

*The technology economy of the mid-  
21<sup>st</sup> Century:  
challenges and opportunities*

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3<sup>rd</sup> April 2009



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# TECHNOLOGY ADVANCE AS A NEW KIND OF MULTISTAKEHOLDER ENTERPRISE?

Website: [www.cbni.eu](http://www.cbni.eu)

# WILL NANOTECHNOLOGY BE THE SAFEST IMPLEMENTATION OF ANY TECHNOLOGY IN HISTORY?

*SIGNS ARE PROMISING*

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# Centre for BioNano Interactions Partners



## Academic partners:



NUI MAYNOOTH  
Ollscoil na hÉireann M<sup>a</sup> Nuad



## Industry partners:

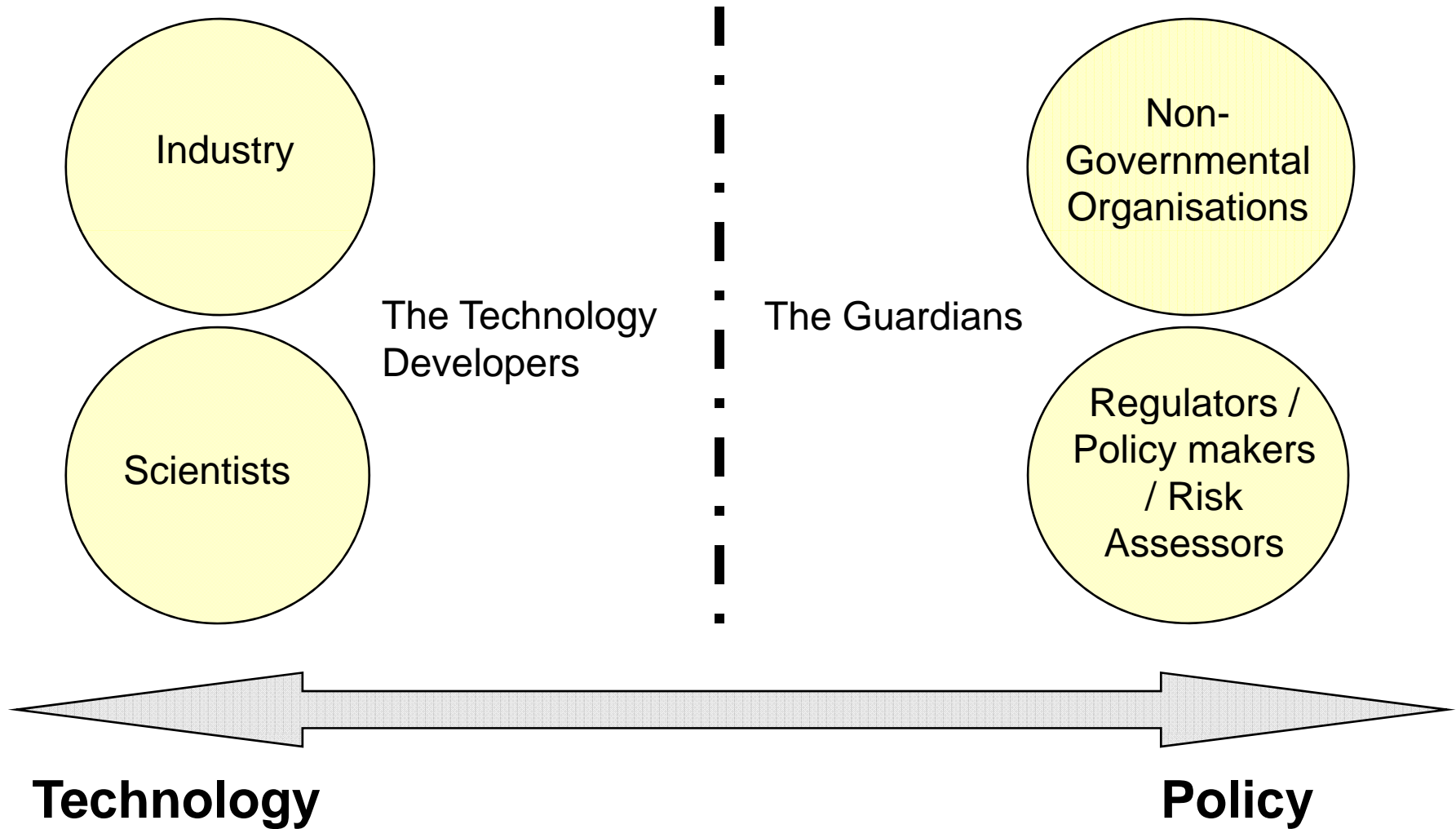


Glantreo



## Funding partners:





- To make Nanotechnology the safest technology ever implemented!

*The promise of Nanotechnology.....*



***Nanoparticles offer the potential to reach new places in the body and in cells***

- anywhere in body:

< 35nm passes Blood Brain barrier? – potential for neuro-therapy

- anywhere in the cell

<100 nm enter cell, < 40nm nucleus – potential for gene therapy

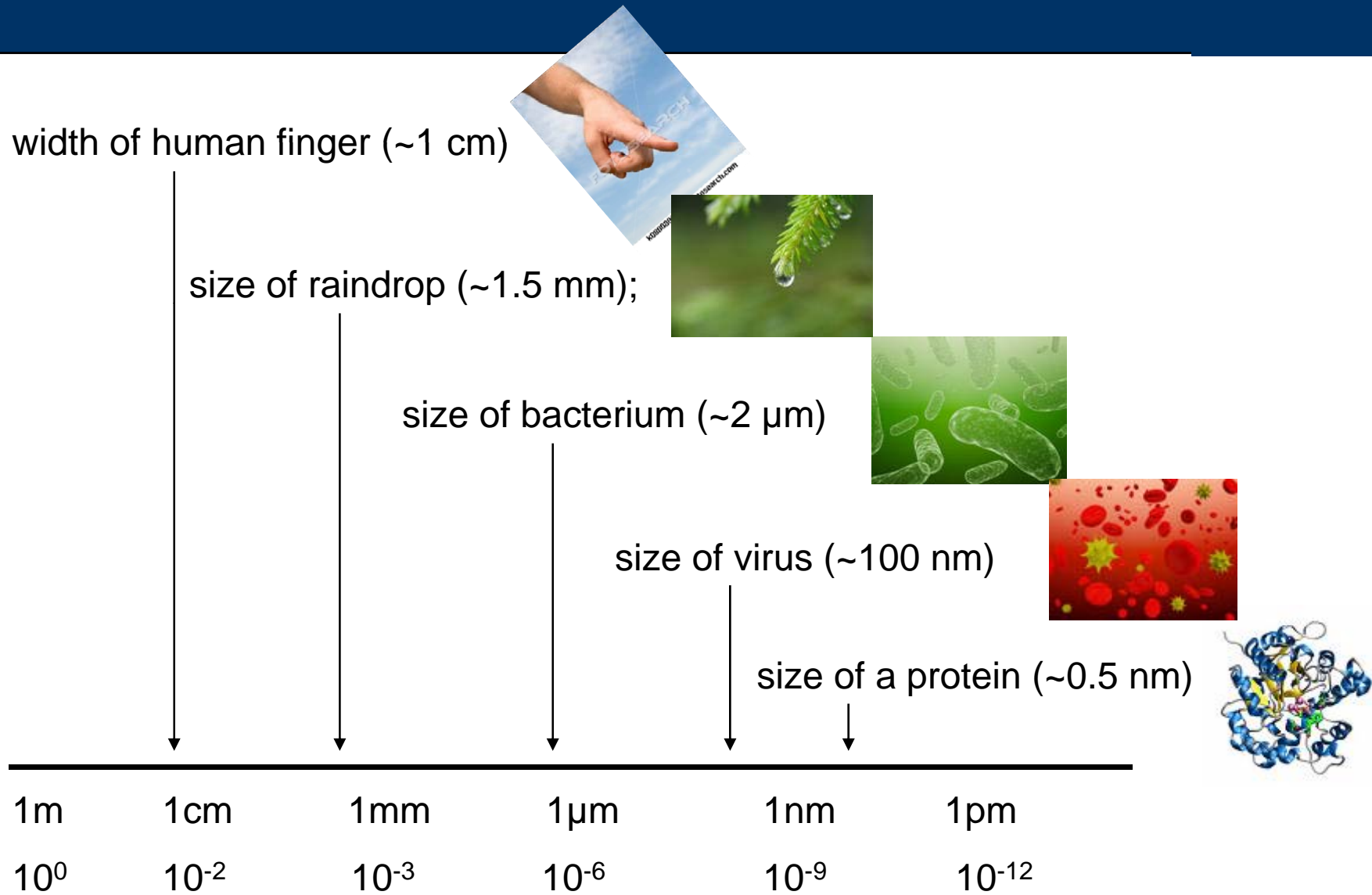
***.....is there a risk of Nanotechnology?***



# Nanotechnology: THE OPPORTUNITIES



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- Sales of products incorporating nanotechnology rise to 15% global manufacturing output by 2014, totalling \$2.6 trillion.
- Value will approach the size of the information technology and telecom industries combined, and be 10 times larger than biotechnology revenues.
- However, sales of basic nanomaterials like carbon nanotubes and quantum dots will total only \$13 billion in 2014

**Nanotechnology's economic impact will arise from how these fundamental building blocks are used, not from sales of the materials themselves.**

Lux Research, 2005, "Sizing Nanotechnology's Value Chain."

# cbni Big (and Honest) Dream!



Safe implementation of nanoscale science will improve the human condition

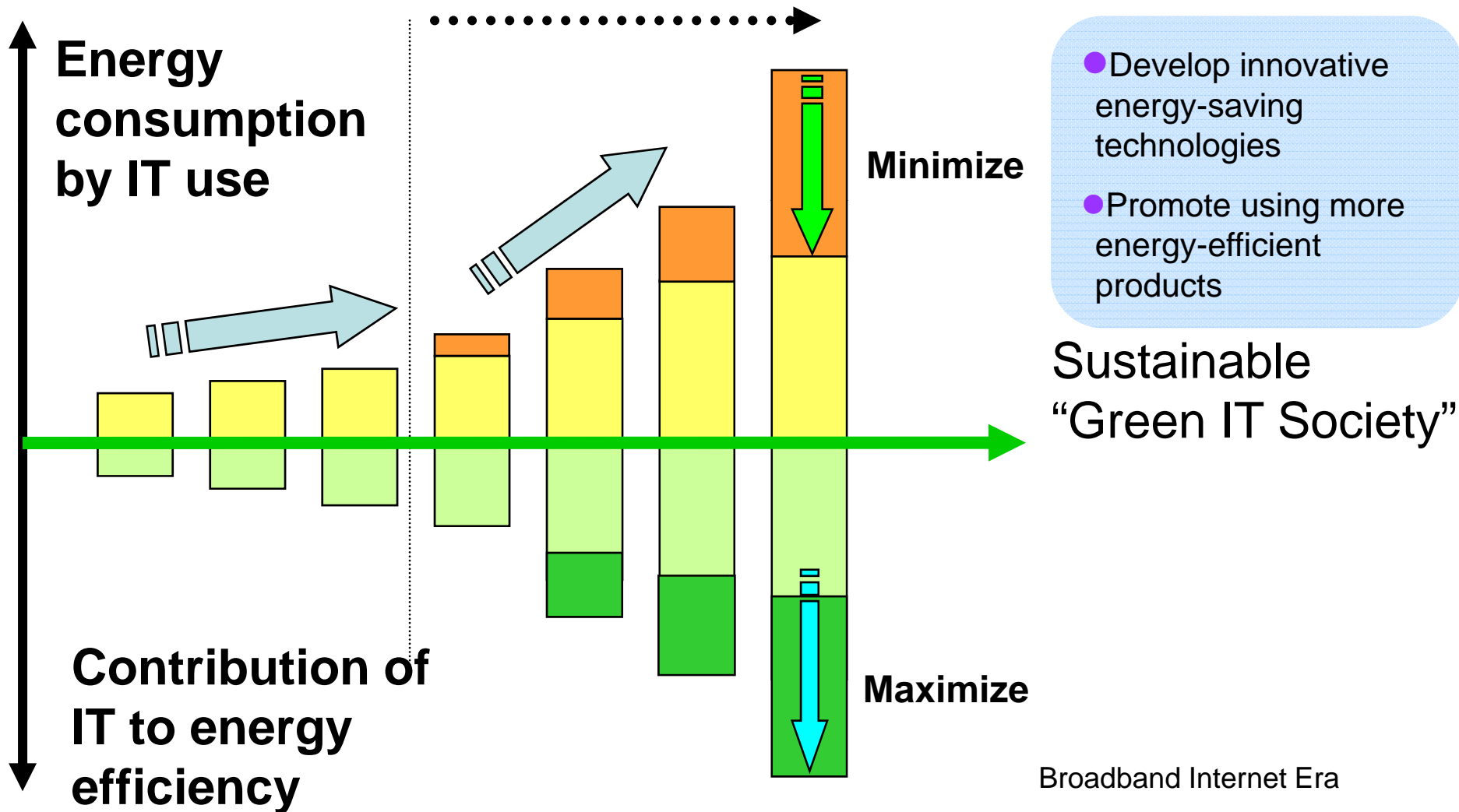
- Innovations IT, telecoms, construction, textiles, etc; safe implementation
- New approaches to diagnose human disease
- New approaches to cure human disease

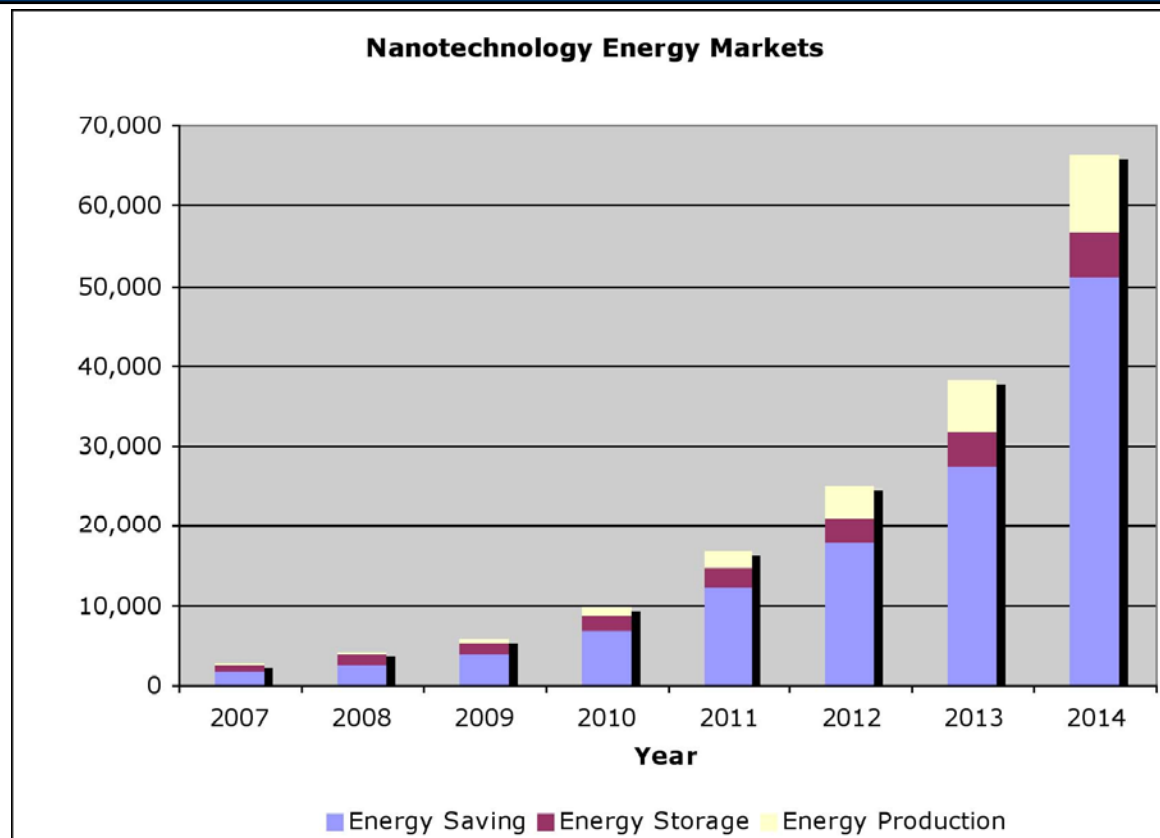
**Better, faster, cheaper, lighter, stronger, more energy efficient, new places** : nano-enabled!

## Applications of nanotechnologies:

- Light harvesting
- Energy transduction (faster computers)
- Energy storage (better batteries)
- Lighter, stronger materials

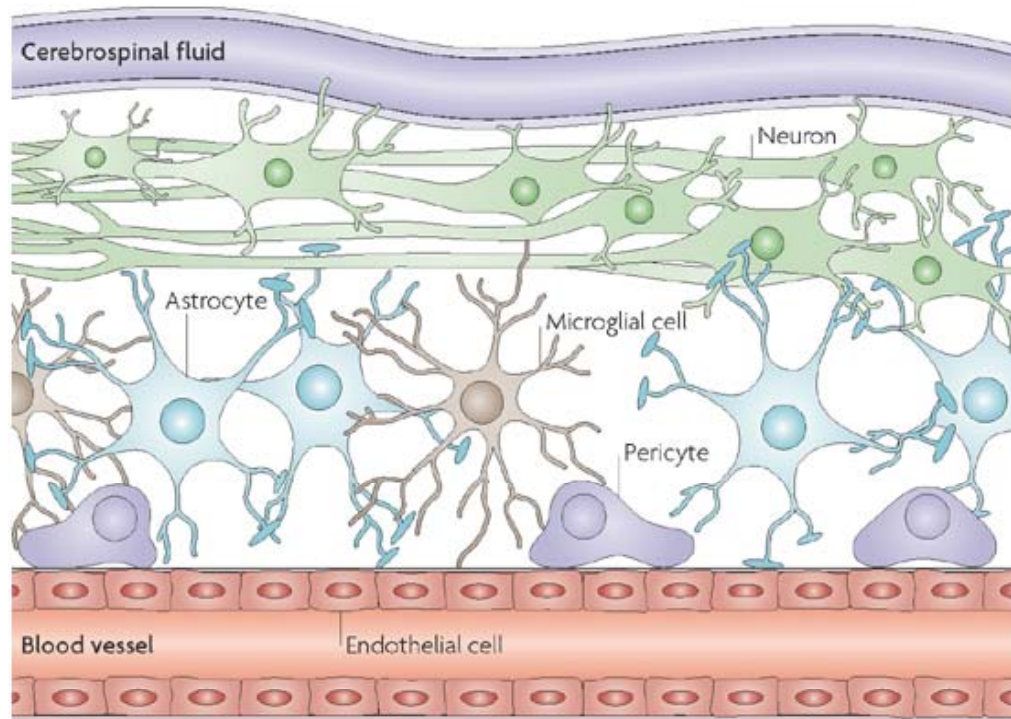
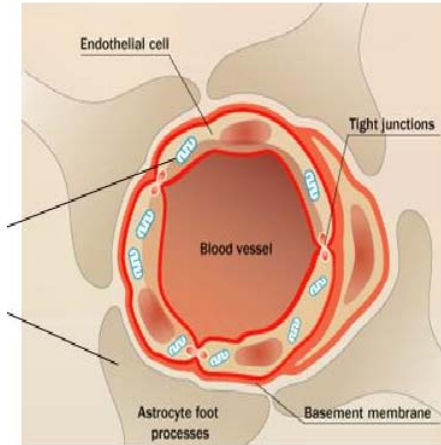






Source: Cientifica

UCD SFI Strategic Research Cluster on Solar Energy Conversion – Prof. Don McElroy  
- *Key element is utilising nanoscale structures to capture and store solar energy*



Nature Reviews | Microbiology

- HIV, Alzheimer's, Parkinson's

# Nanotechnology: THE RISKS?



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## *Price of Failure is High*

- Hard to predict future regulatory framework for companies
- Hard for small companies to secure VC in nanoelectronics etc.
- Looming risk of loss of investment – show stopper

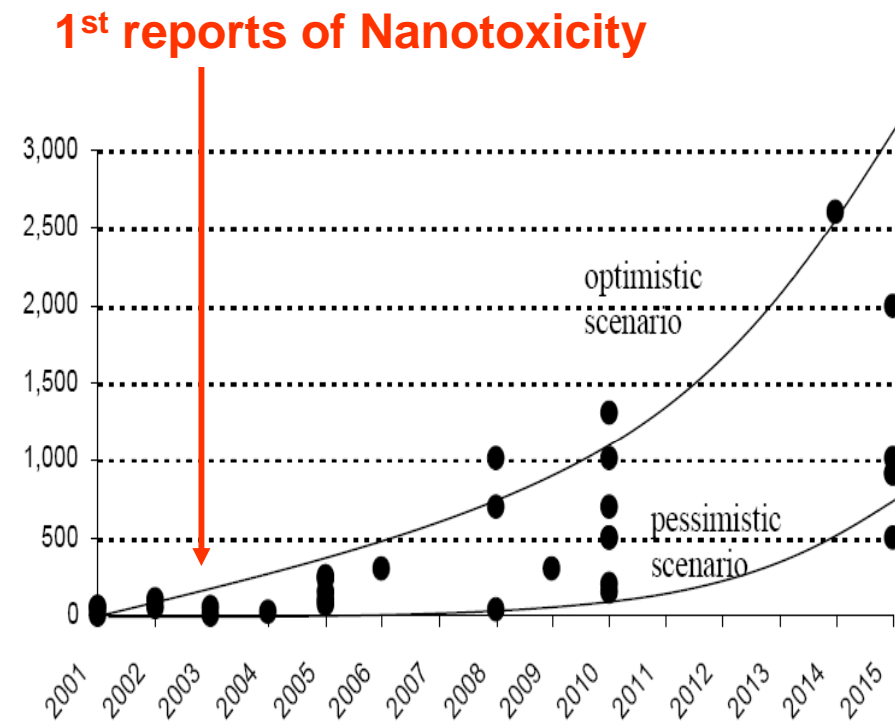
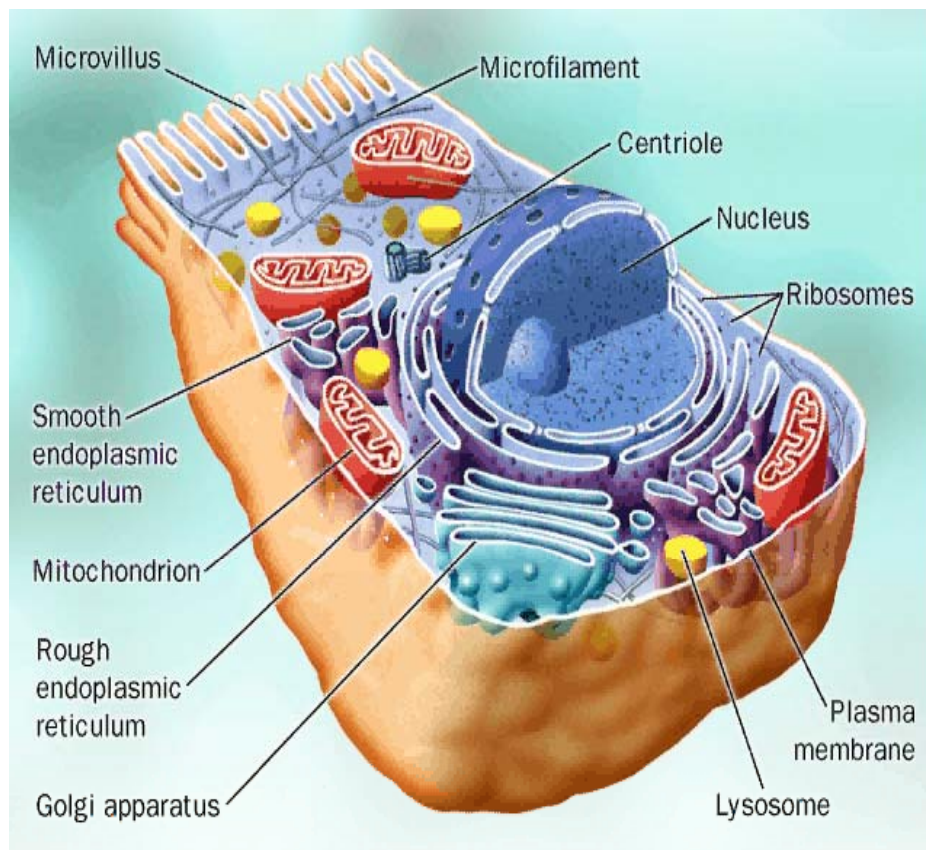


Figure 1: World market forecasts for nanotechnology in billion US Dollar. Diverse sources<sup>1</sup>

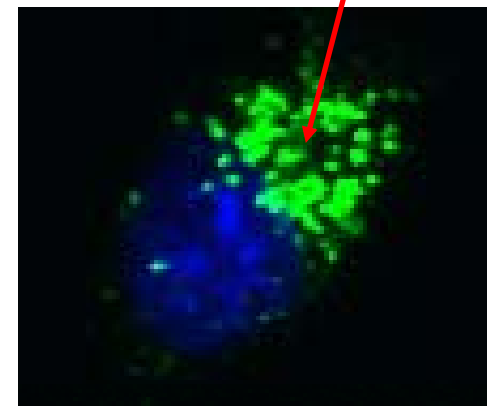
**Ireland needs window into the single major issue that could harm its research investment, and next generation inward investment**



**Nanoparticles can reach parts of cells that larger materials can't..... including the brain**



50 nm polystyrene nanoparticles in cells



# THE HAZARD (IF ANY)?



**NANOHAZARD**

Dimitris Deligiannis, Greece



**NANO HAZARD**

Shirley Gibson, Scotland



Kypros Kyprianou, England

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- Not clear - Two 'opinions' merely to encourage need for more research cited by EU
  - Carbon nanotubes, link to mesothelioma (Edinburgh, Tokyo)?
  - Nanoparticle promotion of protein fibrillation - but no evidence of link to Alzheimer's, Parkinson's diseases, (UCD)
- Overall surprising **lack** of harm (so far) is striking!
- Main Problem is 'not clear'

# THE GUARDIANS



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# Scientific Committee on Emerging & Newly Identified Risks



Scientific Committee on Emerging and Newly Identified Health Risks

SCENIHR

Risk Assessment of Products of Nanotechnologies



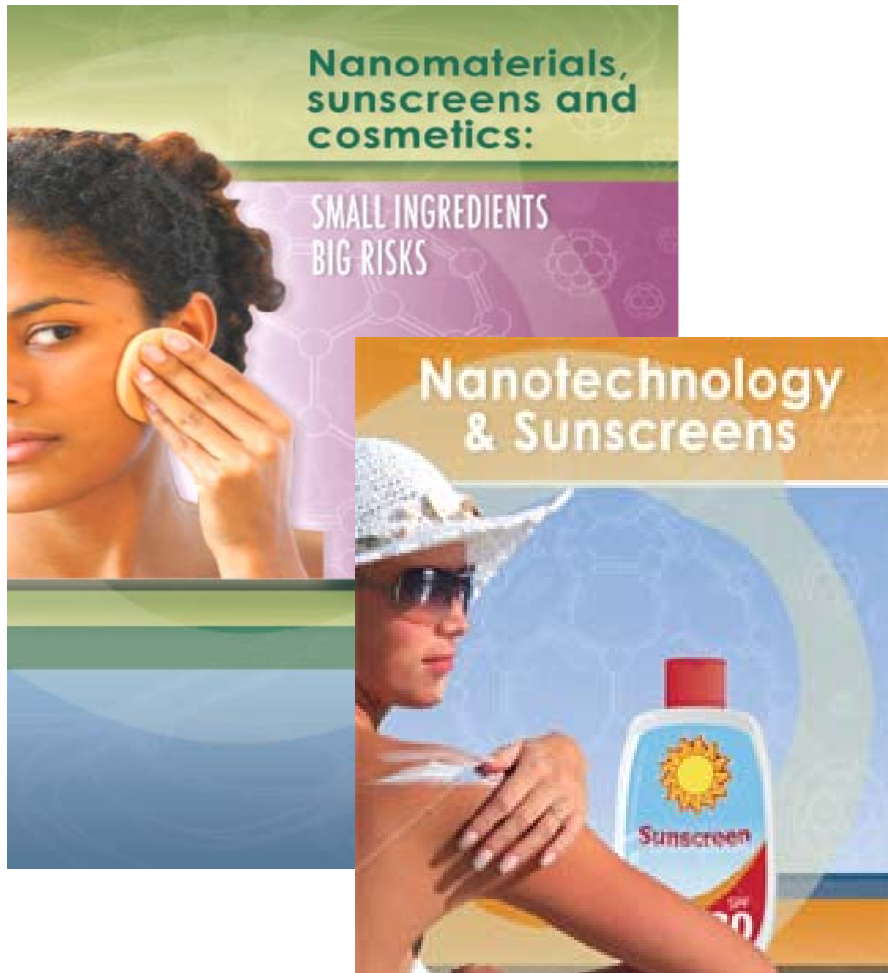
## REACH

**2001** – Strategy for a Chemical Policy (White Paper)

- **All substances**, both already existing (i.e. brought onto the EU market before 1981), and new (i.e. brought onto the market after 1981), produced or imported in **quantities exceeding  $\geq 1$  tonne**, and for which there is no sufficient toxicological documentation **should be tested** for safety for human health and environment.

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# Non-Governmental Organisations



Friends of the Earth *Nanomaterials, Sunscreens and Cosmetics Report*

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# ONE INDUSTRY VIEW

A NEW KIND OF  
PARTNERSHIP?

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# BIAC

The voice of OECD Business



**The Business and Industry Advisory Committee to the OECD (BIAC) is an independent organisation representative of business and industry.**

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*“BIAC calls on OECD policy-makers to foster consensus-based risk assessment approaches.”*

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*“BIAC calls on the OECD leadership to continue to offer strong support for the ground-breaking work that the OECD is carrying out.”*

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***Responsible Development of NanoTechnology: Turning Vision Into Reality  
BIAC Expert Group on Nanotechnology – Vision Paper. February 2009.***

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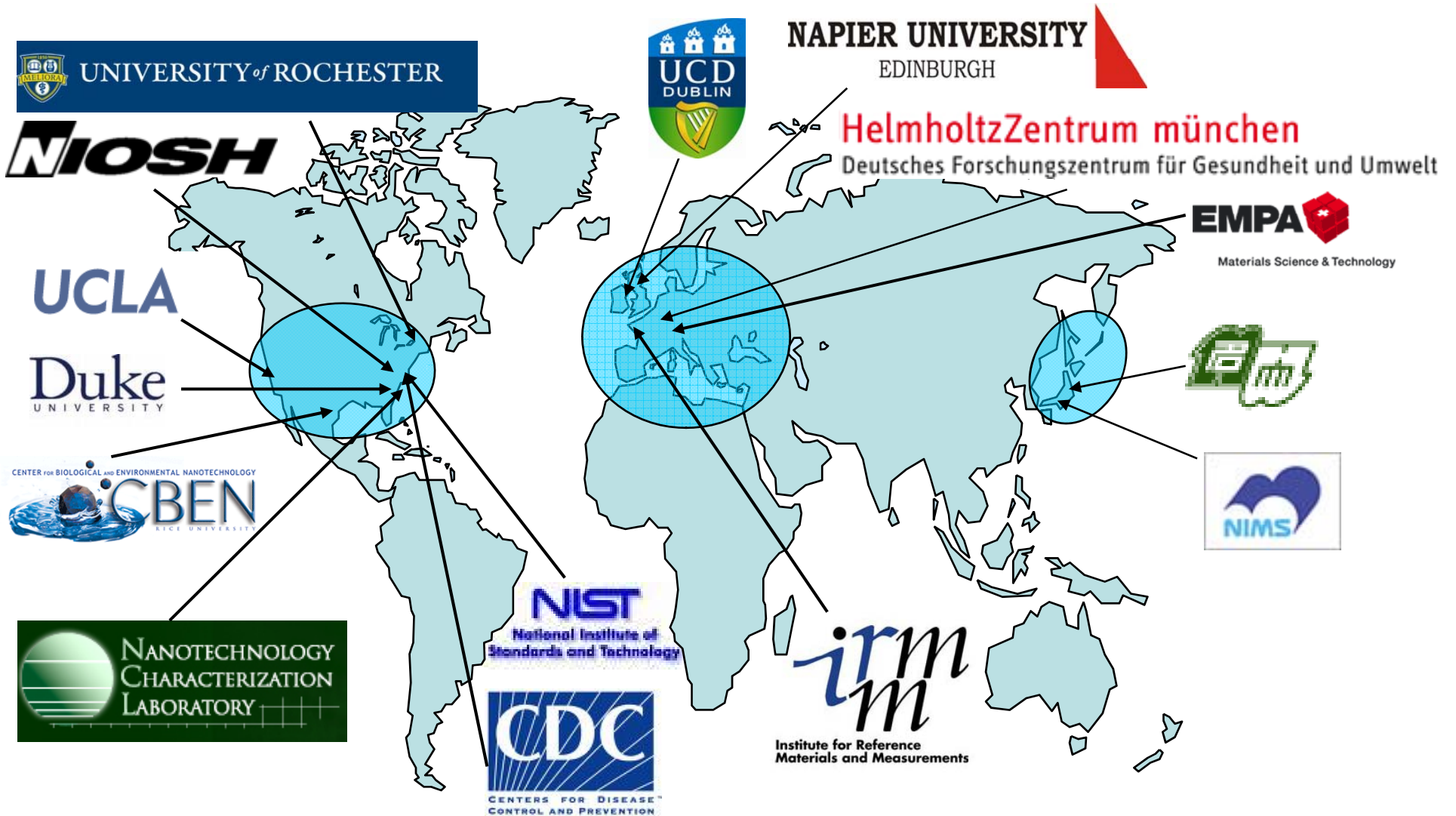
# THE SCIENTIFIC RESPONSE

A NEW KIND OF SCIENCE  
PARTNERSHIP

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# International Alliance for NanoEHS Harmonisation



# WILL NANOTECHNOLOGY BE THE SAFEST IMPLEMENTATION OF ANY TECHNOLOGY IN HISTORY?

*A NEW KIND OF PARTNERSHIP WITH  
'DOERS' SEEKING TO MAKE TECHNOLOGY  
WORK, BUT TO MAKE IT WORK SAFELY*

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- Real opportunity for Ireland to not only be technology takers, but also to be **technology drivers / shapers / regulators!**
- Most of our inward investment is high-tech industry – nano-enabled: crucial that we address the issues!
- Economic success can be joined to environmental sustainability!

# UCD Earth Systems Institute

## Meeting the Challenge of Climate Change Seminar Series

In collaboration with

**Comhar Sustainable Development Council, Environmental  
Protection Agency, Forfás, Geological Survey of Ireland,  
Marine Institute, Met Éireann, Sustainable Energy  
Ireland & Teagasc**

Further details on the seminar series is available at [www.ucd.ie/earth](http://www.ucd.ie/earth)

A paper and podcast of this seminar will be available on the ESI website soon, please join the online ESI mailing list for such notifications

ESI email: [esi.admin@ucd.ie](mailto:esi.admin@ucd.ie)



# UCD Earth Systems Institute

## Meeting the Challenge of Climate Change Seminar Series

Next week...Seminar #17

Friday 17<sup>th</sup> April 2009

Royal College of Physicians, 12.30pm

**Dr. William Smith**

UCD School of Electrical, Electronic & Mechanical Engineering

*Plug-in hybrids – panacea or placebo?*



Further details available at [www.ucd.ie/earth](http://www.ucd.ie/earth)