

Activities of the European Virtual Institute for Integrated Risk Management (EU-VRI) in the area of Nanotechnologies, Risk and Public Health

Snezana Jovanovic (MD, WHO Advisor)
Steinbeis Advanced Risk Technologies, Stuttgart, Germany

Aleksandar Jovanovic
EU-VRI, Steinbeis Advanced Risk Technologies, Germany

EU-VRi: Raison d' être



The one-stop-shop for integrated risk management related product and services

Two main lines of activities:

- EU
- Industry

1. EU

- EU Projects
- TP Industrial Safety ETPIS and German TPIS

2. Industry

- Joint services (the "one-stop-shop" > all products and services available from "one hand")
- Products: software, tools, guidelines, information, ...

Members

Founding:

1. INERIS, France
2. Technologica, Belgium
3. BZF, Hungary
4. University of Stuttgart, ZIRN, Germany
5. Steinbeis GmbH & Co KG, Germany

Associated:

6. CONPRICI, Italy
7. BAM, Germany
8. CNR-IRC, Italy
9. VTT, Tampere, Finland
10. CIOP, Warsaw, Poland
11. TUV, Germany
12. ...



The European Virtual Institute for Integrated Risk Management European Economic Interest Grouping (EU-VRI)

Home Members' Services E-Services Infobases Downloads Management Search

Friday, October 20, 2006 ... Home ... Register Login

EU-VRI News

Friday, October 20, 2006: EU-VRI Meeting in Stuttgart, Germany
An EU-VRI meeting devoted to the preparation of the FP7 proposal will be held in Stuttgart. To read more and apply for participation please click the following link [read more ...](#)

Monday, October 09, 2006: 1st General Assembly of EU-VRI
The first General Assembly of EU-VRI took place at INERIS

Wednesday, September 27, 2006: Possible FP7 Large Scale Collaboration Project
A start-up paper for a possible FP7 Large Scale Collaboration Project [read more ...](#)

Tuesday, August 01, 2006: On-line registration available

Welcome to EU-VRI

European Virtual Institute for Integrated Risk Management, the European organization which provides the highest quality of professional service, consulting, information and education needed in the broad area of modern integrated risk management and management of emerging risks. EU-VRI covers, but is not limited, to the areas of oil and gas industry, e-health, biomedical industry, corporate social responsibility, environmental risk management, business risks, transport risks, logistics... EU-VRI is organized as an EEIG.

INTEGRATED APPROACH TO RISK

Water Supply, Transportation, Oil & Gas Production and Storage, Government Services, Social aspects, Legislation (e.g. available vs. ...), Link to security, Emergency Services, Information & Communications, Banking & Finance, Electric Power, NATURAL HAZARD & DISASTERS

see site!

The starting point ...

- **What is the REAL safety concern and/or safety impact of nanotechnologies:**
 - ("mere") presence in the environment?
 - ("mere") presence in tissues?
 - occupational and/or other health issues/problems/diseases?
- **From the Public Health (PH) point of view the answer is simple: possible and actual effects on humans! ... Individuals and groups ...**
- **Much of the current research stops before reaching the level of Public Health**

TECHNOLOGY



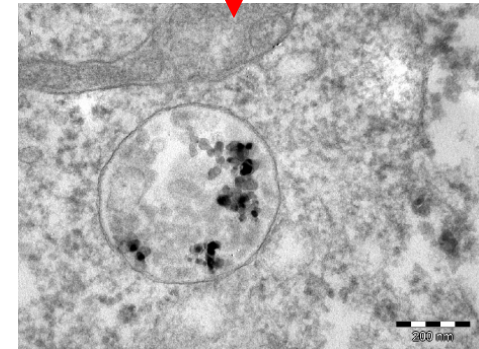
RELEASE



ENVIRONMENT



(HUMAN) TISSUE



Aluminum nanoparticles inside an endosome of an A549 cell from an in vitro toxicity experiment (cf. ToxSci 2006)



Short-term and long-term adverse effects: disorders/diseases

Human exposure to nanoparticles ...



- **yes, we are exposed ... and this IS a problem of INDUSTRIAL SAFETY!**

Process	Total concentration in measurement range 14-673 nm, (particles.cm-3)
Outdoor, office	up to 10 000
Silicon melt	100 000
Metal grinding	up to 130 000
Soldering	up to 400 000
Plasma cutting	up to 500 000
Bakery	up to 640 000
Airport field	up to 700 000
Welding	100 000 up to 40 000 000

!!

!!!

ref: SCENIHR 2006,
Möhlmann, 2004

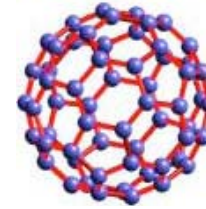
Human exposure to nanoparticles ...



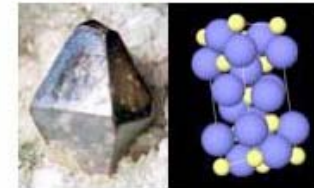
➤ Examples!

- pulmonary and dermal toxicity of fullerenes
- distribution and dermal penetration and pharmacokinetics
- physicochemical characteristics and dermal penetration of metals oxides in sunscreens
- potential photocarcinogenicity of titanium dioxide
- ...

Fullerenes



Metal oxides



The starting point ...

➤ Can Nanomaterials be Toxic? ... YES!

- Wide range of materials can be made "nano"
- Nanometer range is where life processes happen – e.g. inhaled ultrafine particles are toxic to lung and cardiovascular system
- Transported easily, go unexpected places
- Accumulate in cellular organelles
- Some components are toxic as chemicals, i.e. they can be toxic both as chemical and nano!
- Many (most?) of possible effects belong to the category of "low-doses-long-term-exposure" which is an unsolved problem in itself, also for "non-nano" materials!
- ... Huge knowledge gap: **Currently we have "a nano part" of knowledge needed to assess the toxicity of nanomaterials!** ... probably just about 10^{-9} of knowledge we have about the toxicity of chemicals! ... think about REACH!

TECHNOLOGY



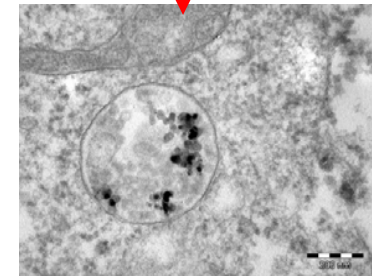
RELEASE



ENVIRONMENT



(HUMAN) TISSUE



Aluminum nanoparticles inside an endosome of an A549 cell from an in vitro toxicity experiment (cf. ToxSci 2006)



Short-term and long-term adverse effects: disorders/diseases

The starting point ...

- **What do we have (“good news”)?**
 - public and scientific interest
 - Overall methodology/approach (e.g. the IRGC)
 - Running research (US, EU, ...)
 - Some methods and tools
- **What we still miss (for sure!)**
 - clinical research
 - targeted epidemiological research/surveys
 - integration of research: analytical, in silico, in vitro, in vivo ...
 - integration of nano-issues into the routine practice of public health ... regulatory framework missing!

TECHNOLOGY



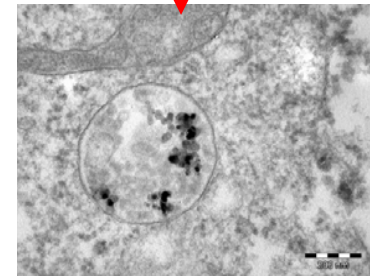
RELEASE



ENVIRONMENT



(HUMAN) TISSUE



Aluminum nanoparticles inside an endosome of an A549 cell from an in vitro toxicity experiment (cf. ToxSci 2006)



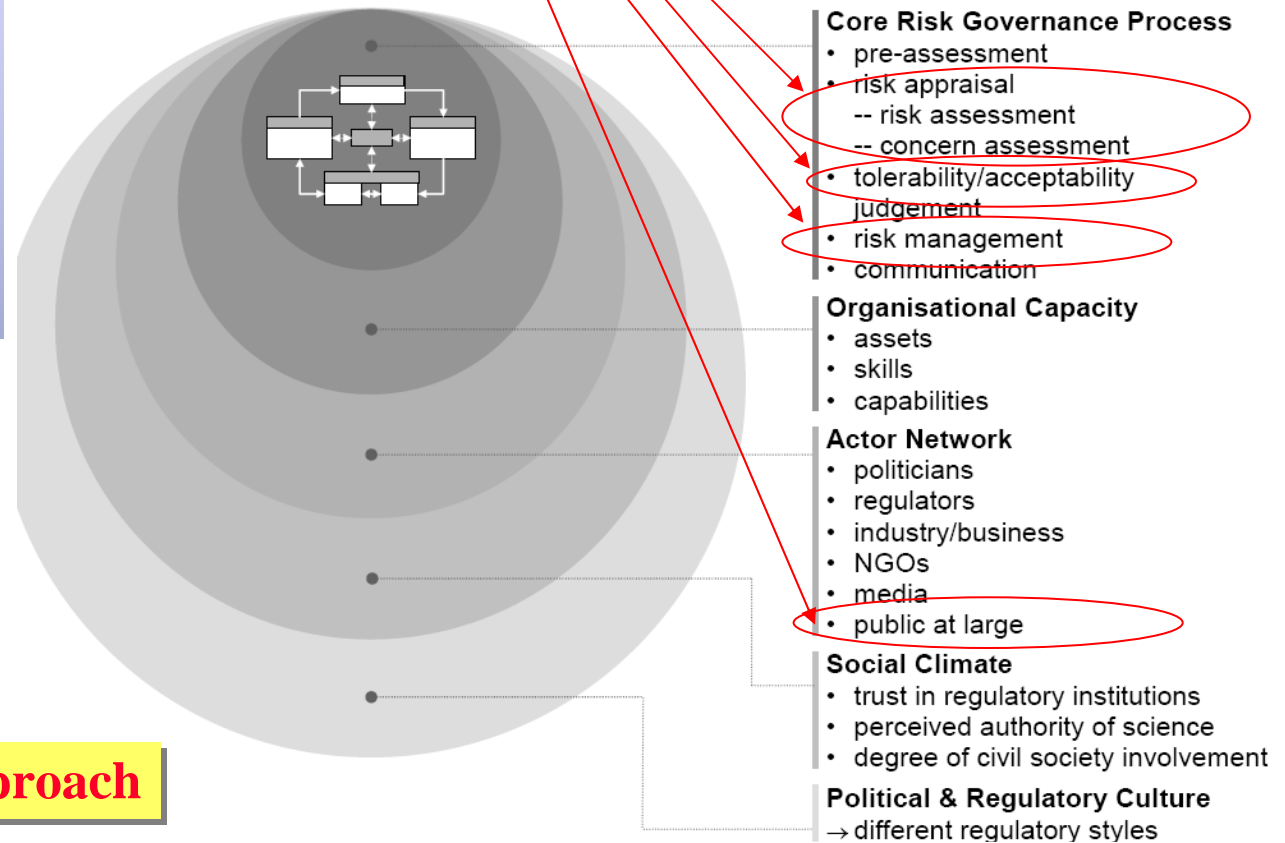
Short-term and long-term adverse effects: disorders/diseases

What is so specific about nano-technologies with respect to public health?

Public Health (primary concerns)



IRGC RISK GOVERNANCE FRAMEWORK (I/III): OVERVIEW



methodology/approach

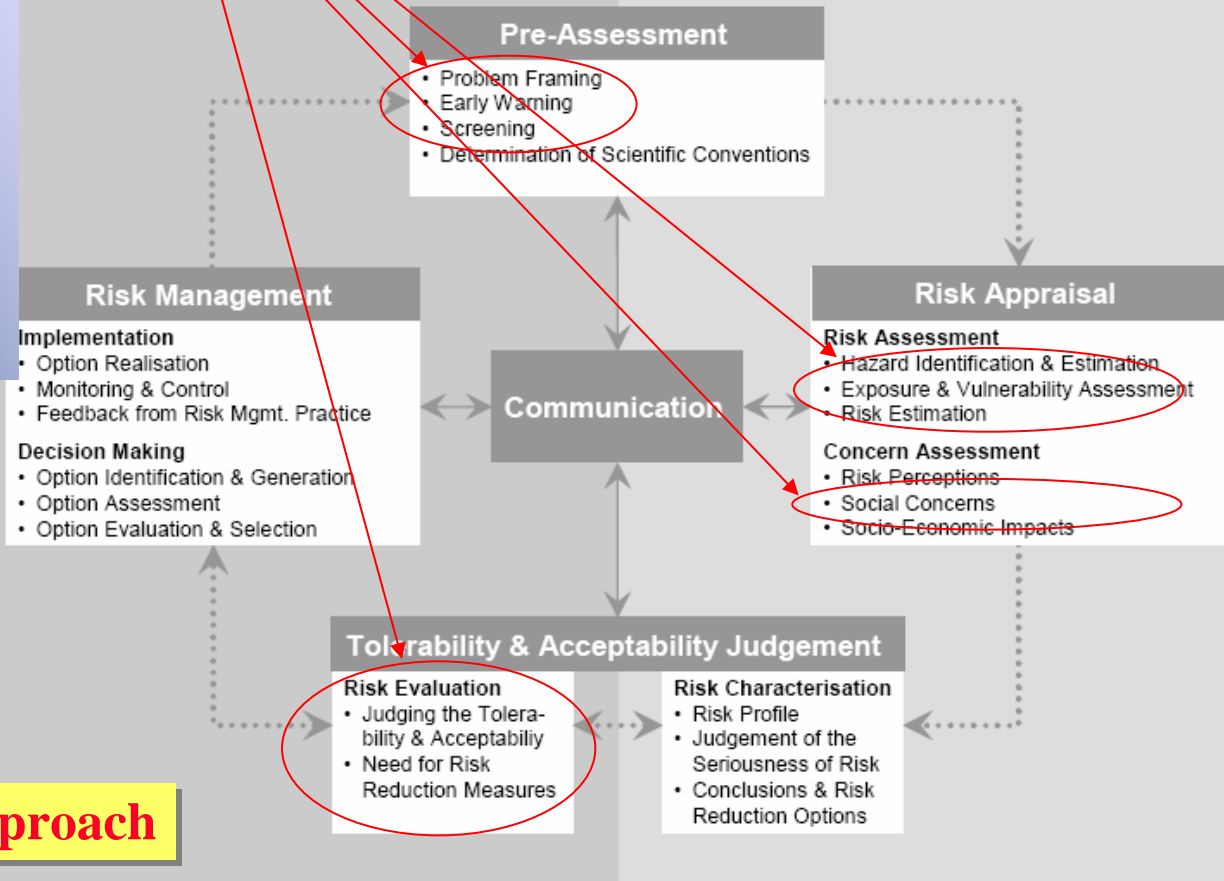
IRGC RISK GOVERNANCE FRAMEWORK (II/III): CORE PROCESS

What is so specific about nano-technologies with respect to public health?

Public Health (primary concerns)

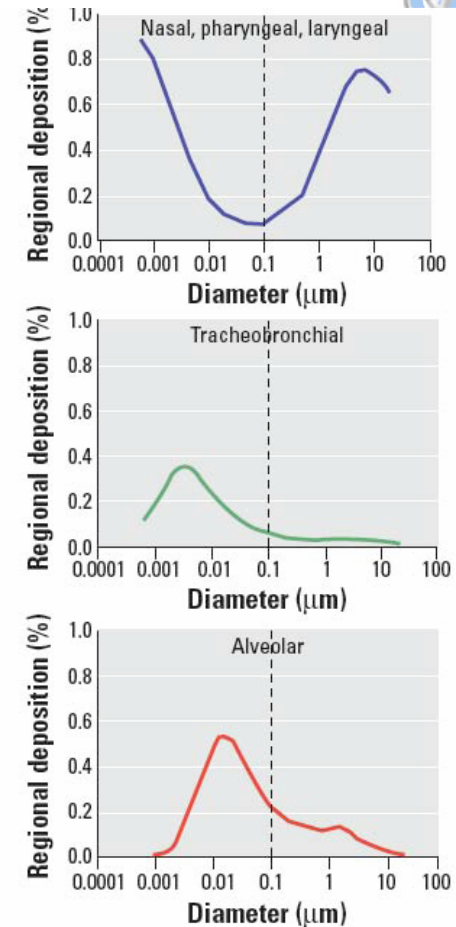
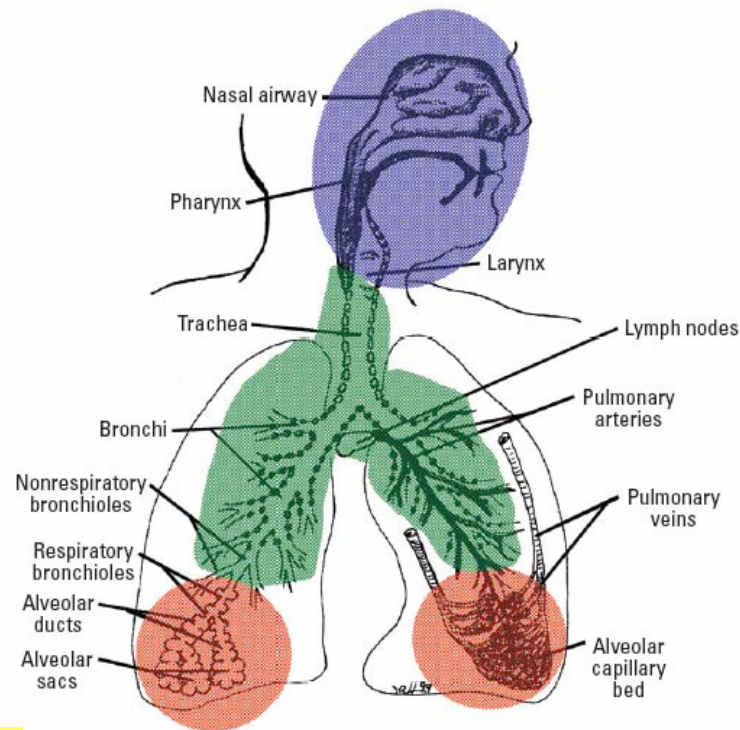
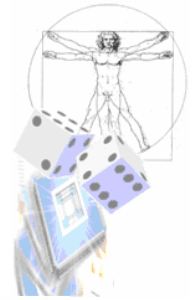
Management Sphere:
Decision on & Implementation of Actions

Assessment Sphere:
Generation of Knowledge



methodology/approach

**Example
(US):
Pulmonary
Deposition as
a function of
particle size
(not so
straight-
forward – PH
research
needed!)**



running research

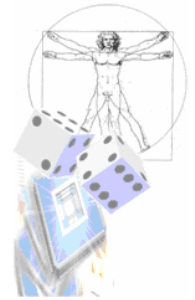
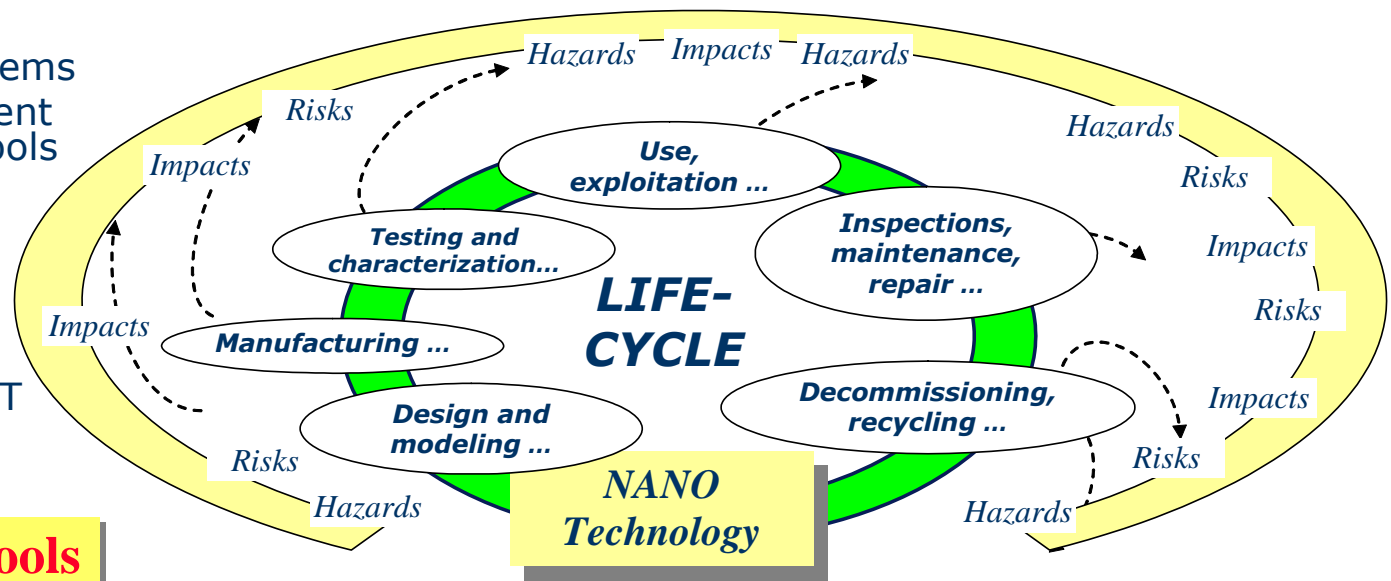
ref: Bucher, NTP 2006

Methods and tools – part of the solution:

- IT infrastructures (databases, communication possibilities ...)
- simulation
- bio-inspired modeling (e.g. artificial organs, artificial life)
- advanced methodologies
- data mining
- complex systems
- risk assessment methods & tools
- ...

INTEGRATED RISK MANAGEMENT (Over the life-cycle)!

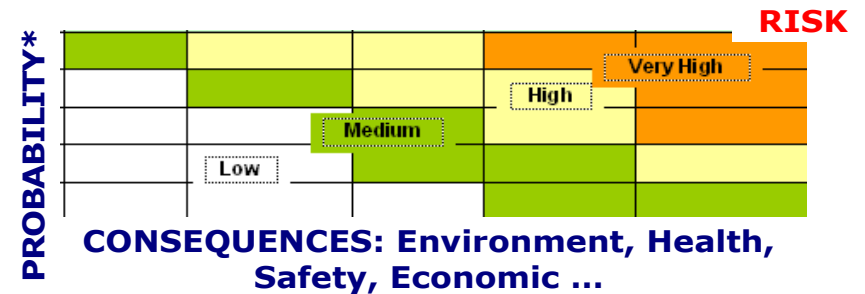
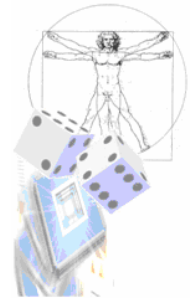
methods & tools



(integrated) Risk assessment and management should:

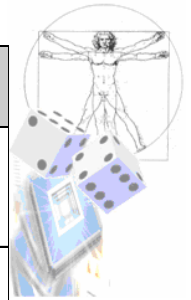
- combine quantitative and qualitative assessment
- deal with low-quality, scattered, inconsistent and few data
- match the model-based and behavior-based assessment be seamlessly combined with the preliminary screening analysis
- provide a preliminary assessment of risks and effects of low-doses long exposure effects in the (usually!) short times available in research projects

methods & tools



* - Calculated and/or perceived by the society

**Conclusions:
we still lack
a lot!**



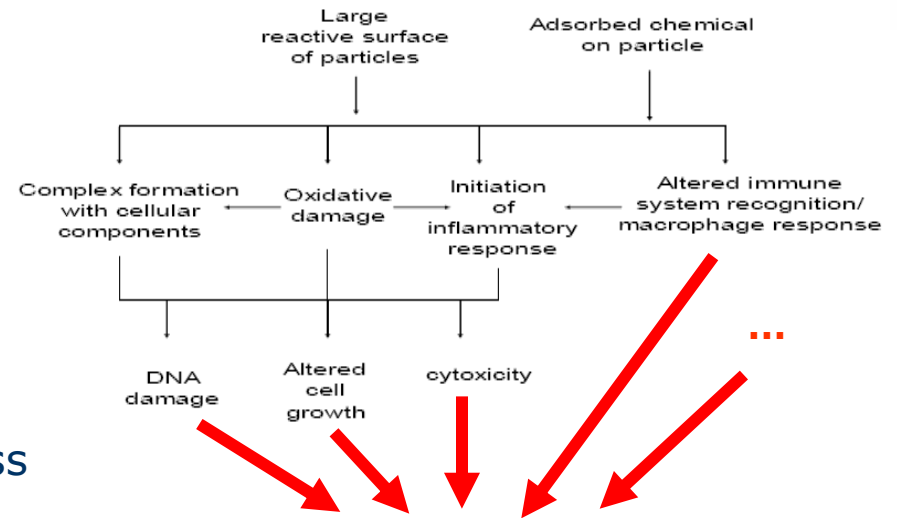
Comparison / Differences		
	Chemicals / particles	Nanomaterials
<i>Can we reasonably predict?</i>		
• Structure/ properties	yes	no !
• Absorption	yes	no
• Distribution	often	no
• Metabolism	often	sometimes
• Excretion	often	no
• Toxicity	often	no !!
• Target organs	often	no !!
• Persistence/reversibility of effect	often	no !!!
<i>Do we know how to design, perform and interpret studies? !!!</i>		
• Material preparation	yes	no
• Study designs	yes	no
• Interpretation	yes	yes

ref: Bucher, NTP 2006

CONCLUSIONS ...

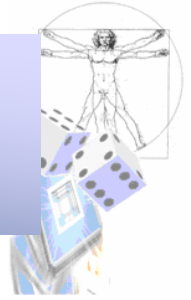


- General conclusion:
 - Yes, there is a cause for concern/caution
 - No, there is no quick answer
 - Yes, we (as public health people) know what questions to ask
 - Yes, were we making progress
- Main issue: effects on humans can be far more complex than "just" DNA damage ... e.g. chronic diseases, reduced work ability ...



Short-term and long-term adverse effects ON HUMANS (also "work force"!): disorders/diseases???

... in other words ...



- Health effect are:
 - not only “depositions” and “concentrations”, but more
 - how the people feel (“thick” or “well”!)
 - ... if exposed to nanoparticles, nanomaterials, nanotechnologies ...
- ...and for industry and industrial safety it means the exposure of:
 - work force
 - users of their products
 - general population

TODAY

FUTURE?

Nanotechnology /
nanochemistry

Nanotoxicology

Nanopathology

Public
health