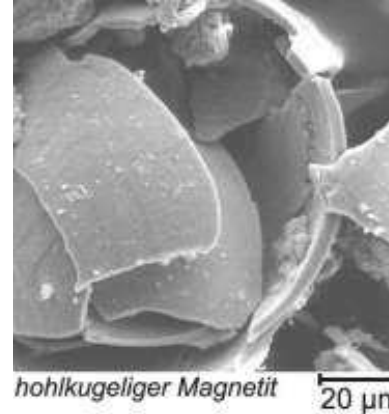
Risiken erkennen – Gesundheit schützen

- **Development of diseases of the air passages and cancer by inhaling nanoparticles**
- **potential damage to digestive systems**
- **development of health impairments over long periods due to regular use of cosmetics containing nanoparticles**
- **side effects of nano-medicaments**
- **interaction between nanoparticles and food ingredients**
- **nanoparticles escaping from production plants and spreading uncontrollably into the environment**

Fine dust (Particle <math><10 \mu\text{m}</math>)



Feinstaubemissionen in Deutschland (Quelle: BMU)



NANOTECHNOLOGY AND NUTRITION

Food products

Organic combinations as transport agent (e.g. for additives, aromas vitamins, enzymes) with molecule-size in the nanometer-category.

Anorganic combinations as for ex. some food additives

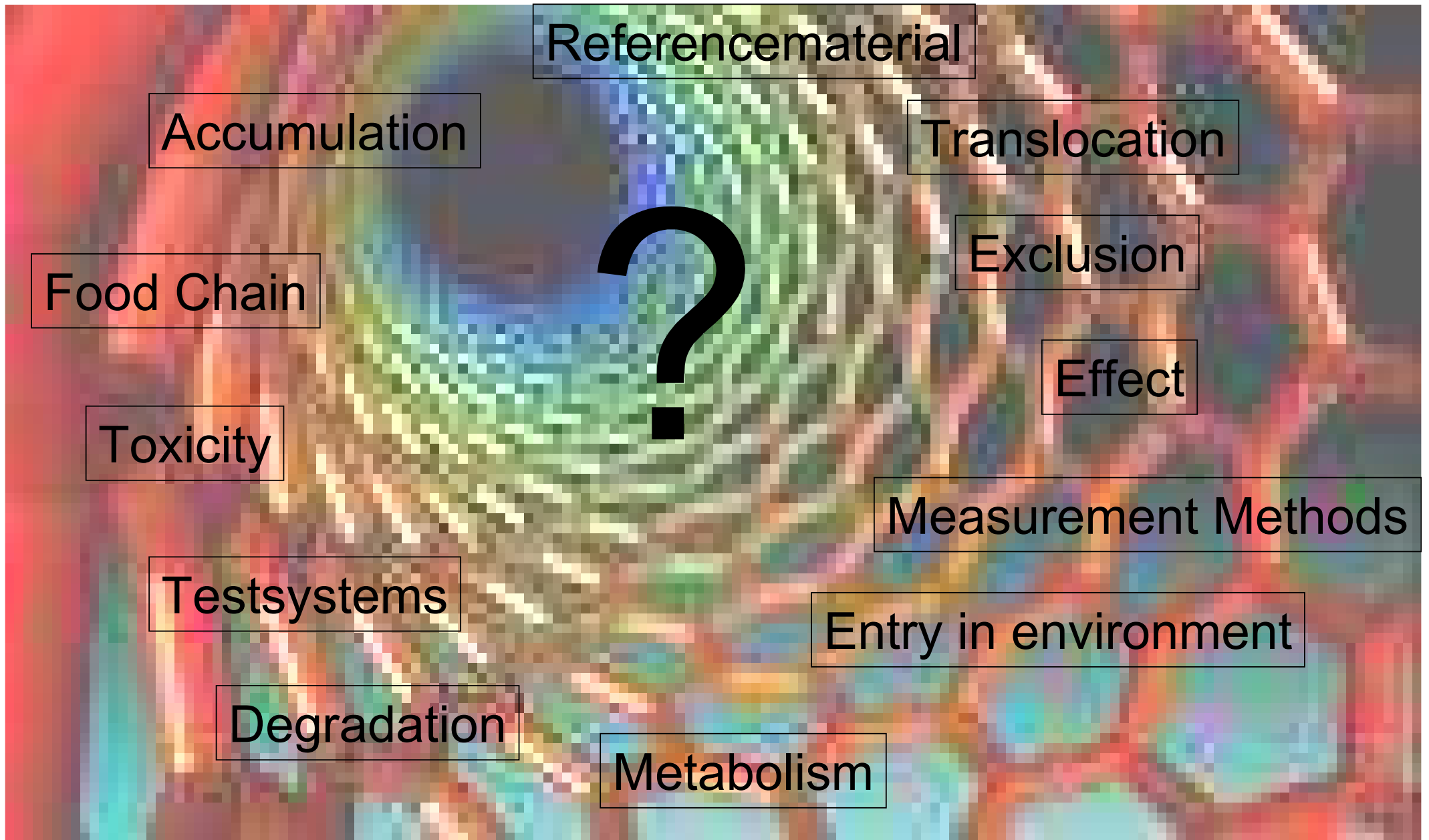
Materials, which come into contact with food

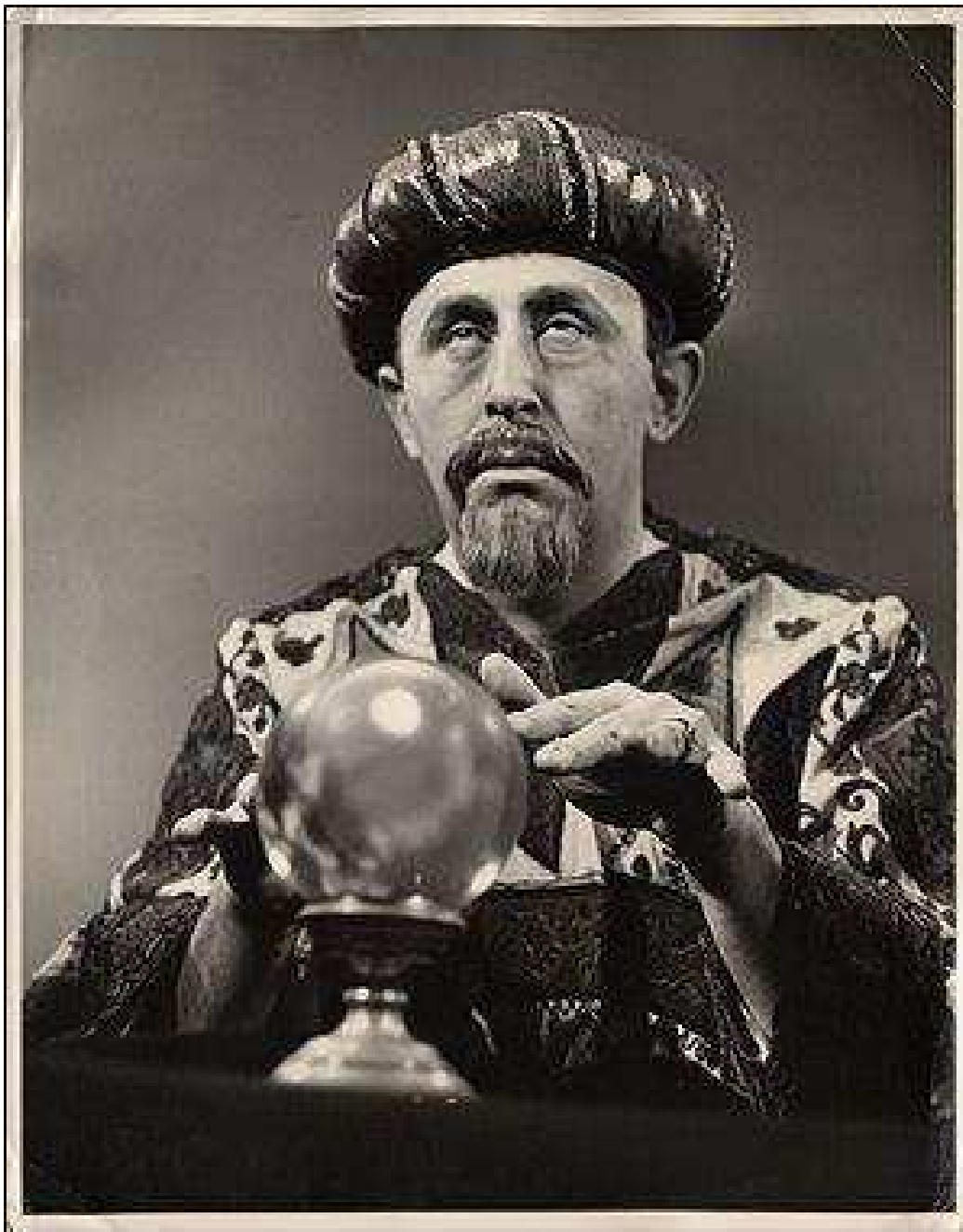
- packaging materials
- materials, which come into contact with food during production, processing and transport



Differentiation between free and surface-bound nanoparticles

Nanoparticle open questions





Potential Risks from Nanotechnology?



Risiken erkennen – Gesundheit schützen

Thanks for Your Audience

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