Nano-in-Food
~
Threat or Opportunity for Organic Food?

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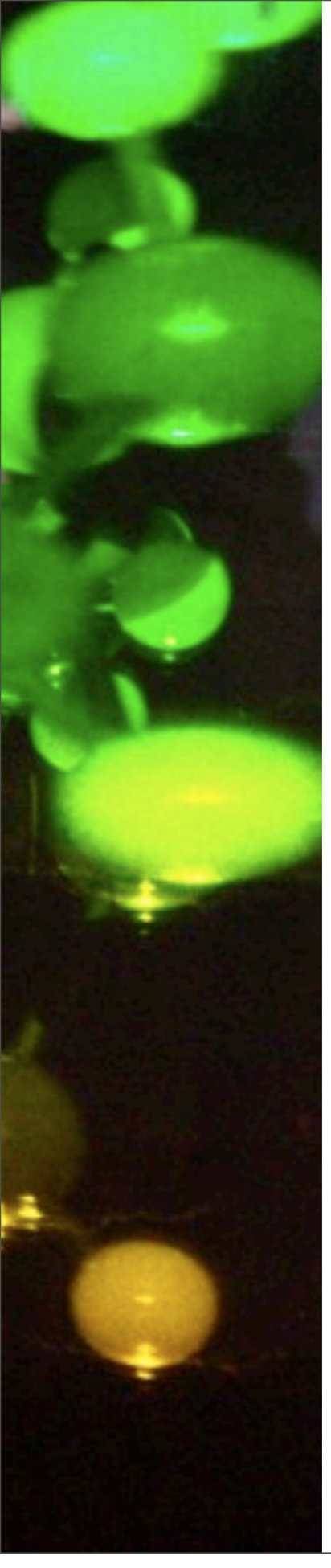
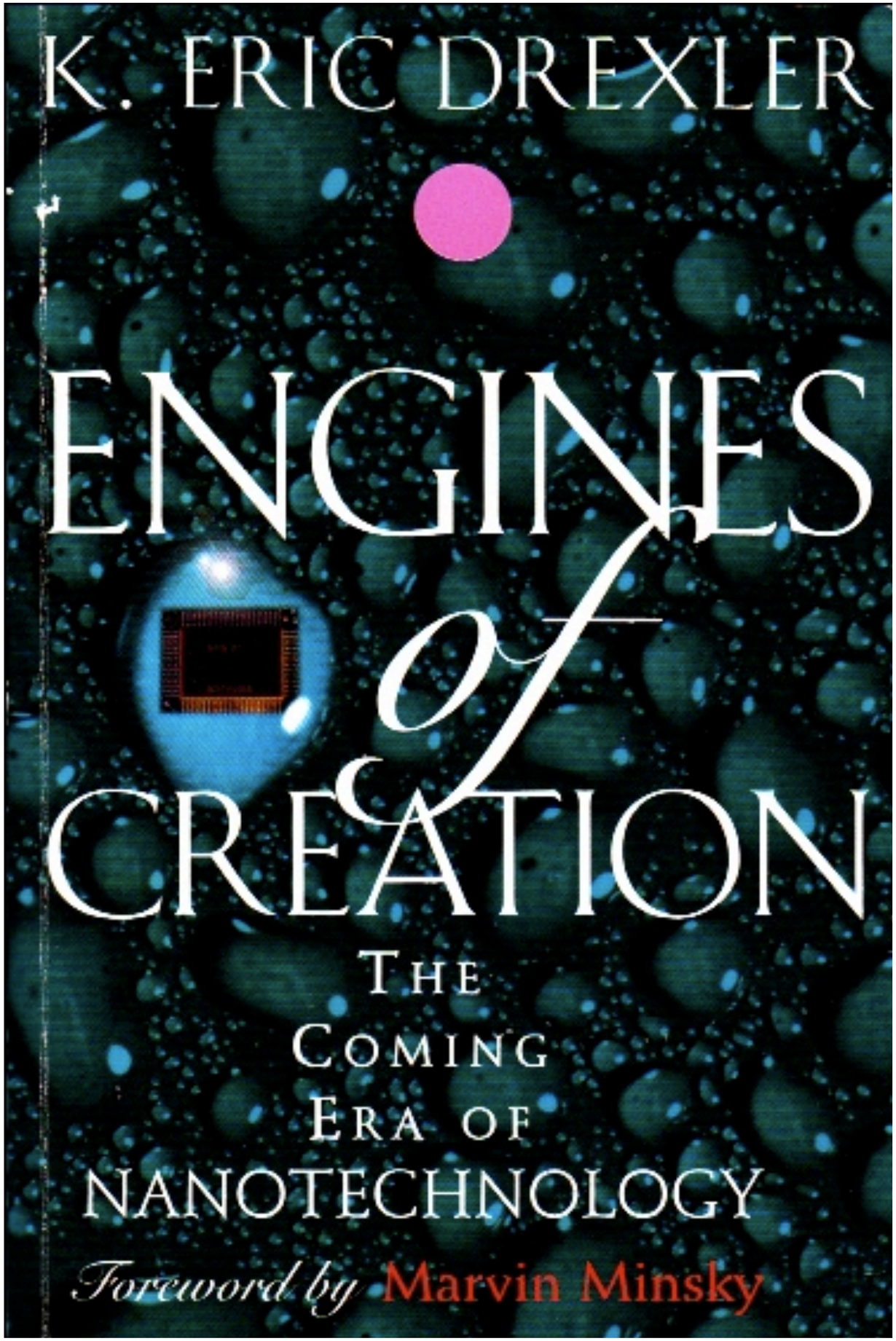
IFOAM Organic World Congress, 16-20 July, 2008



What is Nanotechnology?

1-100 nanometres
nanometre = 1 billionth of a metre

"the precision-engineering of materials at the scale of 10^{-9} (one ten thousandth the breadth of a human hair), at which point, new functionalities are obtained, resulting in products, devices and processes that will transform various industries" (AON, 2007)



Eric Drexler
1990

"an enormously original book about the consequences of new technologies"

Minsky, p.v, intro

"... are we too wicked to do the right thing... too stupid to do the right thing... too lazy to prepare"

Drexler, p.200

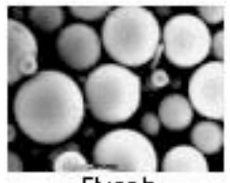
The Scale of Things – Nanometers and More

Things Natural

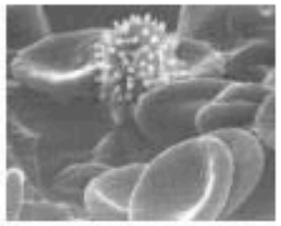
Dust mite
200 µm

Ant
~ 5 mm

Human hair
~ 60-120 µm wide

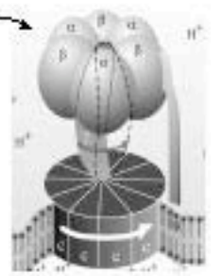


Fly ash
~ 10-20 µm

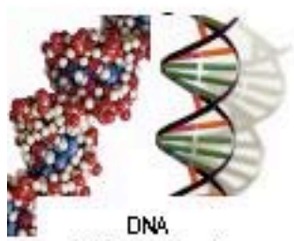


Red blood cells
with white cell
~ 2-5 µm

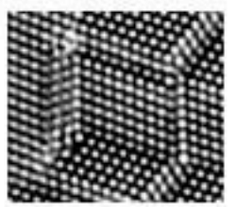
~10 nm diameter



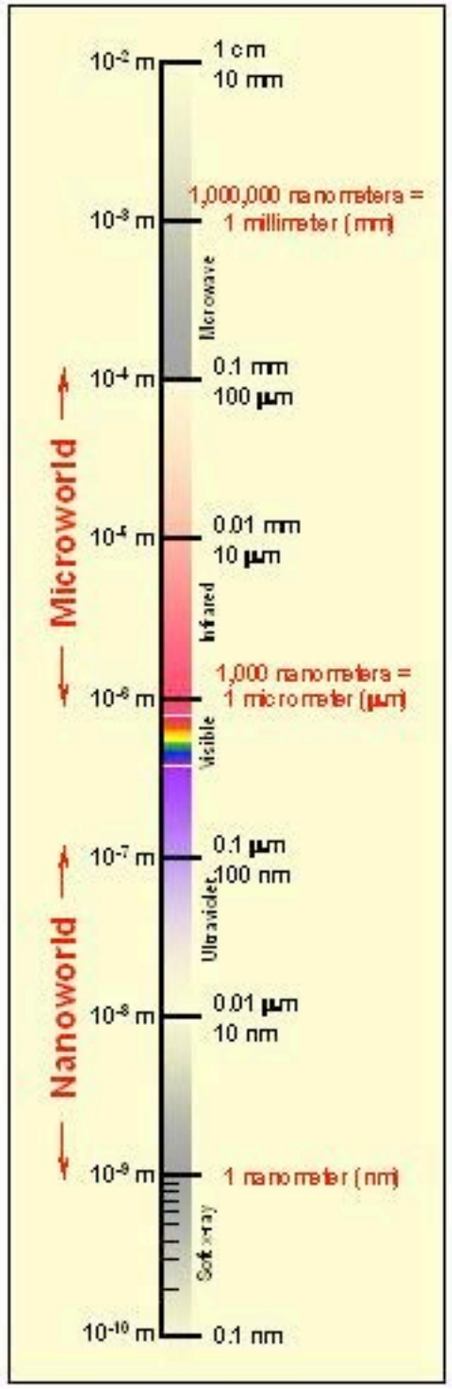
ATP synthase



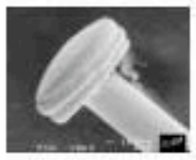
DNA
~2-12 nm diameter



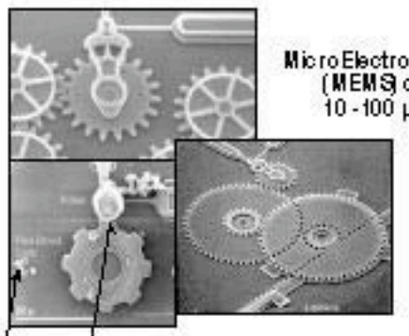
Atoms of silicon
spacing ~tenths of nm



Things Manmade

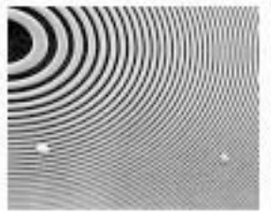


Head of a pin
1-2 mm

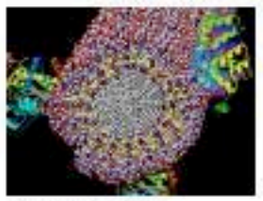


MicroElectroMechanical
(MEMS) devices
10 - 100 µm wide

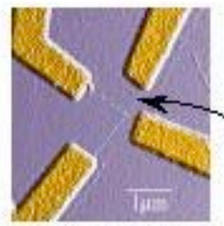
Pollen grain
Red blood cells



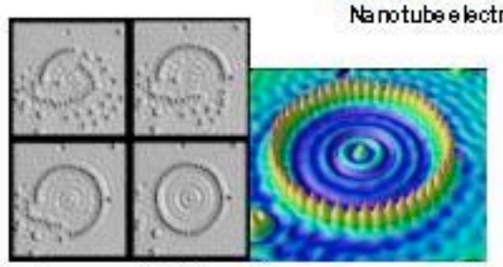
Zone plate x-ray "lens"
Outer ring spacing ~35 nm



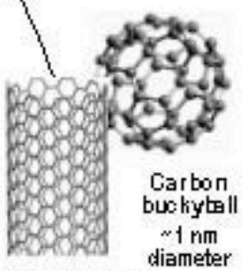
Self-assembled,
Nature-inspired structure
Many 10s of nm



Nanotube electrode



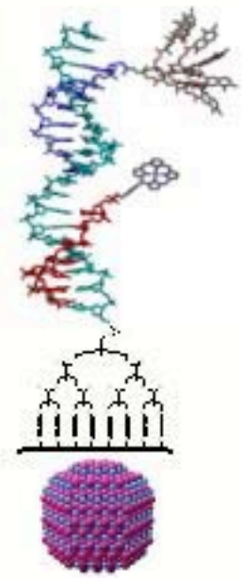
Quantum corral of 48 iron atoms on copper surface
positioned one at a time with an STM tip
Corral diameter 14nm



Carbon
buckyball
~1 nm
diameter

Carbon nanotube
~1.3 nm diameter

The Challenge



Fabricate and combine nanoscale building blocks to make useful devices, e.g., a photosynthetic reaction center with integral semiconductor storage.

Image source: Smalley Institute, Rice University, 2006, cnst.rice.edu/nano.cfm

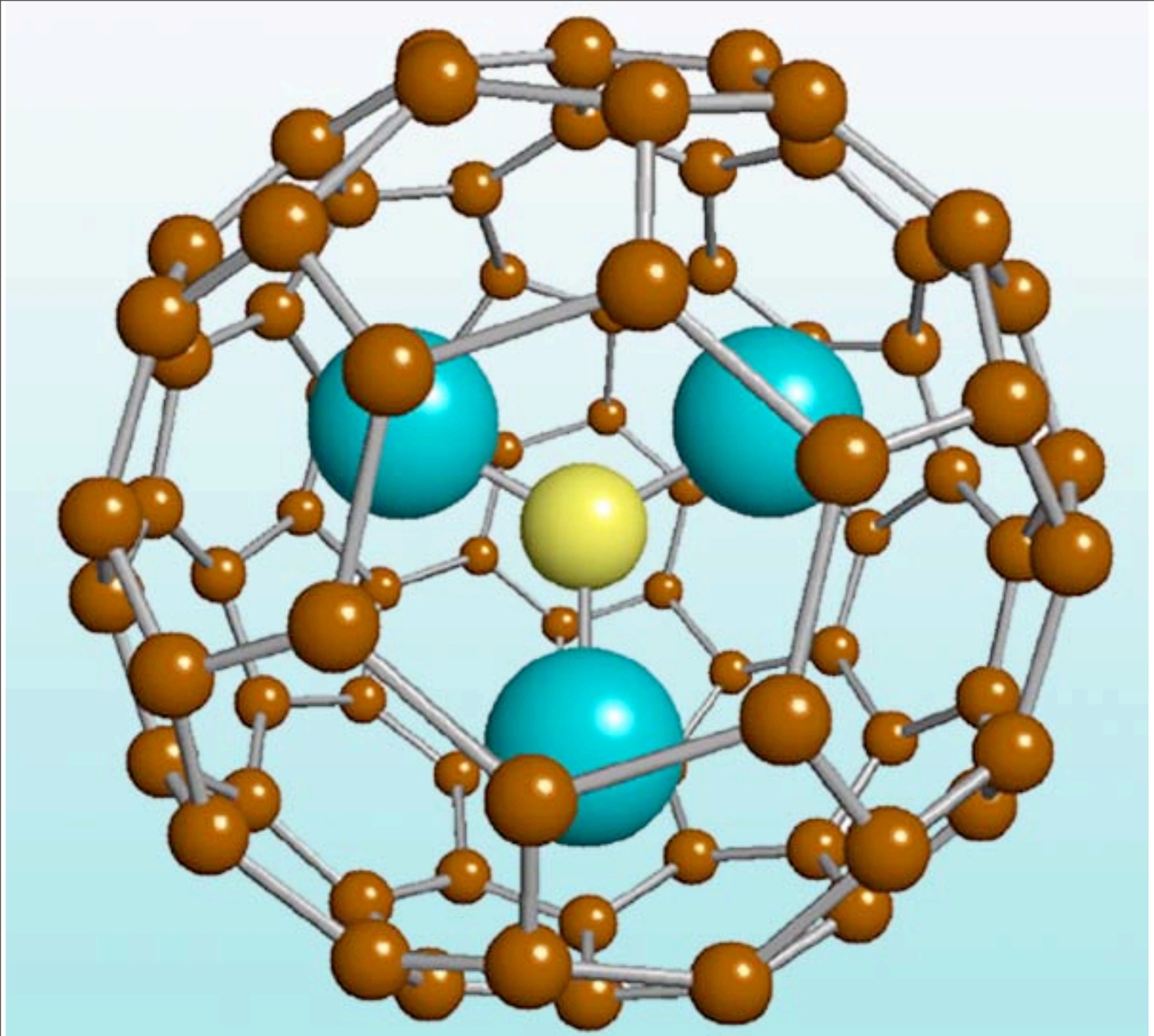
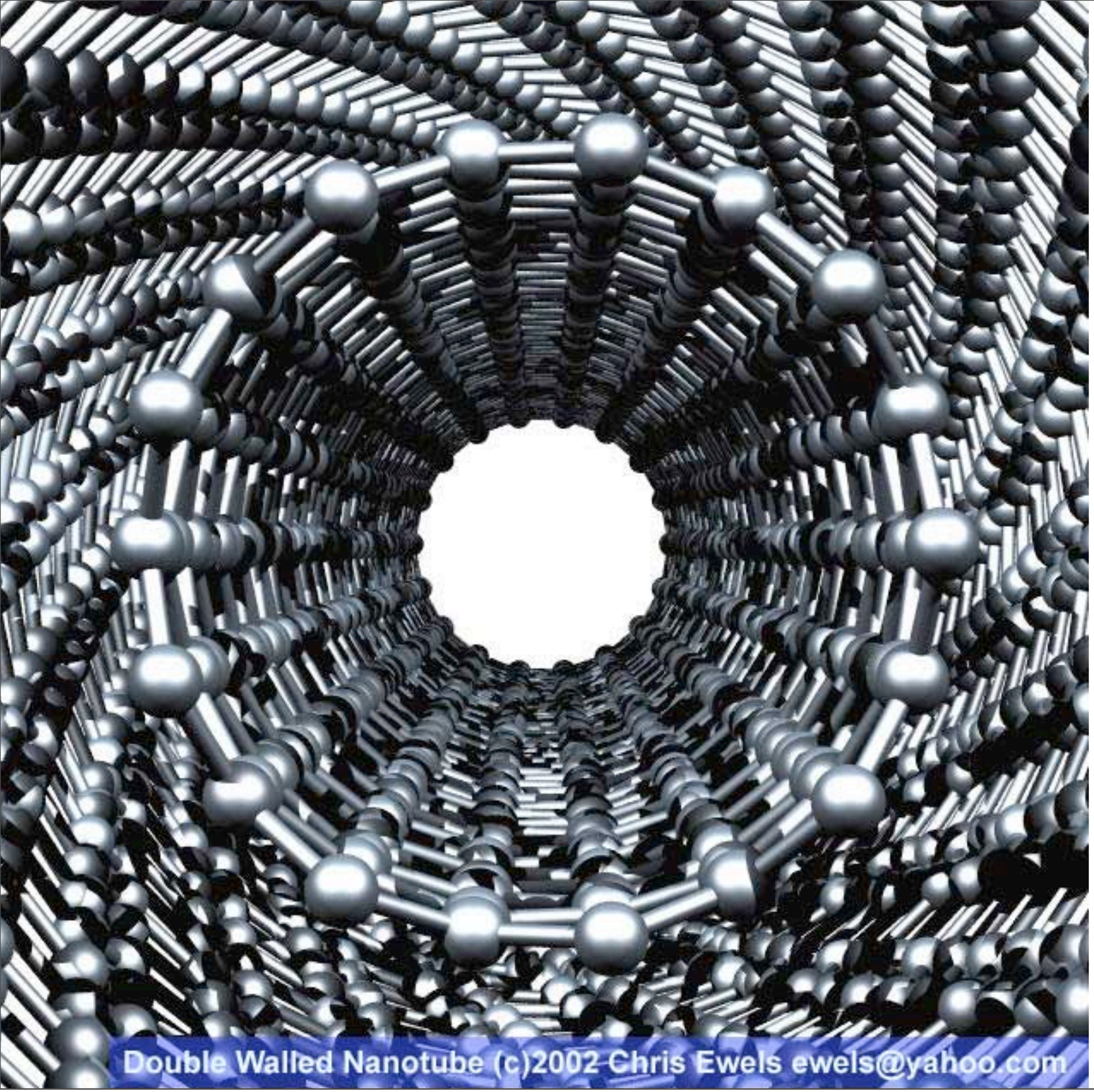
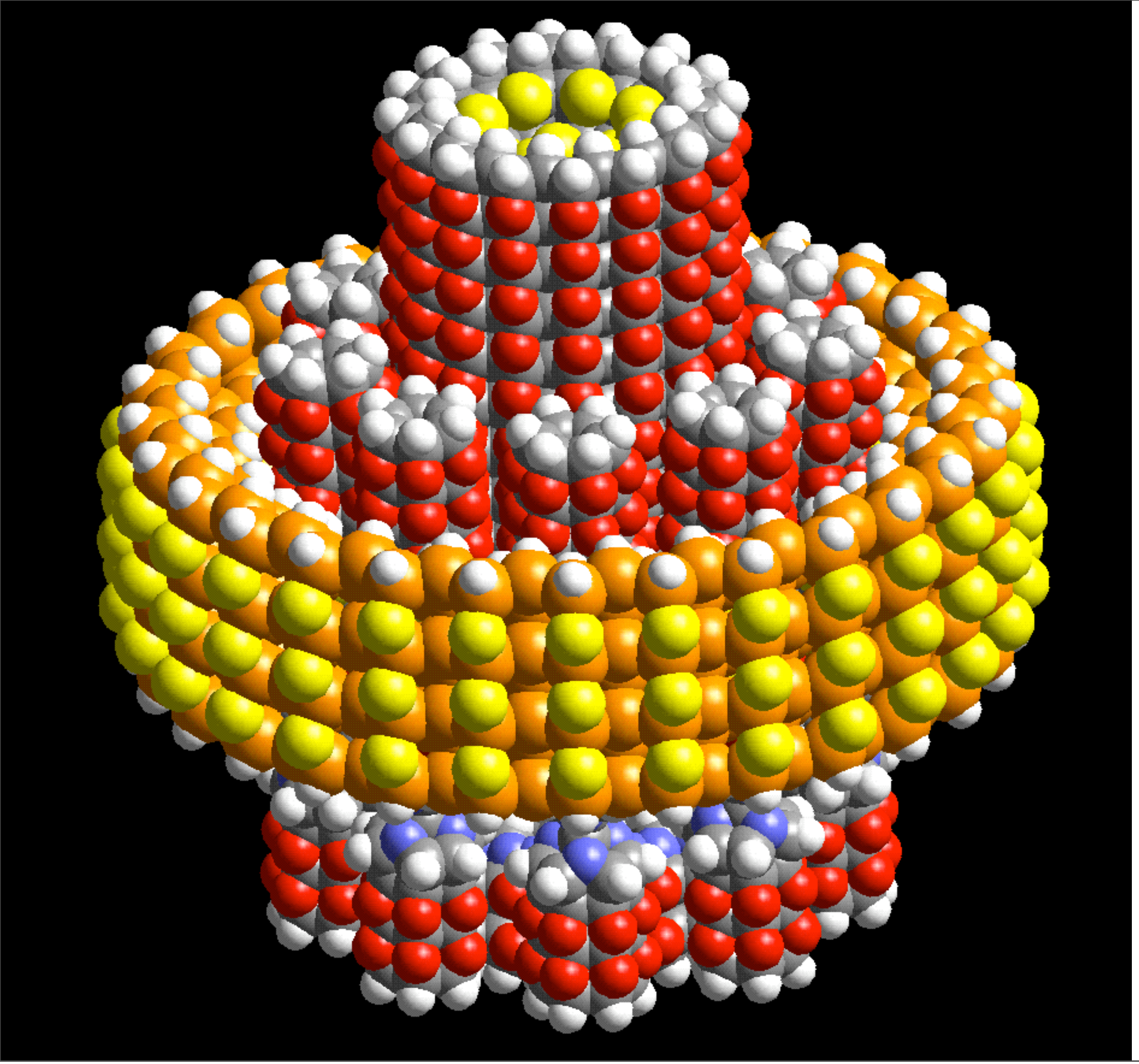


Image credit: Courtesy LUNA Innovations

"Medical Buckyballs. Computer model of a molecule made by LUNA Innovations of Blacksburg, Va. The company plans to produce novel "buckyball" materials for medical diagnostics and other military and commercial applications. The technology was developed in part with a 2001 award from NIST's Advanced Technology Program (ATP). The ATP grant helped to accelerate the development process for new nanomaterials for medical imaging and drug delivery.

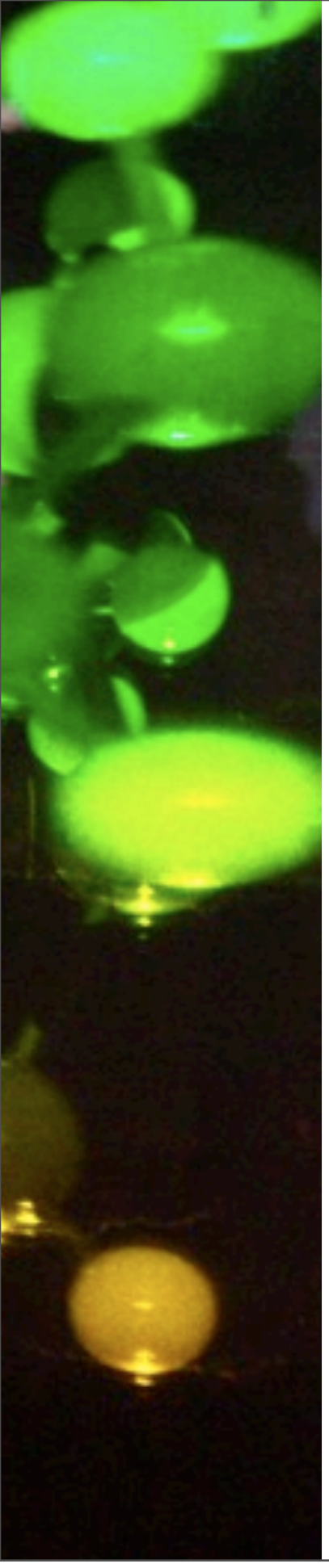
http://www.nist.gov/public_affairs/05nano_image_gallery.htm


Double Walled Nanotube (c)2002 Chris Ewels ewels@yahoo.com



www.zyvex.com/nanotech/nano4.html

Logo image: Fourth Foresight Conference on Molecular Nanotechnology, 1995



Why Nano?

- New properties
- Surface area:

  particle size ↓ x 1000

  surface area ↑ x 1000

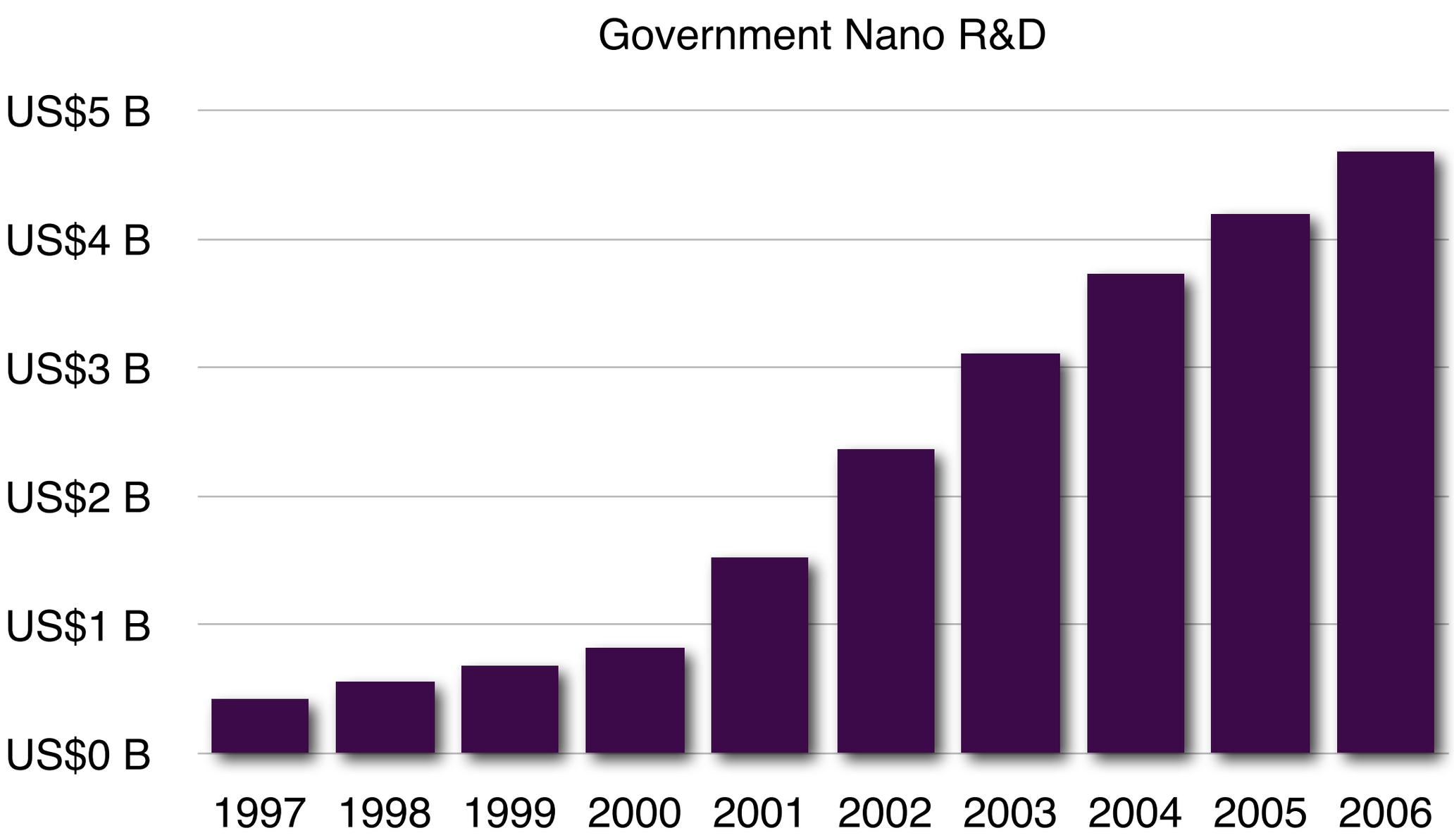
- Doctrine of Substantial Equivalence*

  claim difference > get patents

  claim sameness > avoid regulation

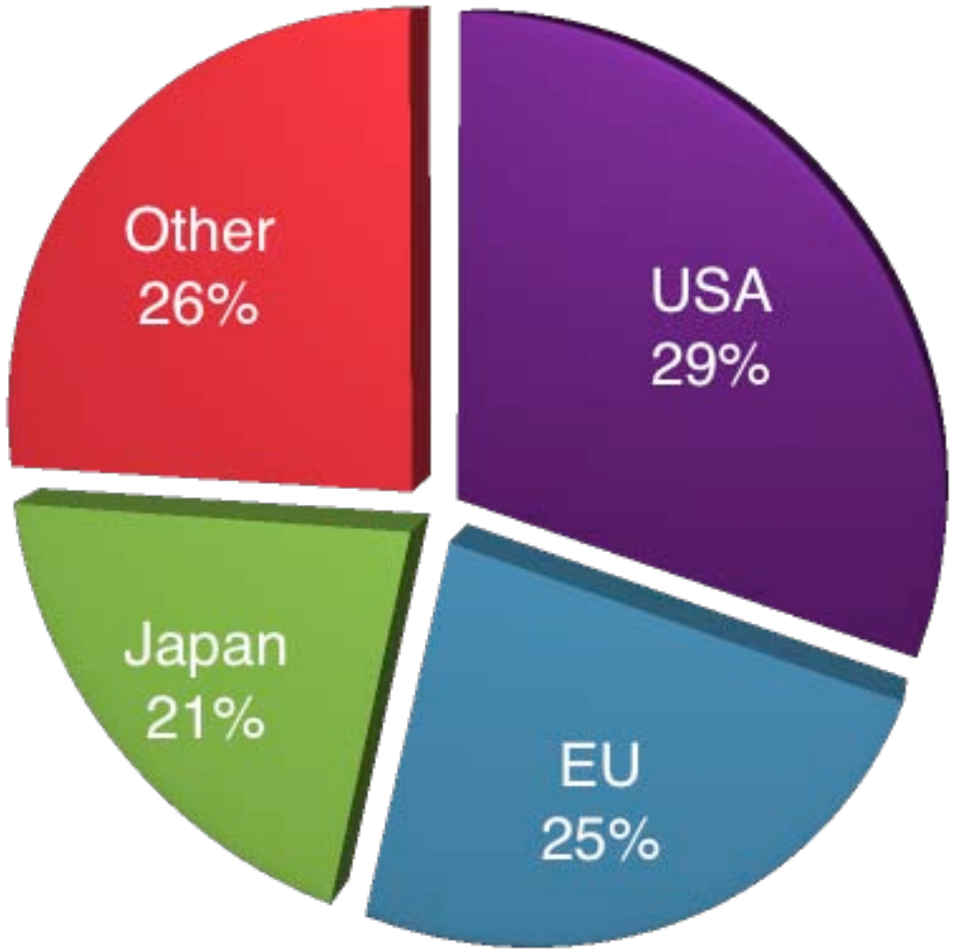
* Paull, 2008, M/C J of Media & Culture, 11(2)

Multi billion $ Research Effort



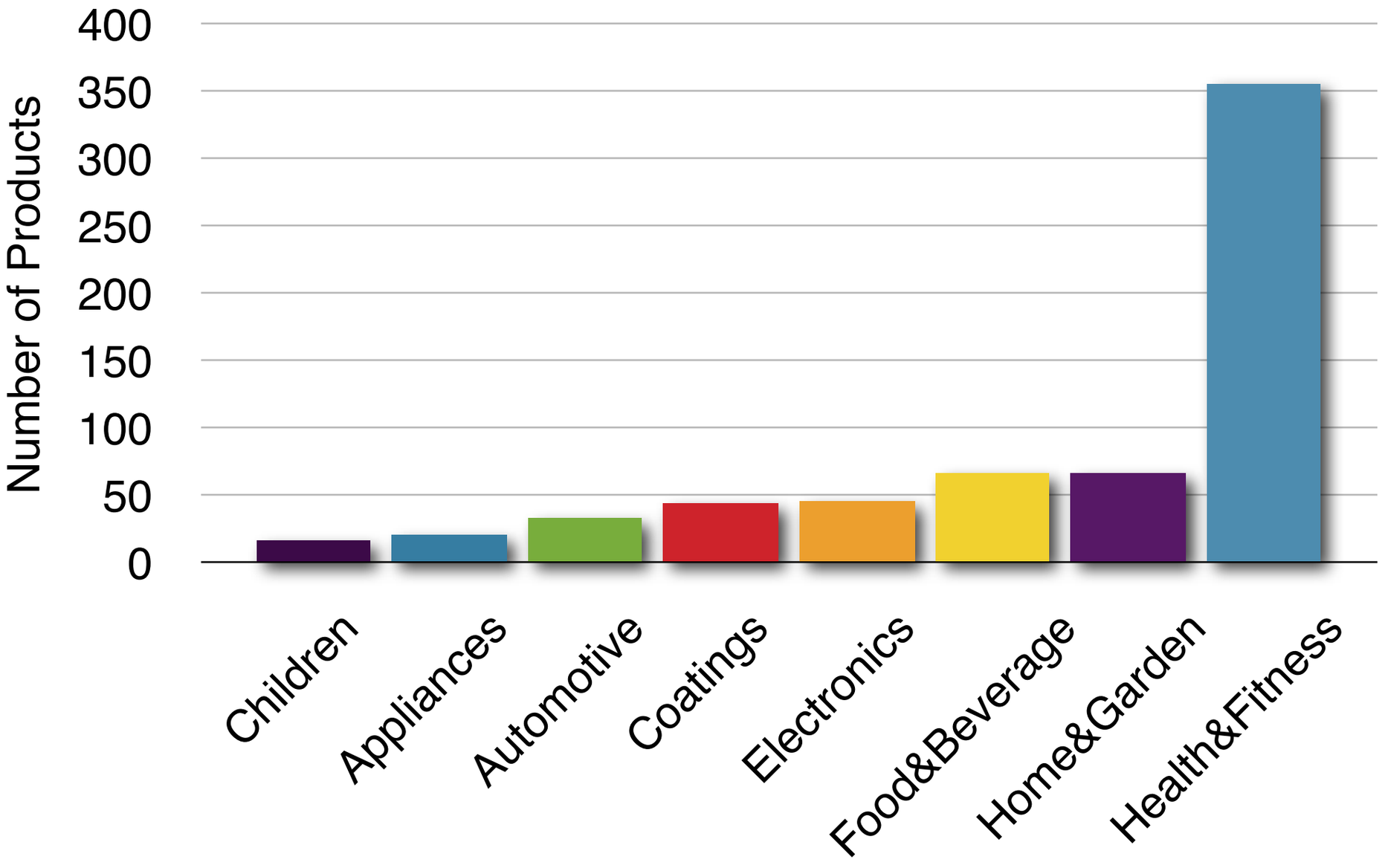
Data source: Roco, 2007

International Research Effort



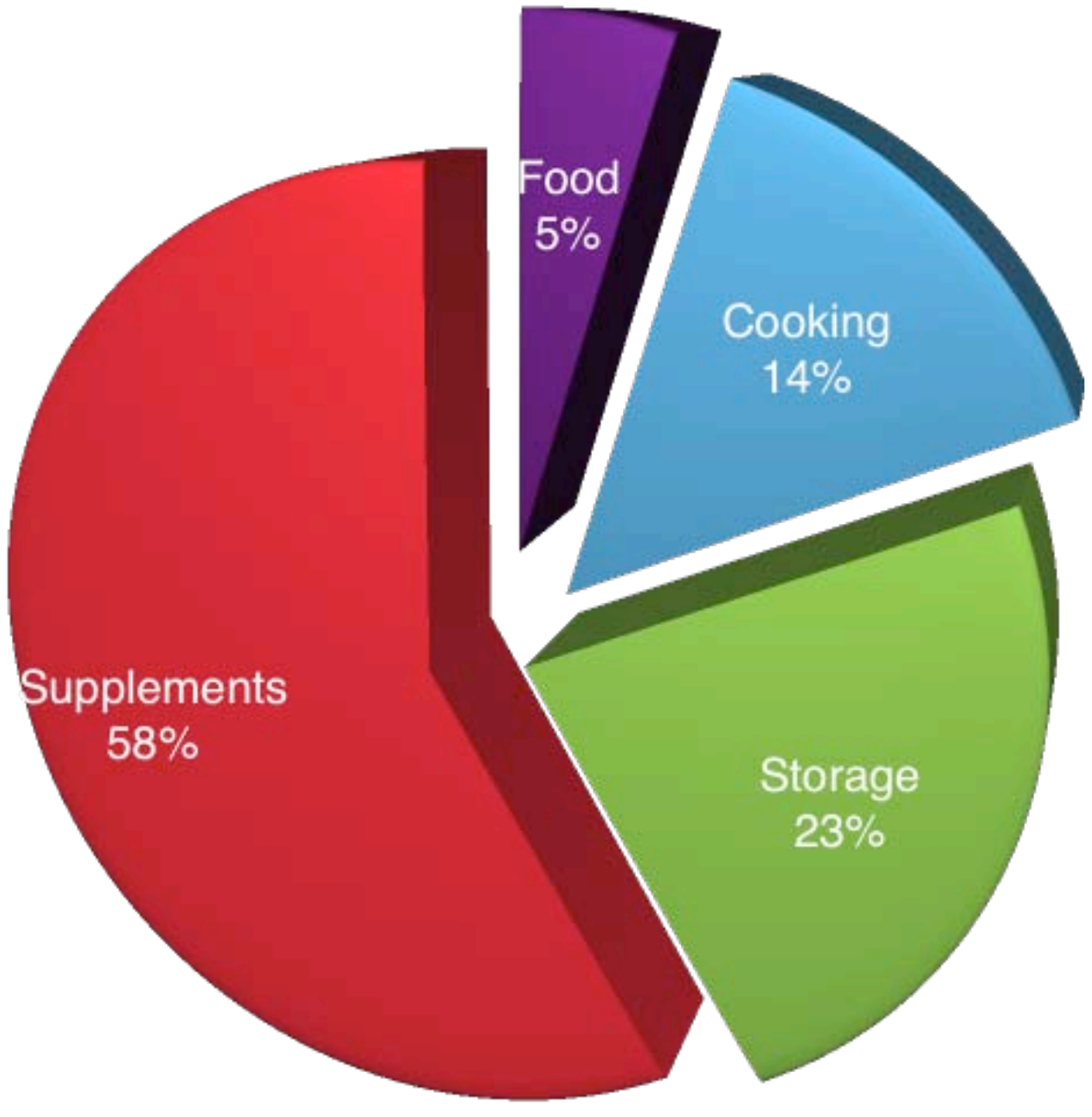
Data source: Roco, 2007

Nano-Products (N = 580)



Data source: WWICS, 2007

Food & Beverage Nano-Products (N = 66)

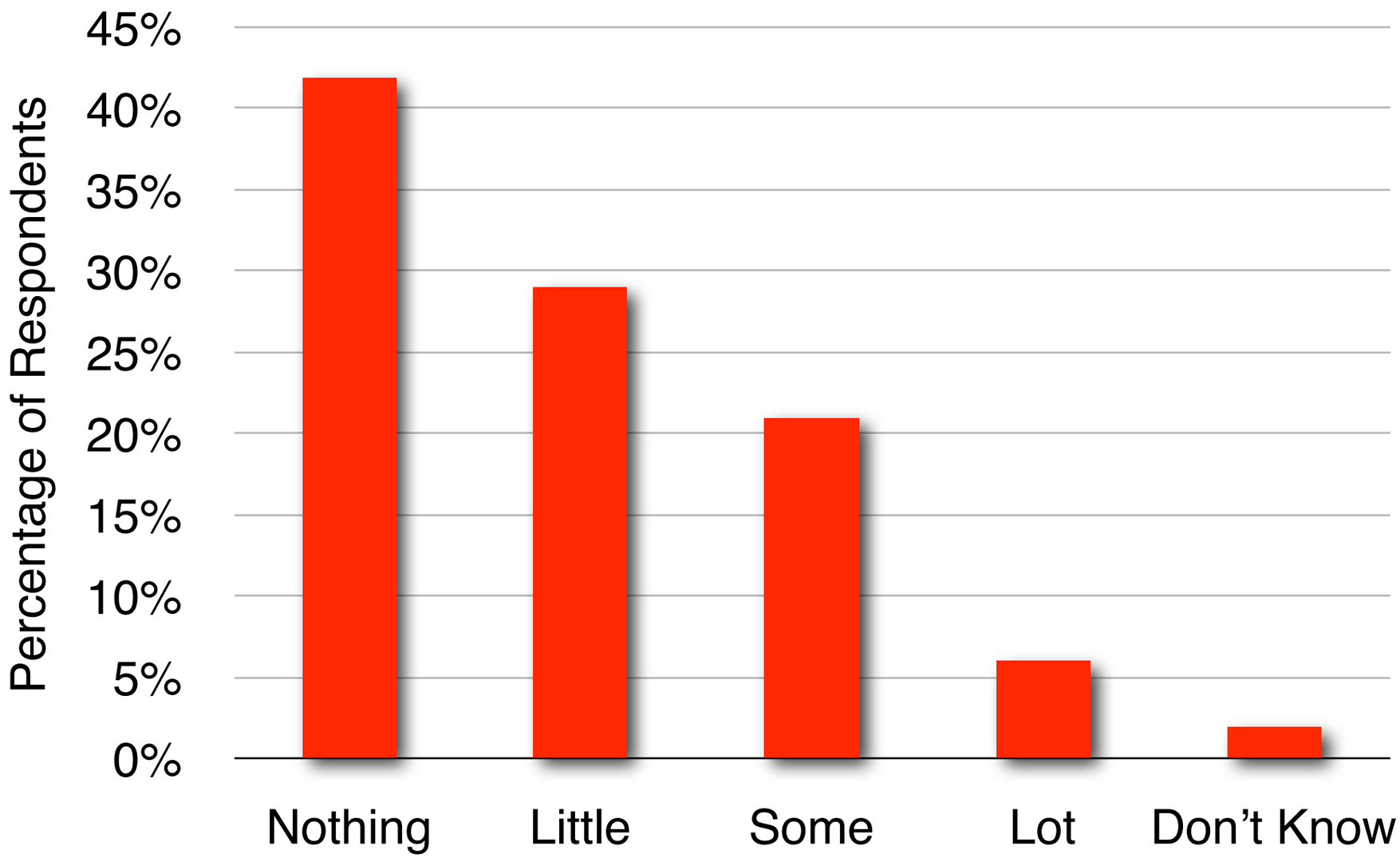


Data source: WWICS, 2007

Hazard Labelling?

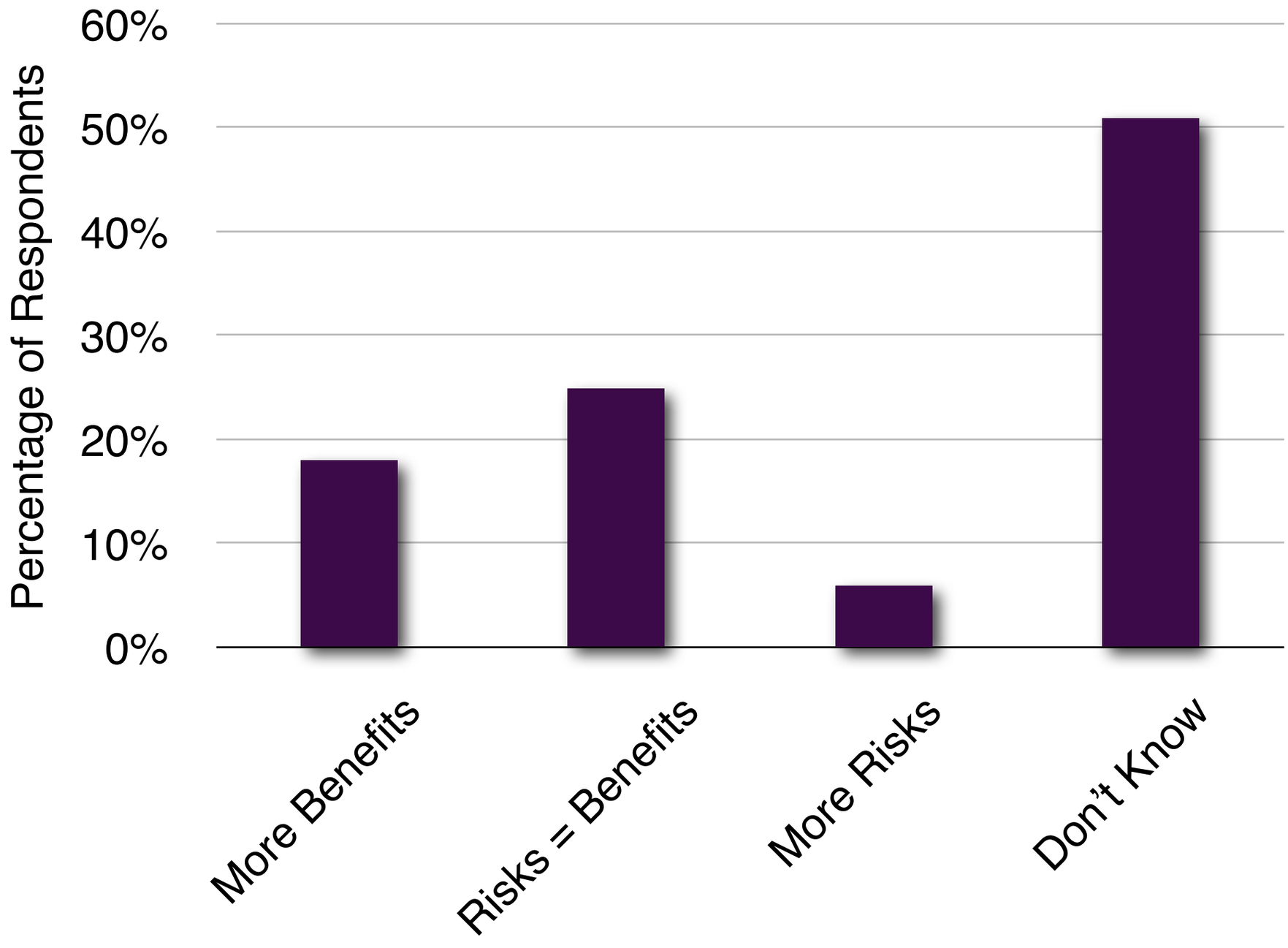
Source: ETC, 2007

US Consumer Knowledge of Nanotechnology



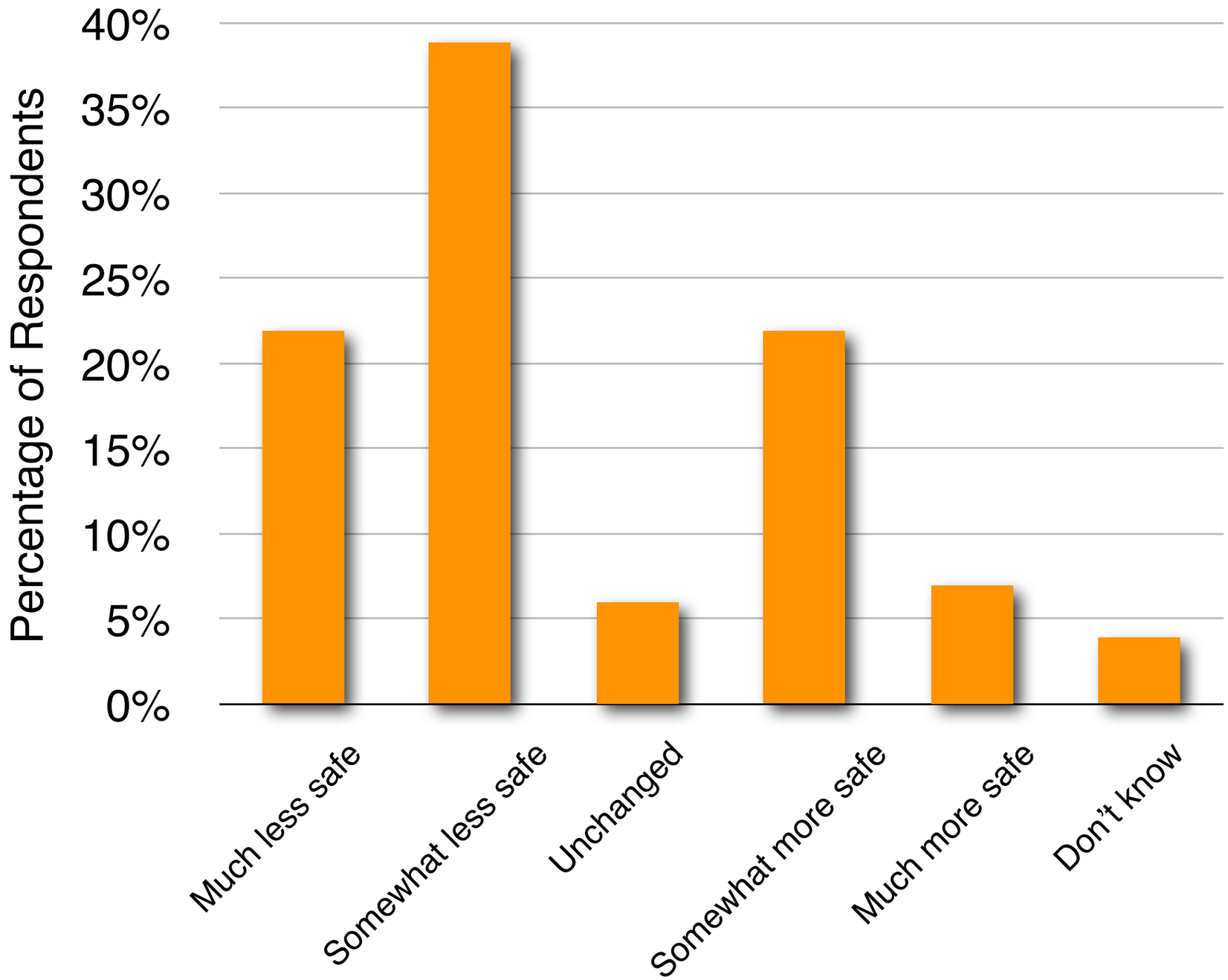
Data source: HRA, 2007, N=1014

US Consumer Perceptions of Risks & Benefits



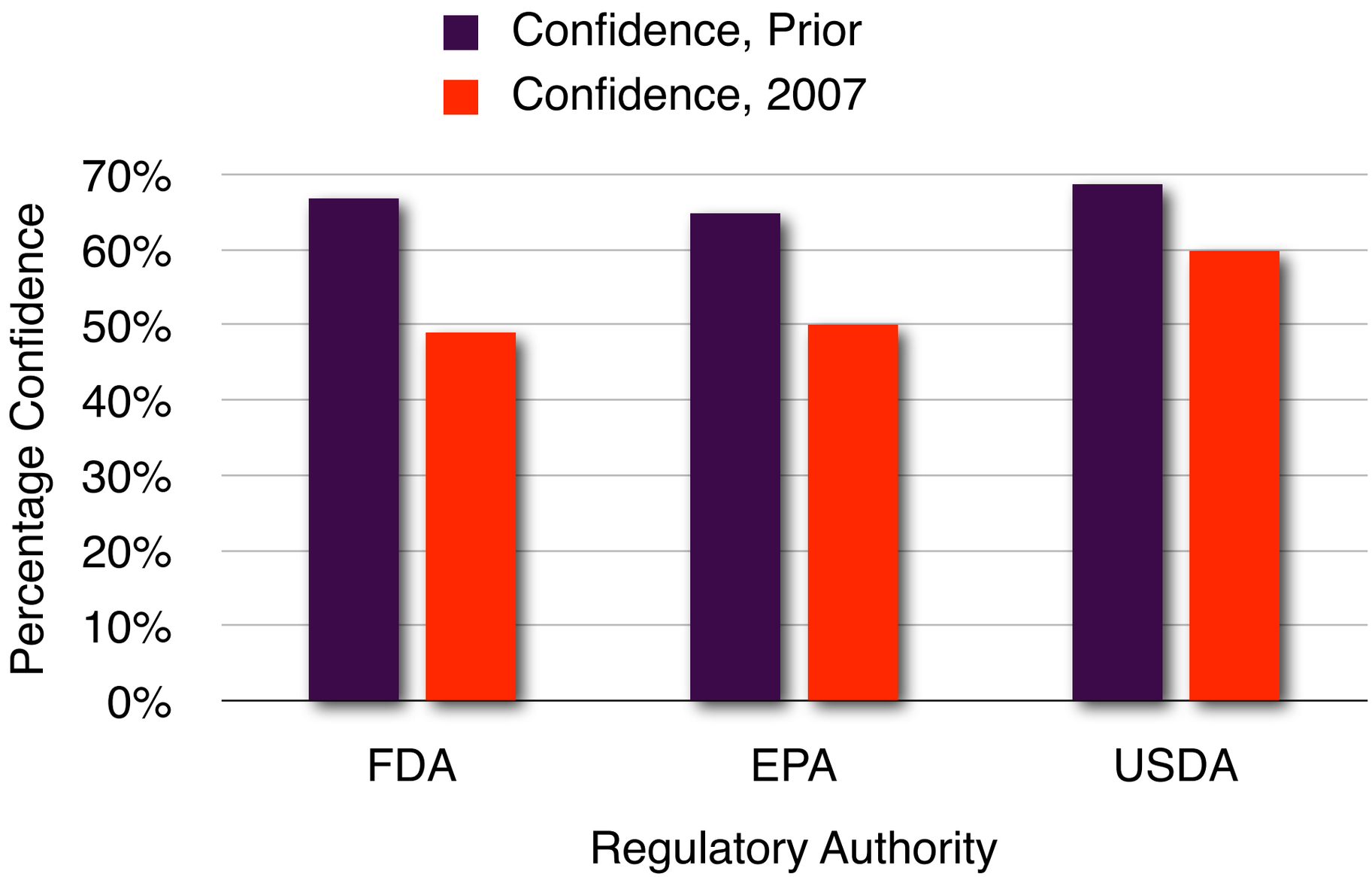
Data source: HRA, 2007, N=1014

Consumer Perception of the Direction of Food Safety over the past 5 years



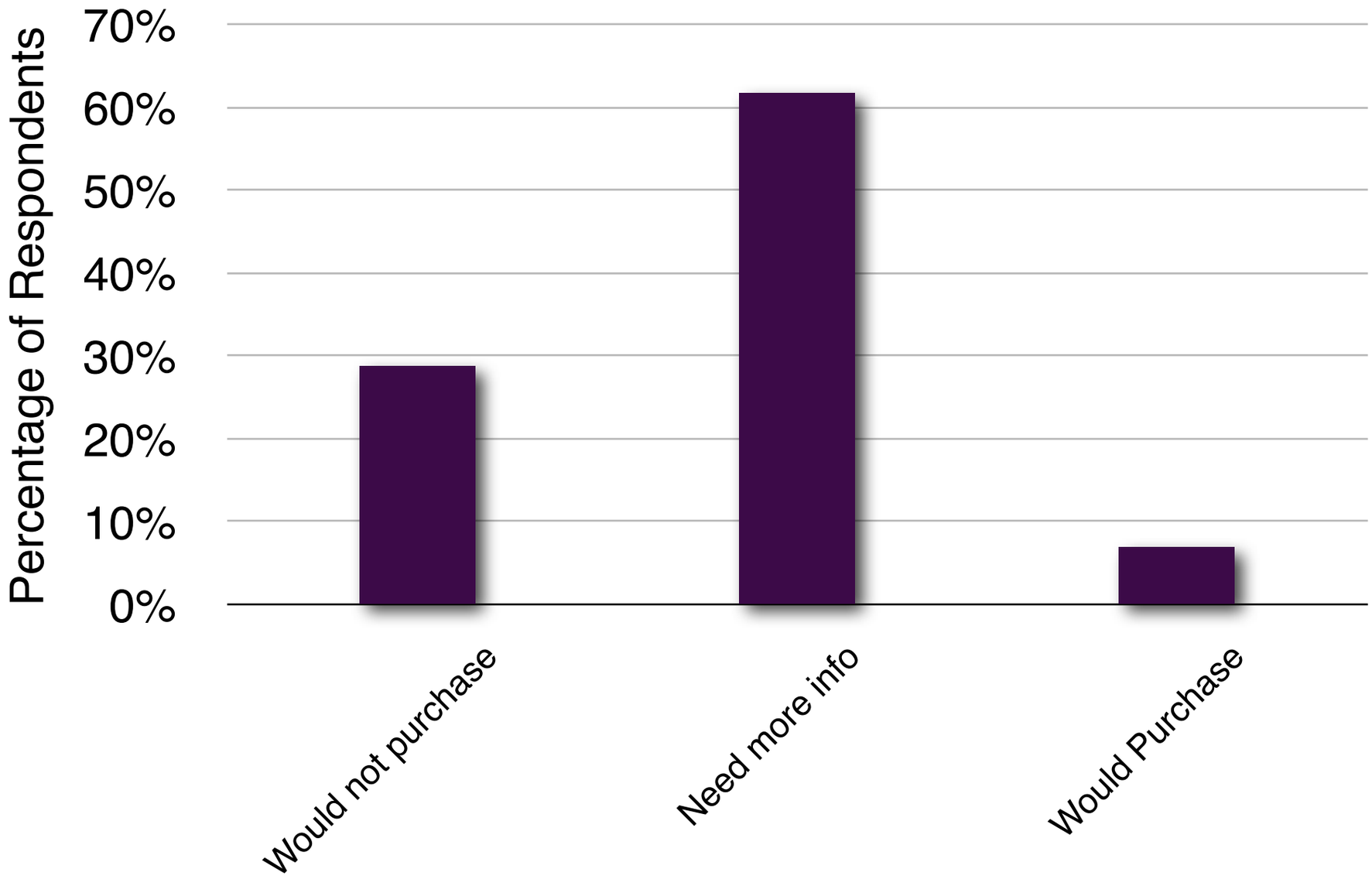
Data source: HRA, 2007, N=1014

Consumer Confidence in Regulatory Authorities over the past 5 yrs



Data source: HRA, 2007, N=1014

Consumer's Willingness to Purchase Food "enhanced with nanotechnology"



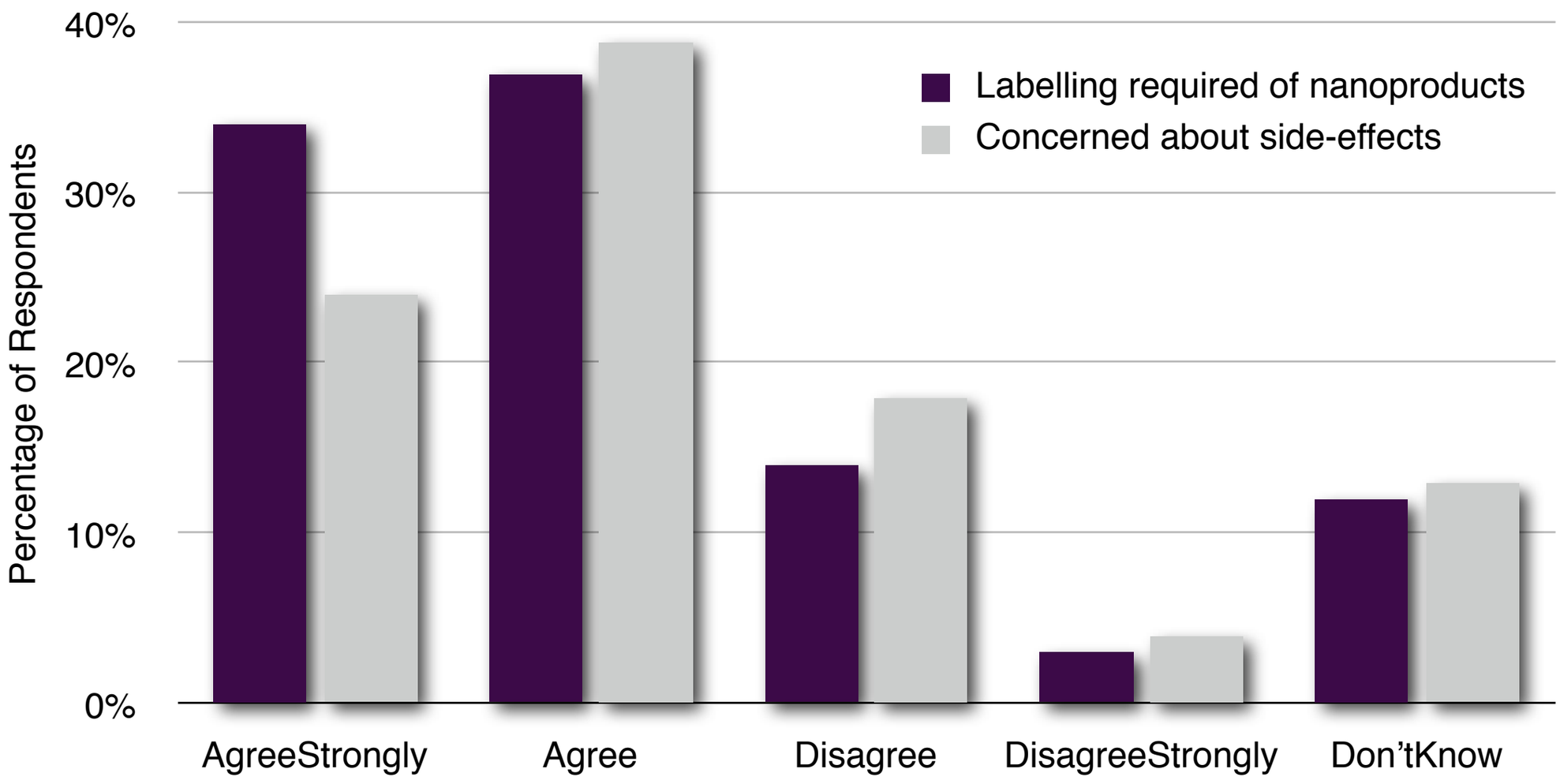
Data source: HRA, 2007, N=1014

Nano-in-Food?

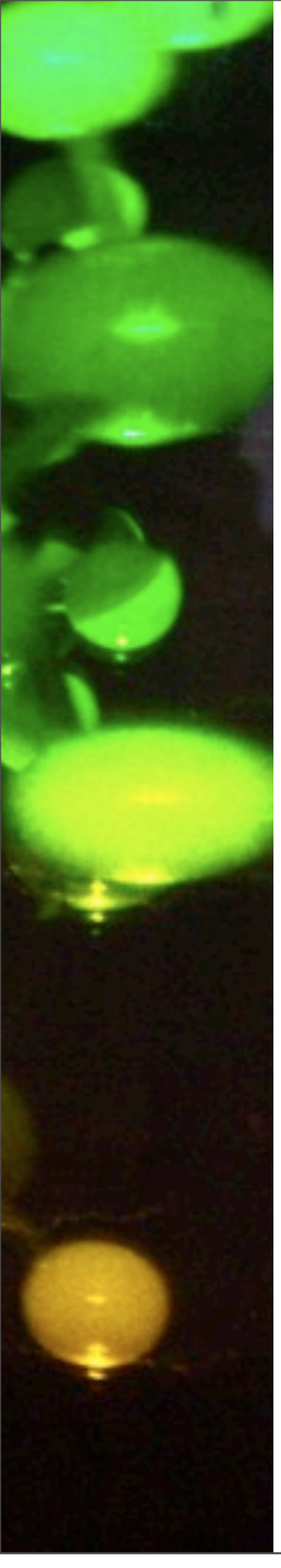
Sources of Nano in Food	Examples
Adventitious	Nano-pollution from: airborne, rain-borne, water-borne nanoparticle-drift from off-farm and/or off-site.
Incidental	Nano-pollution from: nanonized packaging; surface coatings - in packaging, sorting, storage, sales areas; utensils; packaging equipment; transport equipment; filtration equipment.
Intentional	Nano-pollution from: nanonized production inputs; food processing additives; foliar or systemic sprays.

Table source: Paull & Lyons, JOS, 3(1) 2008

Aus Consumer Responses: Labelling & Side-Effects?



Source: Paull & Lyons, 2008; data source: MARS, 2007, N=1000

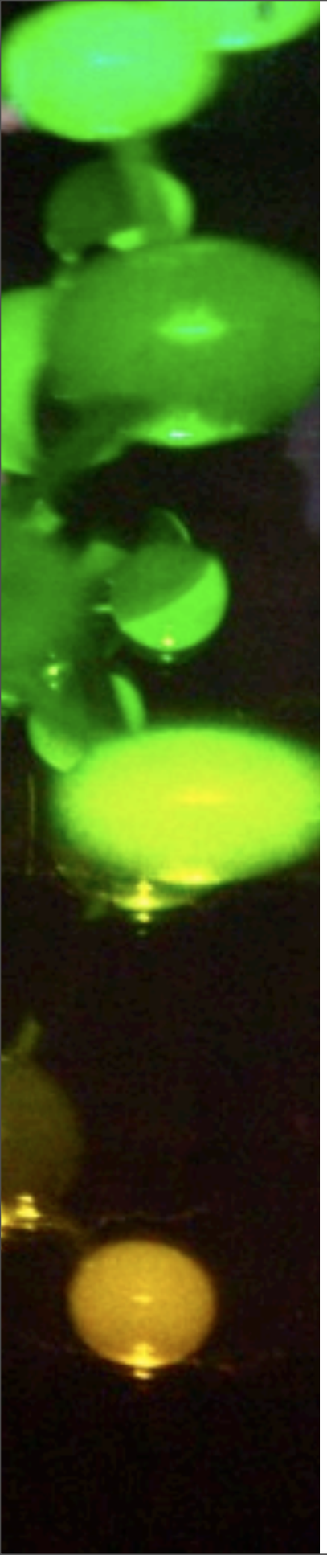


Cryptic food technologies

Synthetic pesticides, fertilizers, irradiation, GMOs...

Leads to Asymmetric Knowledge: invisible & undetectable for consumer

Nanoparticles... the latest cryptic food technology



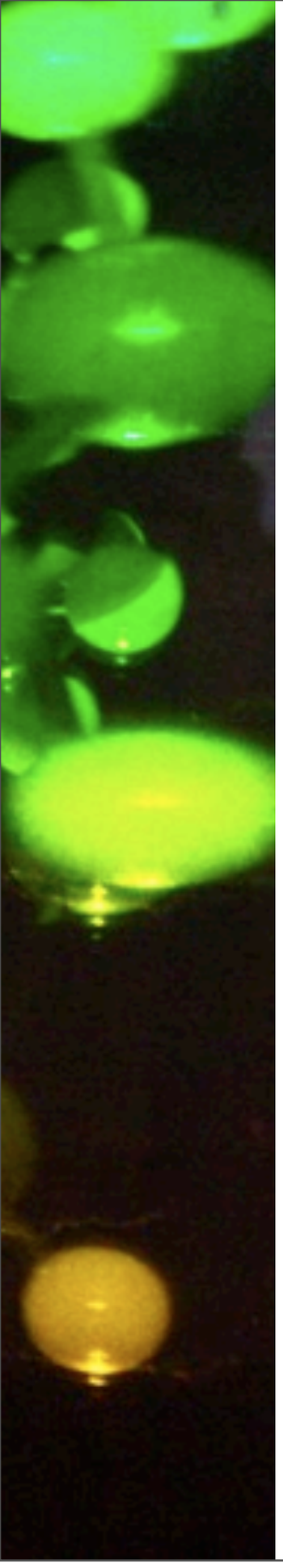
Threat?

- "Certified Organic"

- Explicit exclusion of synthetic pesticides, fertilisers, of GMOs & of irradiation

- Implied Social Contract & consumer expectation: food free of cryptic technologies

- Nano-in-Organic > disenchanted Organic consumers



Opportunity:

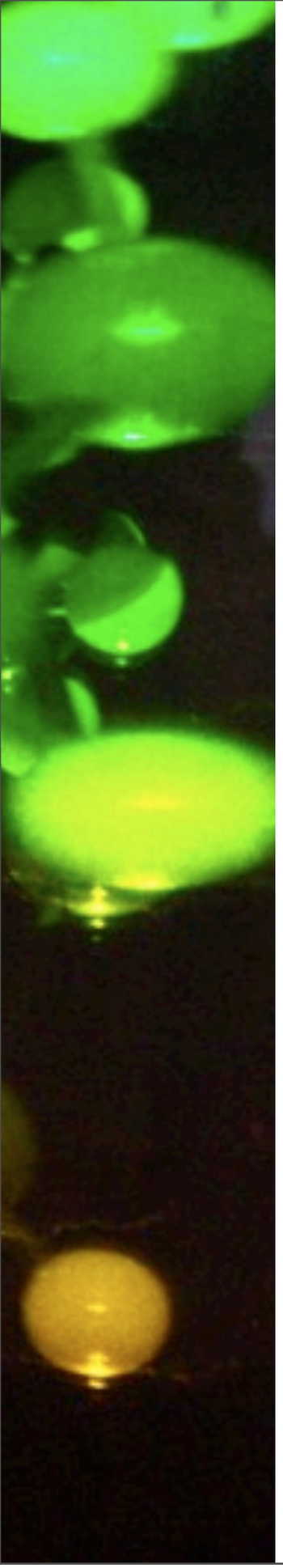
Organic = No Nano

True to the spirit of Organics

True to the Organic "CHEF" Principles
(Care, Health, Environment & Fairness)

Potentially broadens the appeal of Organics...

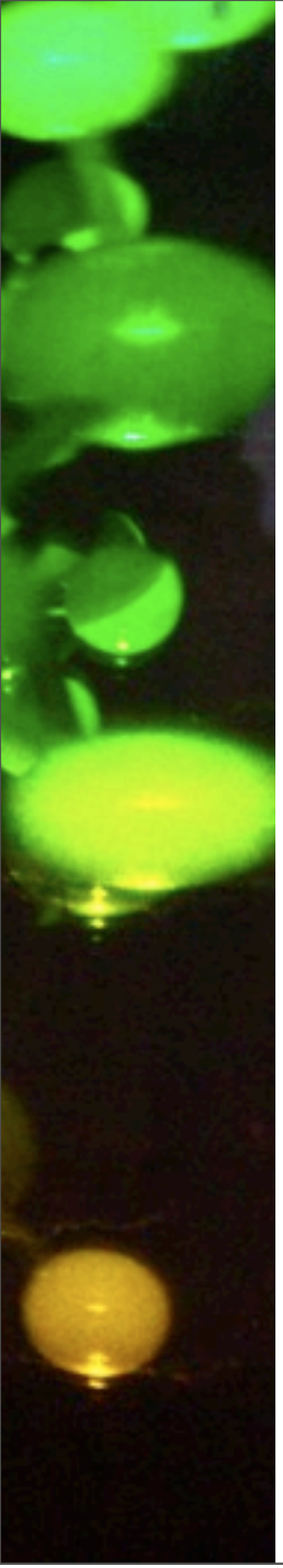
... grants a choice to those consumers who wish to avoid Nano-in food



Soil Association

The leading UK Organic certifier announced a nano-ban, the first Organic certifier to do so

(17 Jan, 2008)



Organic Standards

to specifically exclude engineered Nanoparticles:

- production
- processing
- packaging

adopt precautions against...

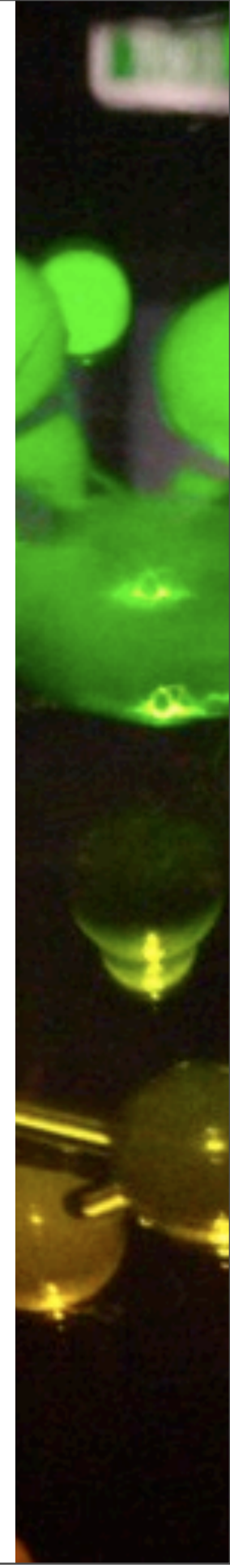
- intentional
- adventitious
- incidental

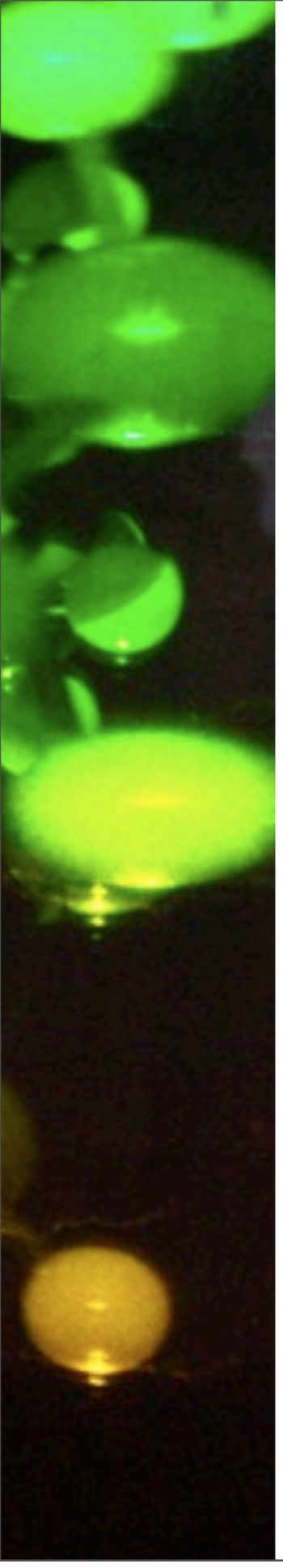
Threat (of inaction):

Organics loses face,
breaches its social contract with consumers &
Organics is contaminated with nanoparticles

Opportunity (to act):

Put a Nano-exclusion in place,
this keeps faith with the existing clientele &
can attract a new clientele of nano-avoiders





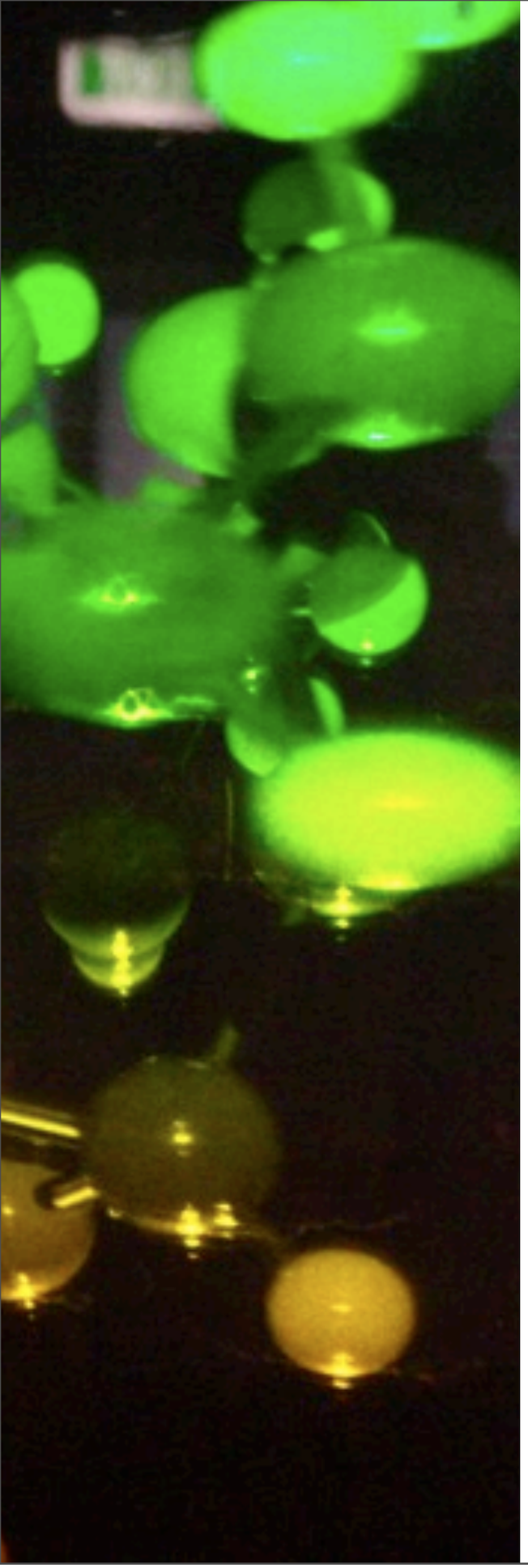
Conclusions/ Recommendations

1.

IFOAM follows the Soil Association's example & adds a nano-exclusion to the basic organic standard

2.

If that is not quickly forthcoming, then regional standards or individual certifiers act pre-emptively and adopt their own nano-exclusions



Paull & Lyons, 2008,

"Nanotechnology: The Next Challenge for Organics"

Journal of Organic Systems

3 (1) 3-22

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Thank you & Questions

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