

# Assessing Nanotechnologies: the future of reflexive co-evolution

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# Co-evolution of technology / technoscience

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- Technology and society always a co-evolution
- TA is a component of it since the 1970s
- TA has often been presented in terms of institutions (OTA)
- ... but the evolution of TA should be seen as part of layers of co-evolution.

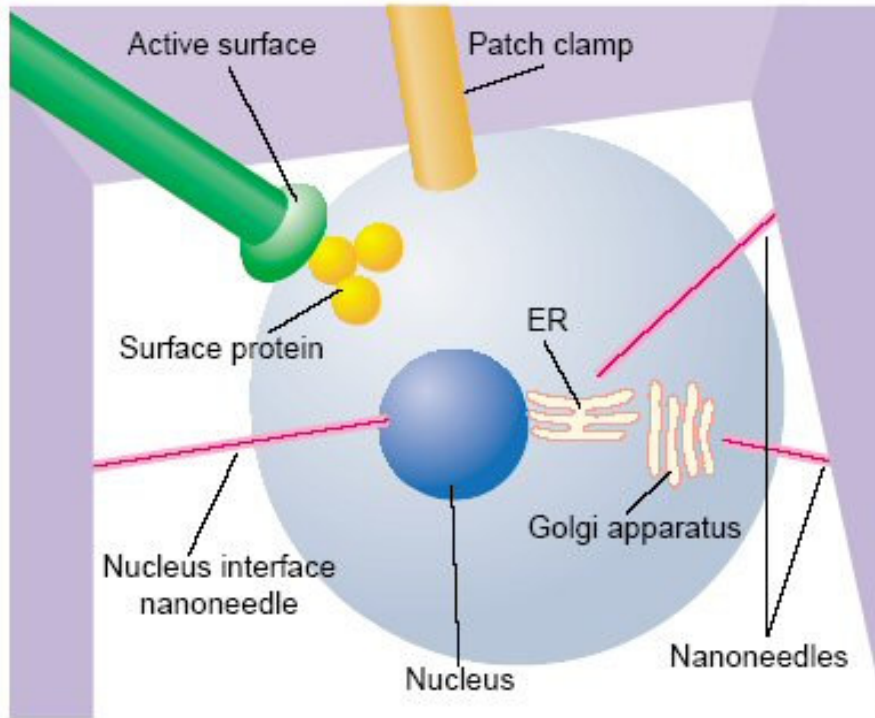


## Three main areas of nanotechnology

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- These dynamics play out differently in the different areas: the technologies are different, and industry structure is different.
- For example, in bionano (and sensors), lots of opportunities for small firms,
- While in micro/nano-electronics the big incumbents are dominant (Intel, Samsung, ST Microelectronics, NXP, Infineon)
- For materials and surfaces the situation is mixed

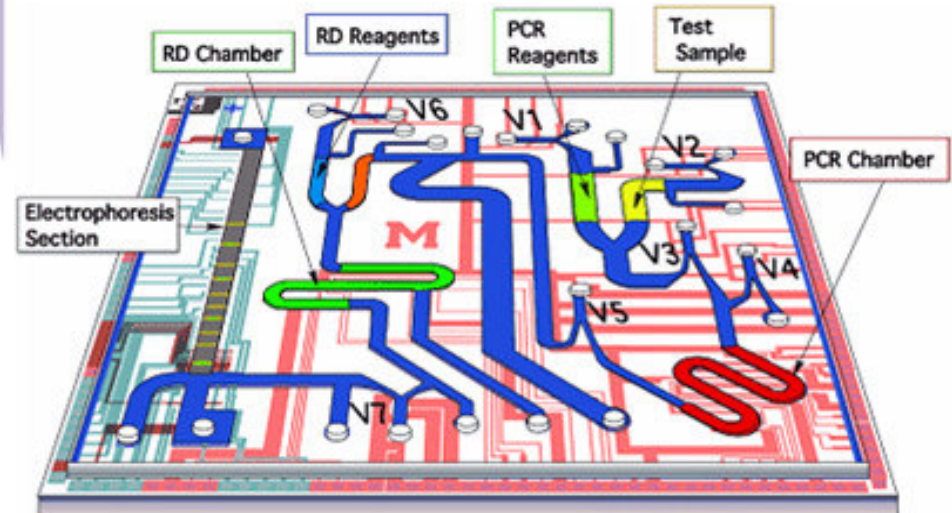
# lab-in-a-cell



**cell fixed on a chip,  
probed in various ways**

*lots of tinkering,  
unclear what  
possibilities are*

**based on earlier work in**



**lab-on-a-chip (micro-fluidics)**



# Layers in co-evolution of technology and society

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- since 1970s: contestation
  - e.g. recombinant DNA
- since 1990s: ELSI
  - e.g. Human Genome Project
- since 2000s: reflexive co-evolution
  - e.g. nanotechnology



# Types of actors and interdependencies related to technology in society

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## ○ Actors:

- technology developers and promoters
  - i.e. insiders / enactors
- funders, consumers, citizens
  - i.e. outsiders / comparative selectors
- third parties
  - e.g. insurance companies
- government actors
- NGOs and other civil society groups

# Main International Fora and Initiatives on Nanotechnology

Slide shown by Tomellini, EU Nanotech Program

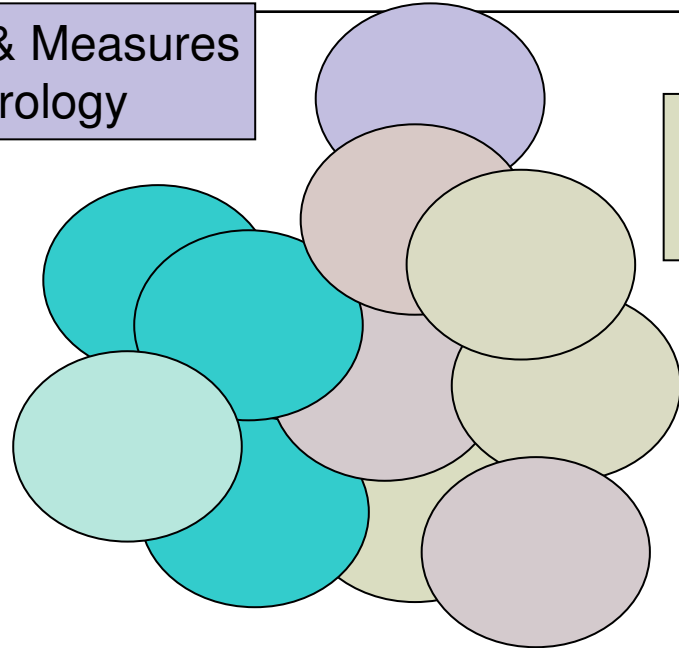
ISO, Int.Comm. Weights & Measures  
standardisation, metrology

OECD  
Global Science Forum

OECD NESTI  
nanotechnology  
indicators

OECD JM CHEMICALS  
proposed WP safety nanomaterials  
characterisation, metrology, toxicity, ...

OECD CSPT  
proposed WP on nanotechnology  
(mandate not yet finalised)



G8 Carnegie Group

Global (informal)  
governmental dialogue  
on responsible  
nanotechnology

UNESCO  
ethics incl. risk assessment

UNIDO, World Social Forum,  
APEC, Meridian Inst.,  
IRGC, ICON, ...



# Governance

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- continuing interdependencies constitute *de facto* governance
- attempts at governance (tentative or otherwise) are embedded in *de facto* governance
- the current views of governance now ask for more interaction and consultation
  - not based on thorough diagnosis
  - interaction for the sake of interaction





# Approaches and tools for reflexive co-evolution

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- Approaches: create spaces in co-evolution
  - upstream public engagement
  - orchestrate bridging events
    - strategy articulation workshops
    - example...
- Tools:
  - focus groups
  - socio-technical scenarios
    - use complexity and storyline
  - based on “endogenous futures”
    - example...
  - multi-path mapping
    - example MediMade



# Increasing reflexivity in co-evolution

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- ongoing positioning and mutual learning amongst stakeholders about
  - dynamics of emerging technologies
  - governance of emerging technologies
  - mechanisms to influence the dynamics
- stimulated by TA-agent inserting herself in ongoing developments and learning
  - making strategies visible



# the possibilities of soft governance

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- other views of roles of nanoscientists and -firms
  - anticipation of possibilities and risks
  - distinguishing between 'good' and 'bad' NGOs
- policy makers / civil society:
  - emerging regulation
- new: demand for dedicated reflexivity agents
  - TA agent
  - convergence workers
  - ethicists



# To conclude

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- Co-reflexive co-evolution as a next phase of science – technology interaction
  - not just typical for nanotechnology
- Reflexive co-evolution as a new model for emerging technologies
  - new division of responsibilities
  - business of consultancies
  - trivialization of reflexivity (otherwise it will not work)