UK Activities on Health Aspects of Nanomaterials

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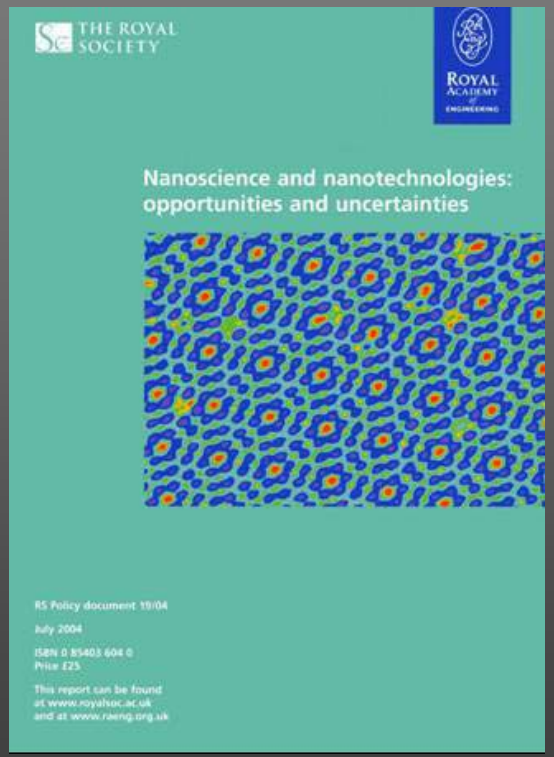
The UK government response to concern over nanomaterials



- Possible adverse health, safety and environmental impacts
- Regulatory issues
- Social and ethical issues
- Stakeholder and public dialogue
- Ensuring the responsible development of nanotechnologies

Professor Anthony Seaton

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The RAEng/RS report: summary

- Nanotechnologies offer great opportunities with many benefits now and in the future
- Development should be debated by the public
- Most nanotechnologies pose no new risks to health, safety or the environment- nanoparticles and nanotubes are a concern
- Research and regulation required immediately to address uncertainties about hazards and risks of nanoparticles and nanotubes

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Response of the UK scientific community

Topic	Group	Site	Aspect of safety
Measurement	HSL (HSE)	Buxton	Workplace measurements
	IOM	Edinburgh	ditto
	CSL/IOM	York/Edinburgh	Tracking the importation and use of nanomaterials in the UK
Setting up networks	Nanosafenet	Begbroke, Oxford	Seeking to set up network of researchers to address safety
	Nanomist	Universities of Birmingham /Aberdeen	ditto
	Nanosafe 2	EU project: UK members include oxonica, qinetiq HSL IOM)	ditto
Toxicology	Ken Donaldson	Edinburgh University, Edinburgh	Inflammatory and toxic effects of nanoparticles
	Dr Vicki Stone	Napier University, Edinburgh	ditto
	Dr Terry Tetley	Imperial College, London	ditto
	Dr Frank Kelly	King's College London	ditto

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A UK multidisciplinary centre aimed at safe use of nanomaterials

Safety of *n*anomaterials Integrated Research Centre

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Purpose of SnIRC

- To generate a scientific evidence base for:
  - Promoting growth of UK nanotechnology industry
  - Safeguarding workplace, public and environmental health
- To become the UK centre for information, advice on health, safety and environmental impacts of nanoparticles.
- To assist UK industry in developing safe nano-materials.
- To integrate with other UK and international researchers and regulators.
- To assist Government Departments in developing sound strategies for managing public/workplace/environmental health and safety.

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SnIRC activities

- already engaged in a range of studies of nanoparticles
- led by key researchers in the relevant fields :-
  - Particle toxicology,
  - Ecotoxicology,
  - Exposure and risk to health and environment,
  - Human studies and epidemiology
- expands on established, integrated research groups
- existing links to industry and to government agencies/regulators
- existing global research collaborations

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SnIRC Programme

- Study the mechanisms of NP interaction with organ systems.
- Develop approaches to assess personal exposure.
- Health impact assessment.
- Risk assessment.
- Investigate the behaviour and long-term fate of NPs in ecosystems.
- Promote internationally agreed protocols to investigate exposure, bioaccumulation and toxicology.

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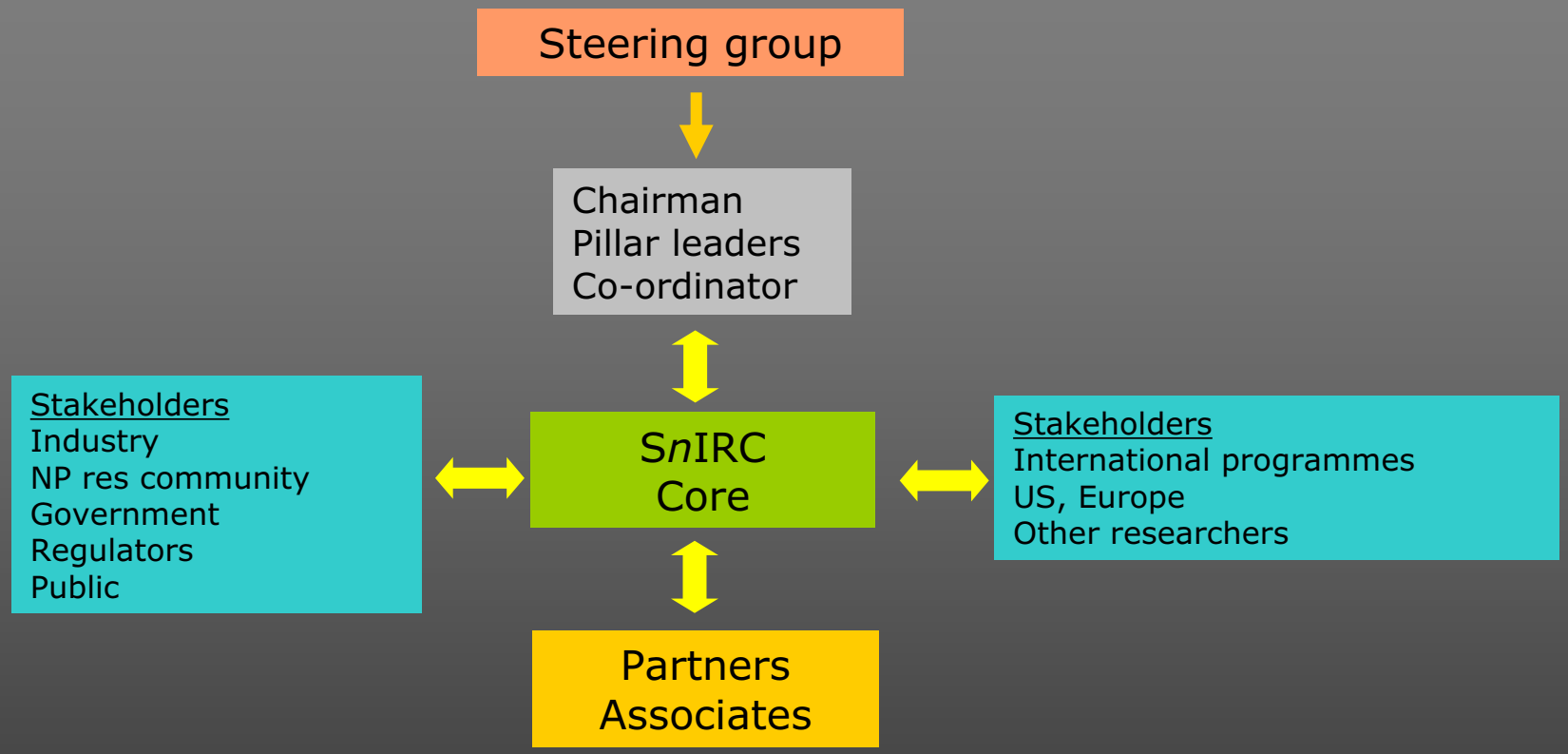
Structure of SnIRC



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SnIRC core

Institute of Occupational Medicine

Self funding research charity

Strengths in regulation-related research and epidemiology

ELEGI Laboratory Edinburgh University Medical School

Strengths in nanotoxicology and fibre toxicology

Napier University

Strengths in ecotoxicology and nanotoxicology

SnIRC Chairman

Professor Anthony Seaton

Aberdeen University

Epidemiology, exposure assessment, human exposure studies

All have many previous national/international collaborations

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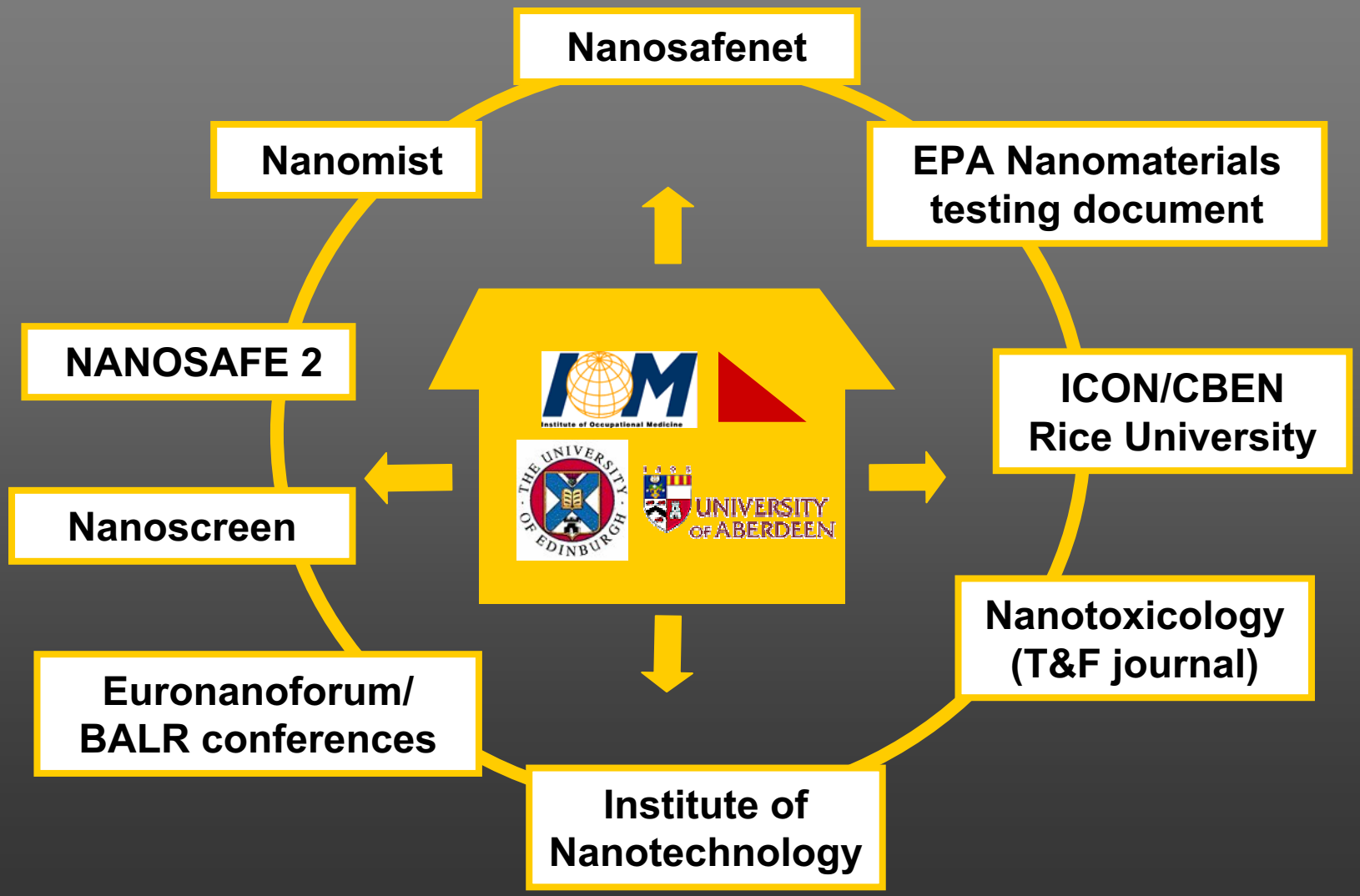
Advisory/consultancy roles of SnIRC members in other nano-initiatives



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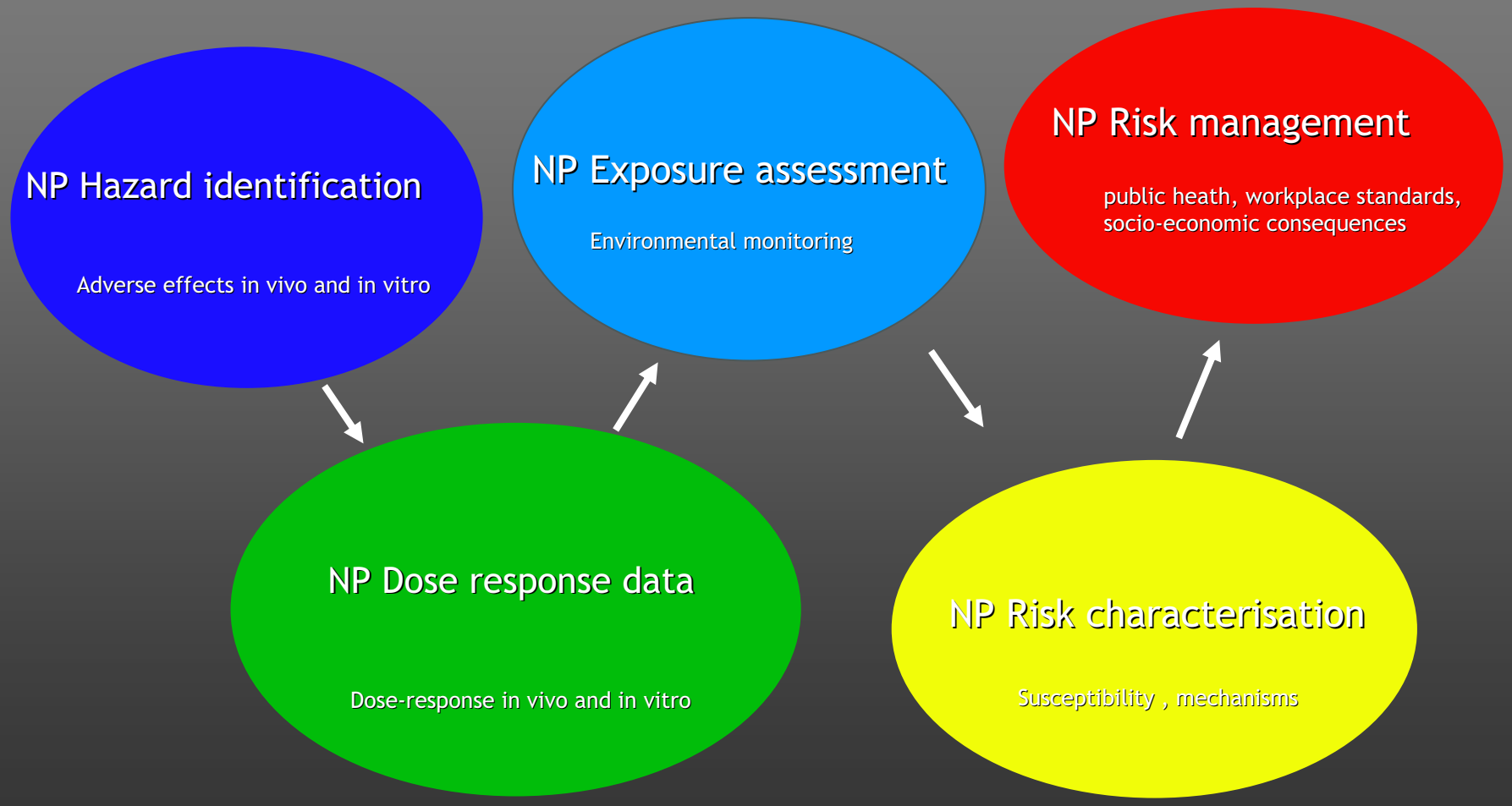
Health Effects Paradigm



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Key issues 1) Nanoparticle toxicology:

the knowledge gap between 'accidental' versus 'engineered' nanoparticles

Nanoparticles	Source	Exposure	Toxicology
Accidental	from combustion Road vehicles, Fossil fuel Cooking e.g. diesel	Low exposure Everyone	++++
Manufactured (1)	Bulk nanoparticles in industry e.g. carbon black, TiO2	High exposure Workers	++
Manufactured (2)	Engineered nanoparticles in the Nanotechnology industry e.g. buckyballs, nanotubes	High exposure Workers then Low exposure everyone	+/-

?

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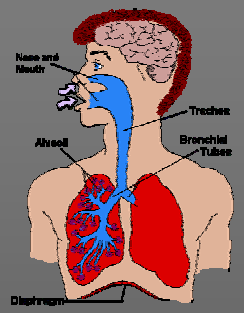
Key issues 2) Target organs for nanoparticle effects



Lungs

Workplace exposure during manufacturing

Gneral exposure during attrition in the environment

Skin

Present in cosmetics

Deposition from air

Brain

Access across the olfactory epithelium

Gut

Cleared from lungs

In foods and drinks

Do the NP migrate from these sites and move around the body to affect other organs and tissues e.g. the blood and cardiovascular system

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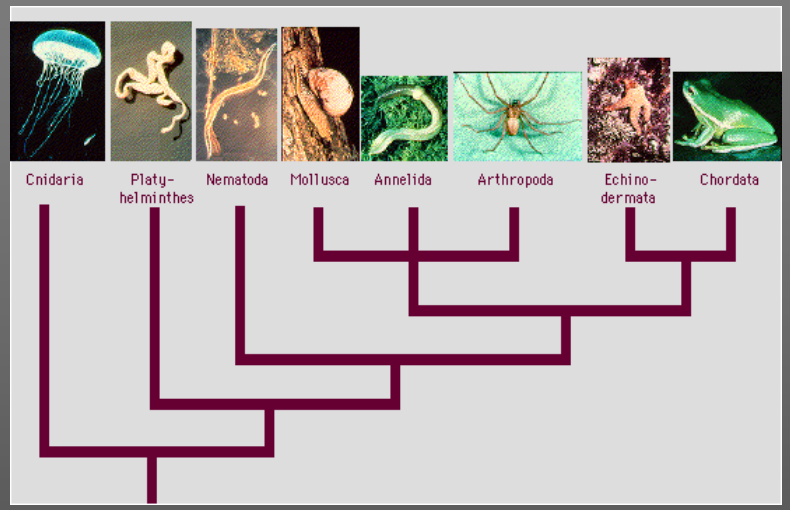
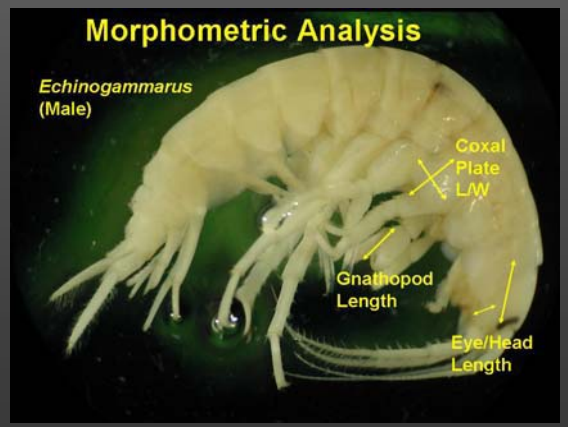
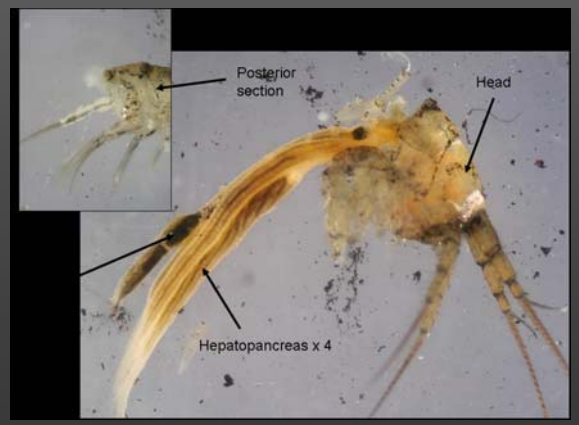
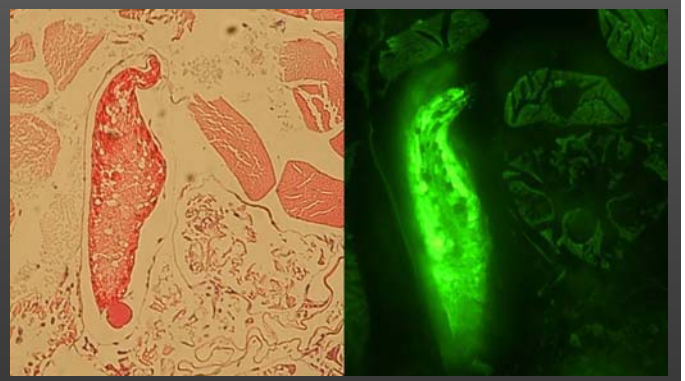
Key issues 3) Potential Ecotoxicological Effects of Nanomaterials









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Key issues 4) Exposure to NP

- Exposure route - inhalation, ingestion, skin
- No data on levels of exposure to engineered NPs
- No data on effectiveness of controls
- Current exposure most likely in research and development scenarios (2000 potentially exposed?)
- Future exposure in more industrial scenarios
- Probable that surface area is the best metric
- No convenient methods or relationships
- Need to adapt existing methods and strategies, develop new instrumentation

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SnIRC website

www.snirc.org

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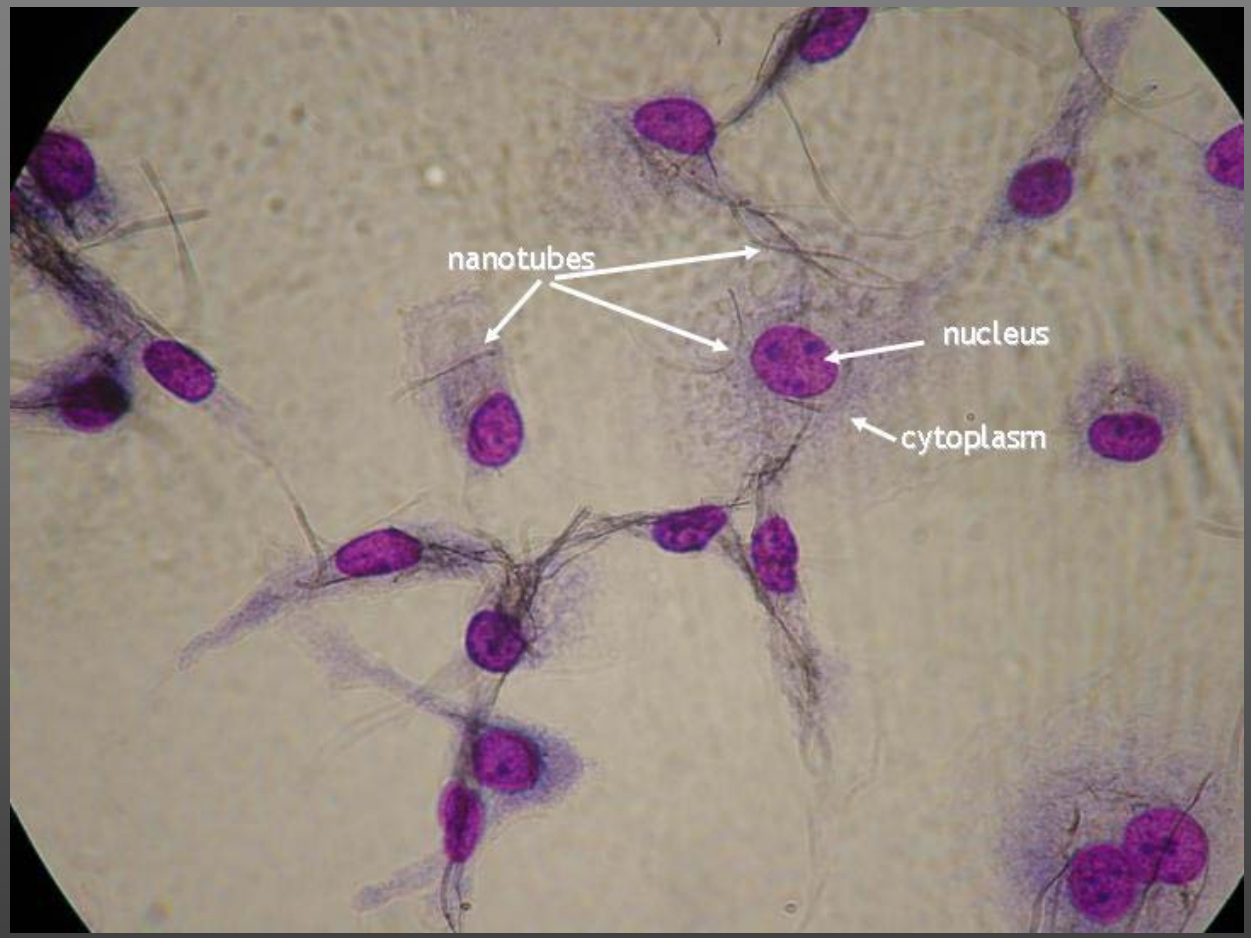
Nanotubes inside lung cells



Courtesy of Dr David Brown and Dr Vicki Stone

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