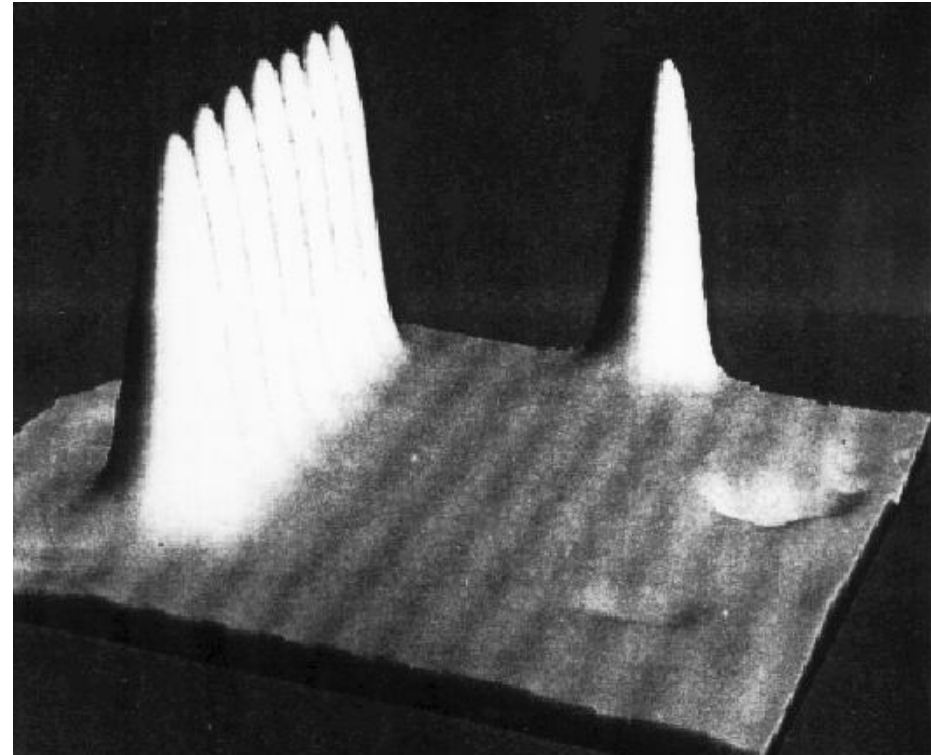


# Teaching Nanoethics Using Science Fiction

Dónal O'Mathúna, BSc(Pharm), MA, PhD  
School of Nursing &  
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donal.omathuna@dcu.ie

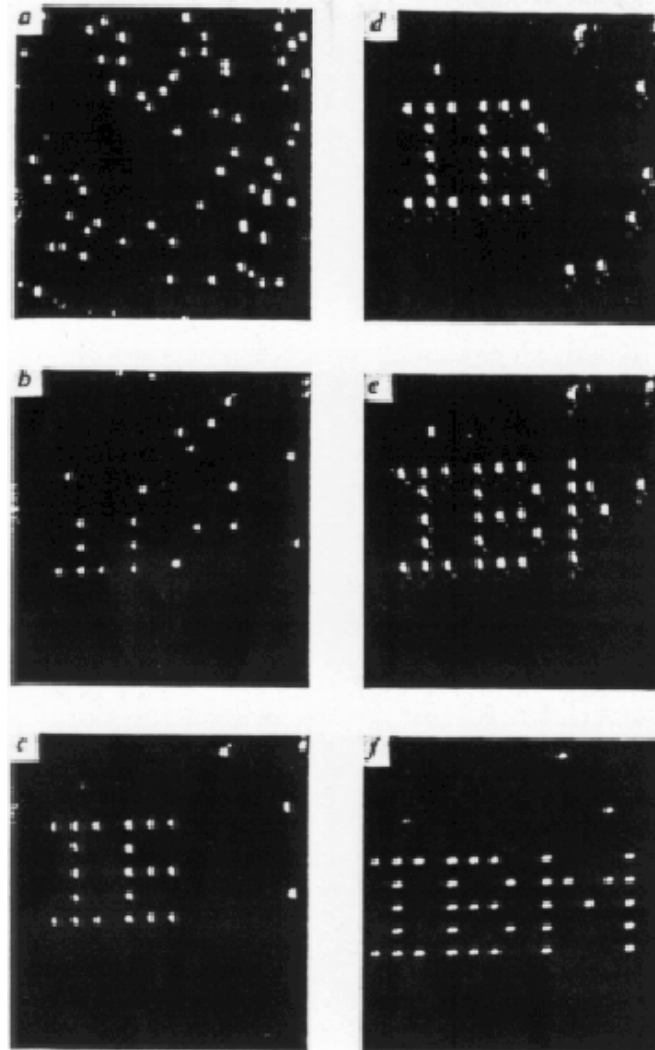
# Nanotechnology

- One nanometer (nm) = one billionth of a meter
- Human hair: about 80,000 nm in diameter
- Hydrogen atom: about 0.1 nm wide



- Richard Feynman's 1959 presentation, "There's plenty of room at the bottom."

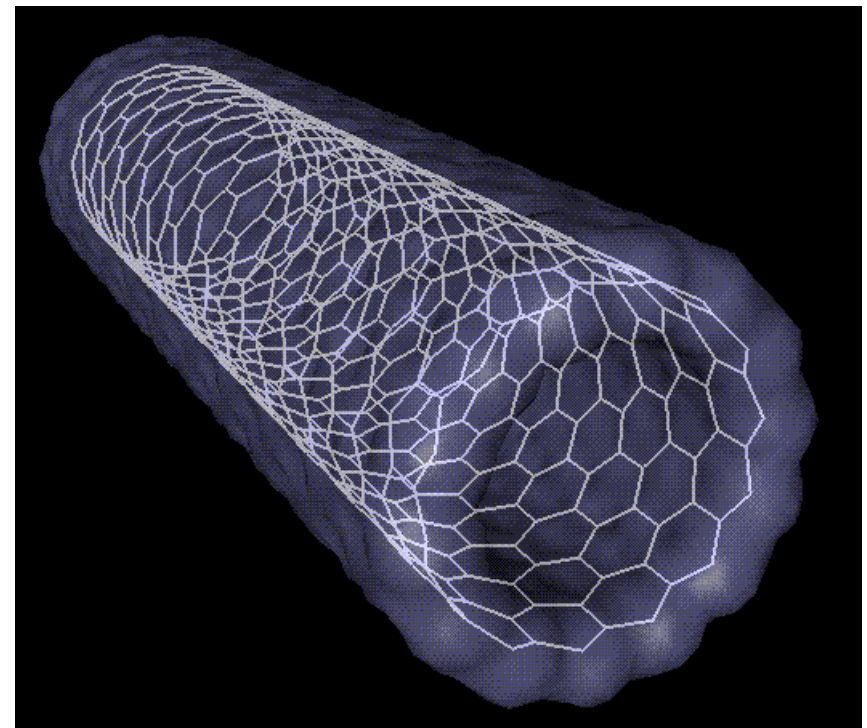
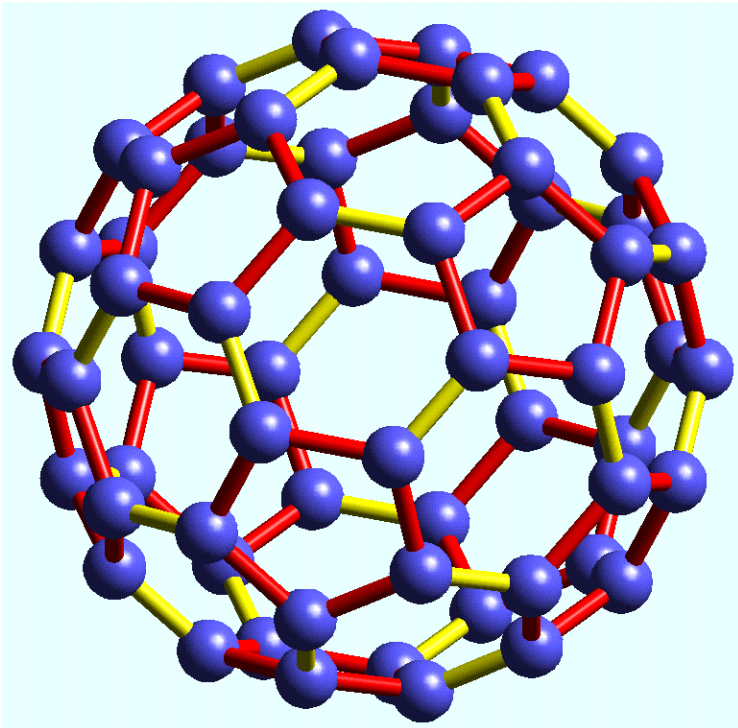
- Don Eigler  
1989



# Buckyballs and carbon nanotubes

(1985)

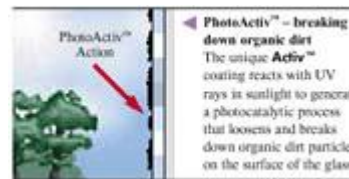
(1991)



A new thought leadership platform that sets a progressive agenda for the future.

VISIT NOW

Forbes Top Nano Products of 2005



**PhotoActiv™ – breaking down organic dirt**  
 The unique **Activ™** coating reacts with UV rays in sunlight to generate a photocatalytic process that loosens and breaks down organic dirt particles on the surface of the glass.



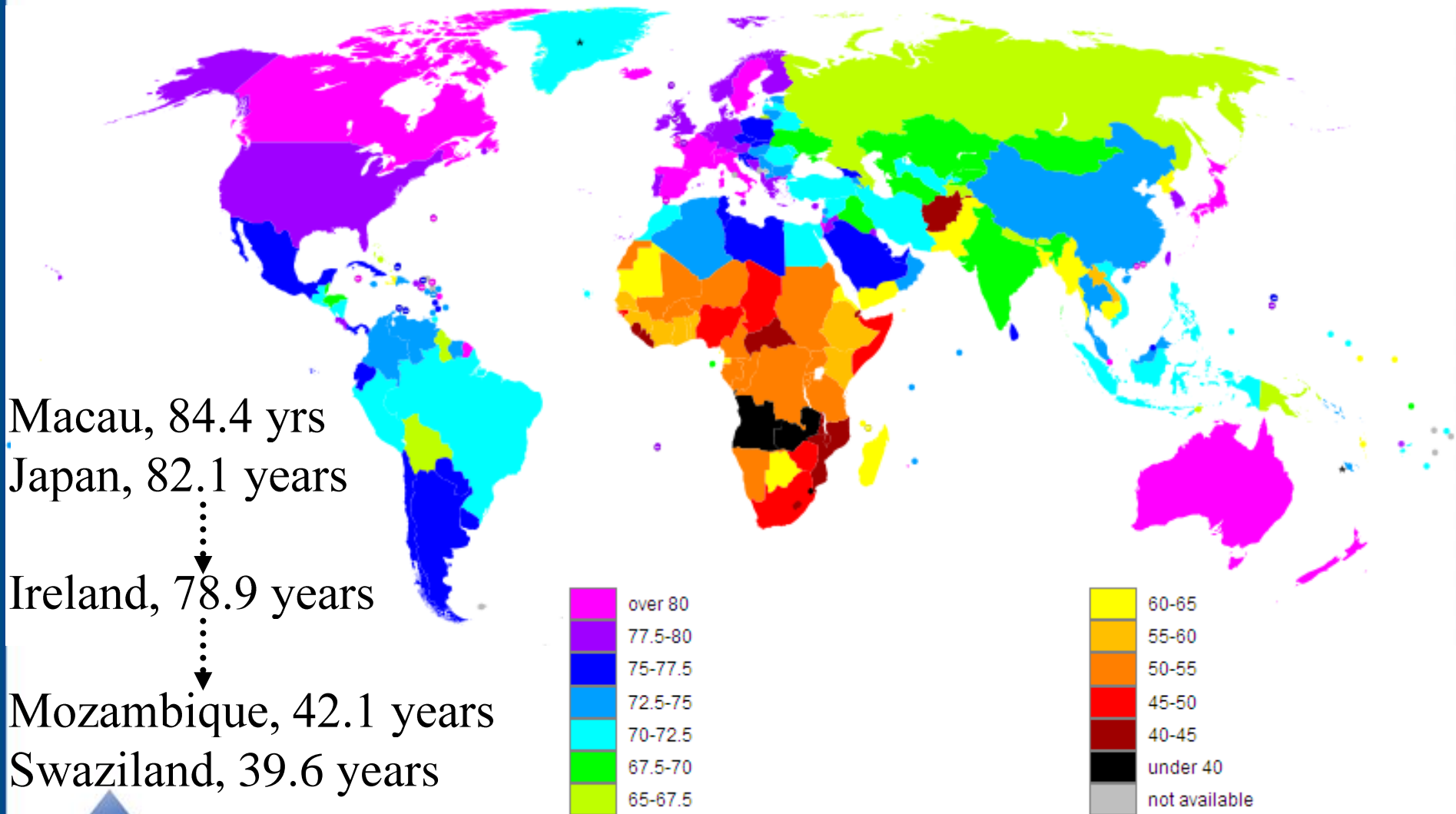
**Hydrophilic – washing away dirt**  
 The surface of the coating is hydrophilic. It attracts water so that it spreads and forms a thin film that 'sheets' away quickly and dries without spotting.



- 2006 data on total spend (public and private):
  - US - \$3 billion
  - EU - \$3 billion
  - Japan - \$2.3 billion
  - Rest of world - \$1.9 billion
- US National Nanotechnology Initiative
  - President Clinton: \$0.27 billion for 2001
  - President Bush: \$1.5 billion for 2009
- Global market: \$1 → 3 trillion by 2015



# Life expectancy (2009)

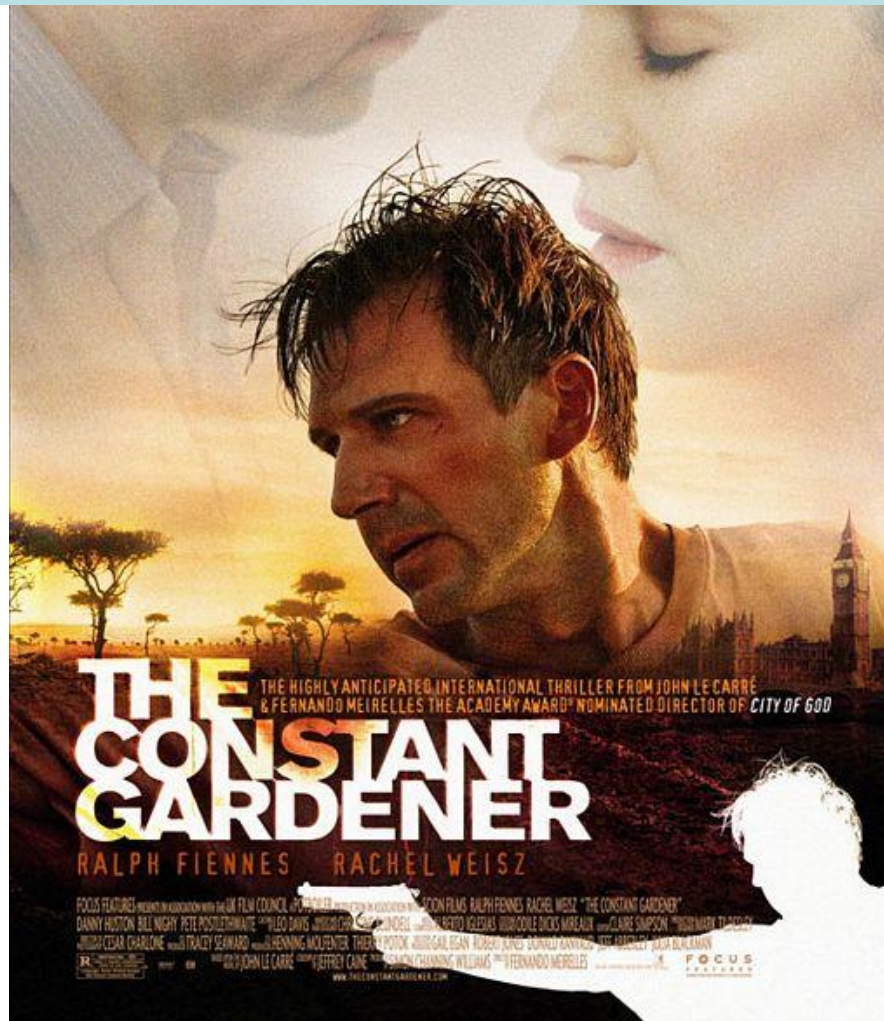


# Who needs nano?

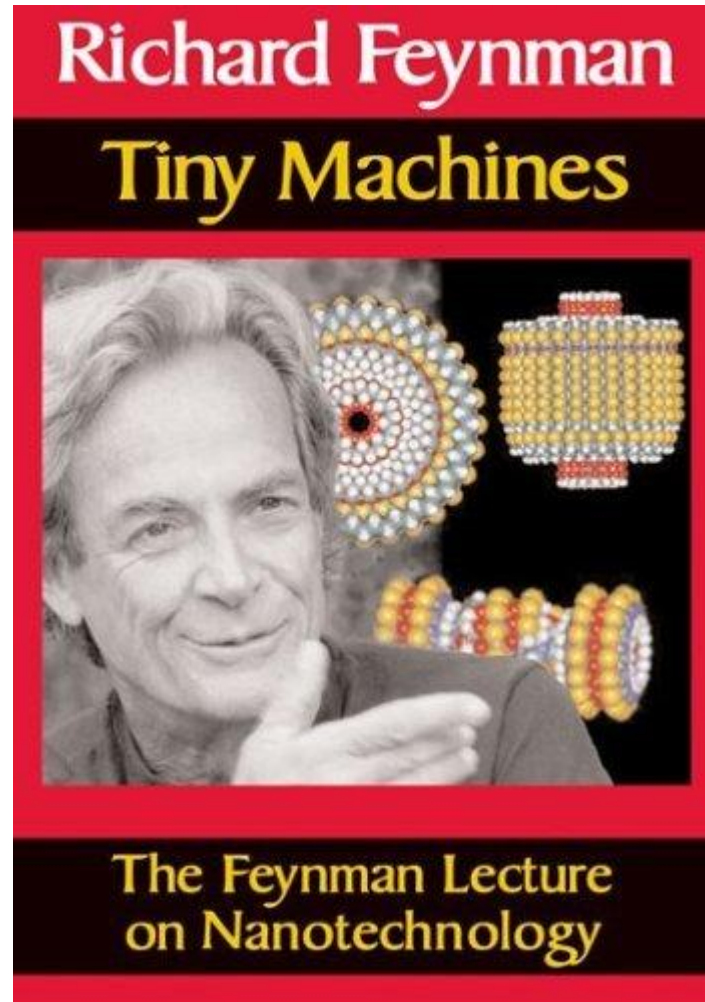




‘We are not paid to be bleeding hearts. ... We are not killing people who would not be dead otherwise. Look at the death rate, not that anyone is counting.’



‘There’s plenty of room at the bottom’ (1959)





FOUR MEN AND ONE WOMAN ON  
THE MOST FANTASTIC, SPECTACULAR  
AND TERRIFYING JOURNEY  
OF THEIR LIVES...

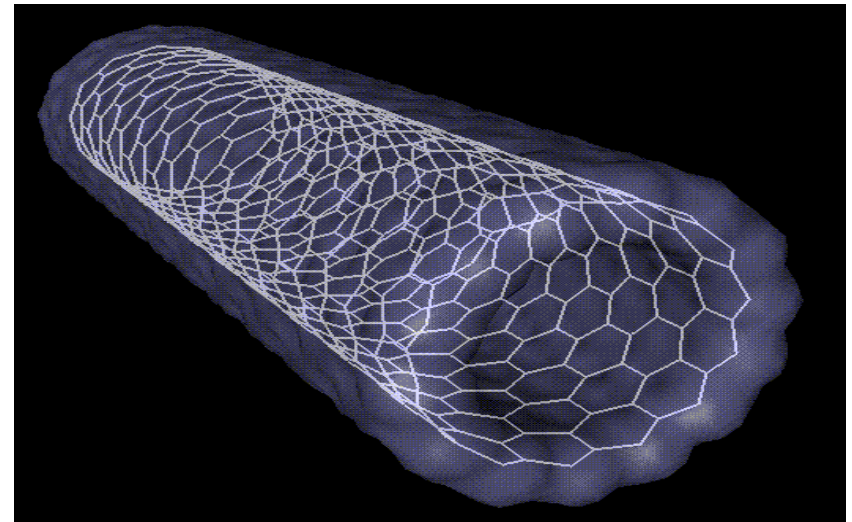
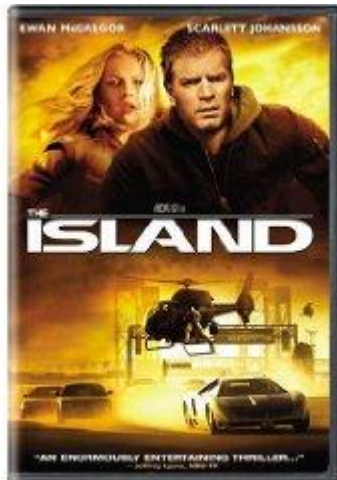
# FANTASTIC VOYAGE

STEVEN DODD - BRIGID WELCH  
EDMUND O'BRIEN - DONALD PLEASENCE  
ADRIAN O'CONNOR - WILLIAM FISHER  
ARTHUR KENNEDY  
SUII DAVID - RICHARD FLEISCHER  
HARRY KLEINER - DAVID DUNCAN  
OTTO KLEMENT - JAY LEWIS BOBBY  
LEONARD ROSEMAN

# Ethics between the Reel...



... and the Real



# A Fantastic Voyage Brought to Life

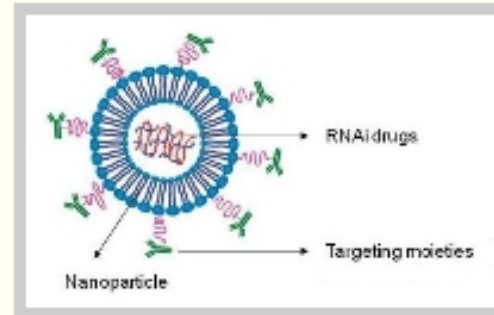
Thursday, January 15, 2009

## TAU scientists develop a medical "mini-submarine" to blast diseased cells in the body

Ever since the 1966 Hollywood movie, doctors have imagined a real-life *Fantastic Voyage* a medical vehicle shrunk small enough to "submarine" in and fix faulty cells in the body. Thanks to new research by Tel Aviv University scientists, that reality may be only three years away.

The blueprints for the submarine and a map of its proposed maiden voyage were published earlier this year in *Science* by Dr. Dan Peer, who now leads the **Tel Aviv University** team at the **Department of Cell Research and Immunology**. The team will build and test-run the actual "machine" in human bodies. Dr. Peer originally developed the scenario at Harvard University.

Made from biological materials, the real-life medical submarine's *Fantastic Voyage* won't have enough room for Raquel Welch, but the nano-sized structure will be big enough to deliver the payload: effective drugs to kill cancer cells and eradicate faulty proteins.



*A nanoparticle decorated with targeting agents that guide it to a specific cell type, leaving healthy cells untouched.*

### A Nano-GPS System

‘The real-life medical submarine’s *Fantastic Voyage* won’t have enough room for Raquel Welch,...

**Normal Nanotechnology**

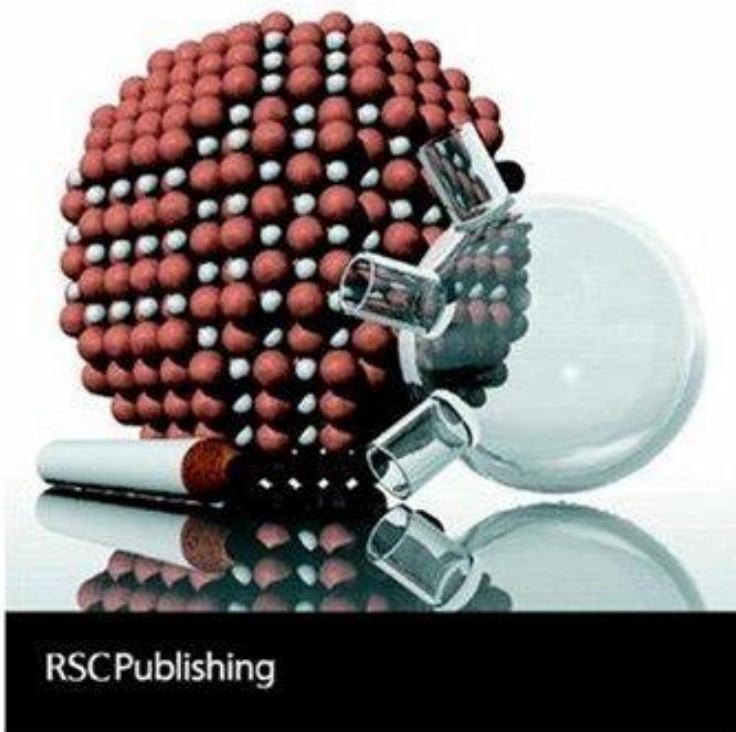
**Futuristic Nanotechnology**



# NANOCHEMISTRY

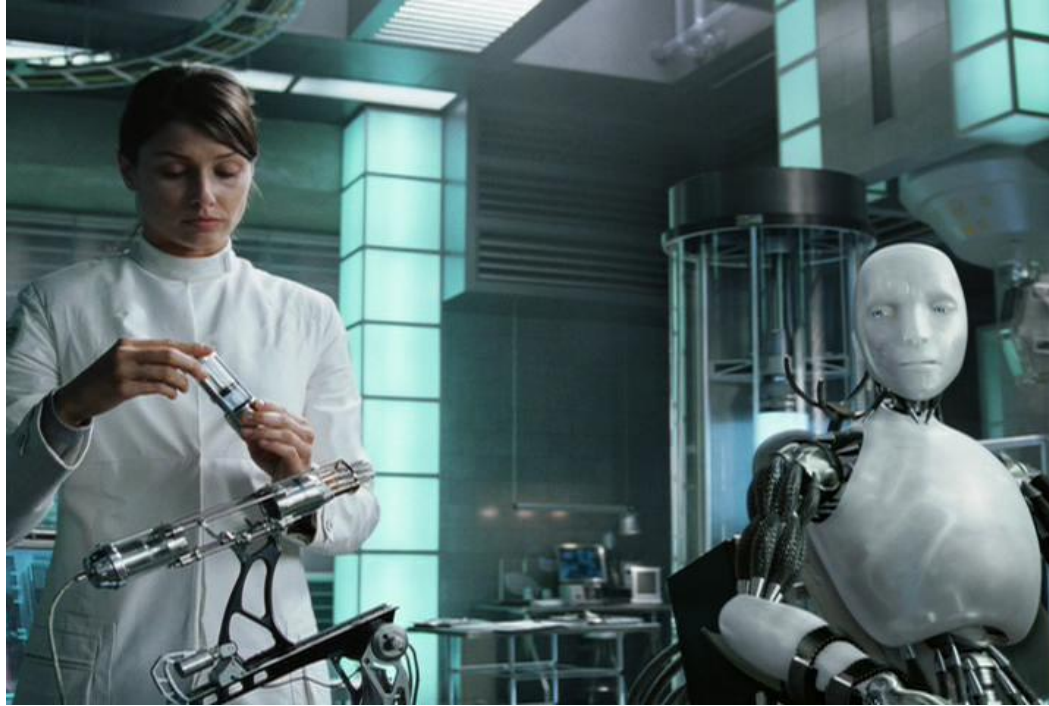
A Chemical Approach to Nanomaterials

Geoffrey A Ozin & André C Arsenault



Nanotechnology  
‘is considered  
poised to  
revolutionize the  
world as we  
know it, and  
transform us  
into something  
better’ (p. x).

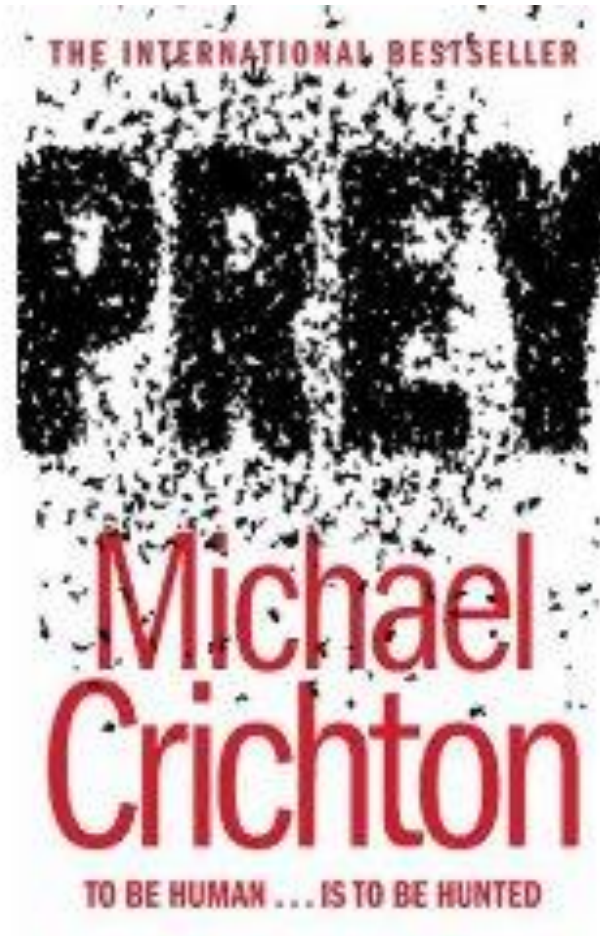
## *I, Robot - a person?*



When does a perceptual schematic become consciousness?  
When does a difference engine become the search for truth?  
When does a personality simulation become the bitter moat  
of a soul?

Dr Lanning



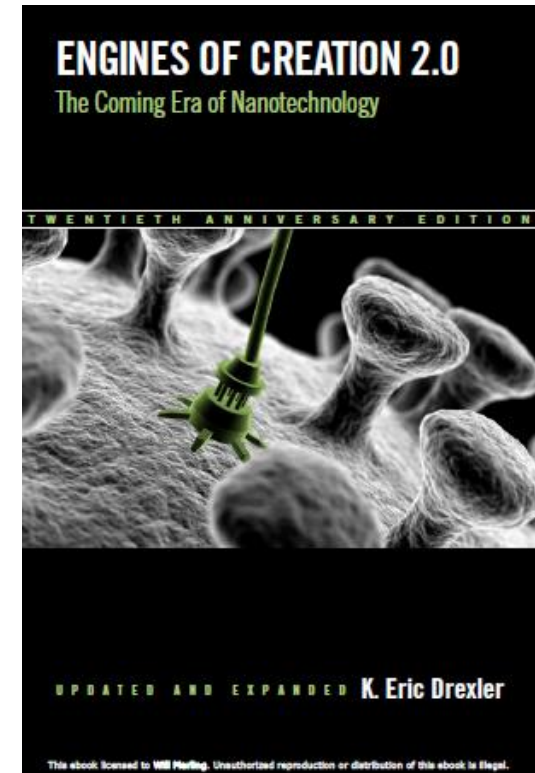


# K. Eric Drexler (1986/2006)

“gray goo”: only on pp. 355-6

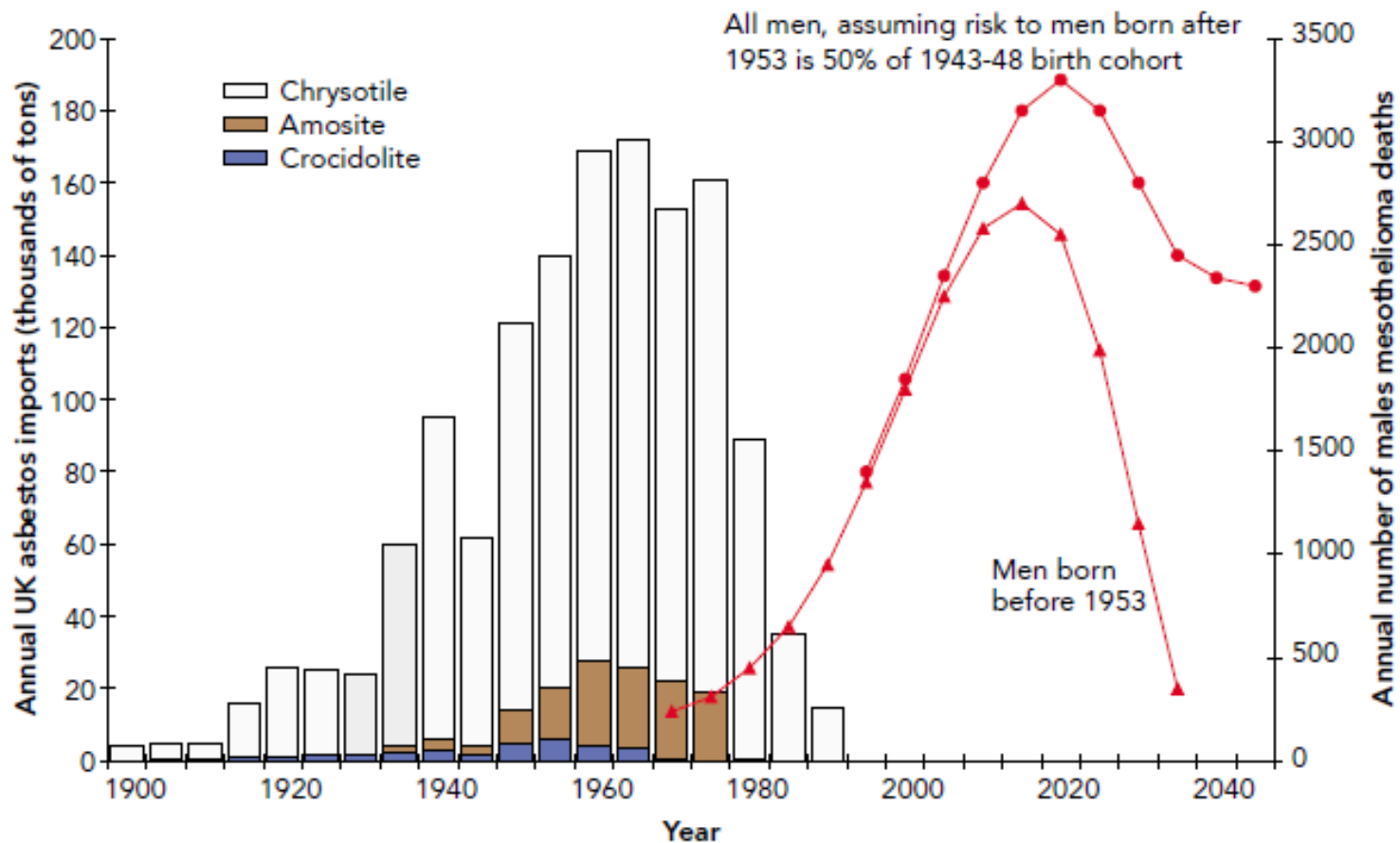
However, he also writes:

- Nanotechnology is the greatest breakthrough in history, ‘for better or for worse’ (p. 58).
- Nano ‘may determine whether we survive and thrive, or whether we obliterate ourselves’ (p. 140).
- Describes ‘nauseating possibilities’ and ‘horrors’ of nano (p. 257).
- He gives ‘reasons for considering nanotechnology more dangerous than nuclear weapons’ (p. 303).
- Nano will give new powers, ‘power that can be used to destroy life, or to extend and liberate it’ (pp. 403-4).
- ‘Together, these advances will make possible a future rich in possibilities, one of which is our own destruction’ (p. 461).



The best of intentions are not enough





# Late lessons from early warnings the precautionary principle 1896-2000



European Environment Agency



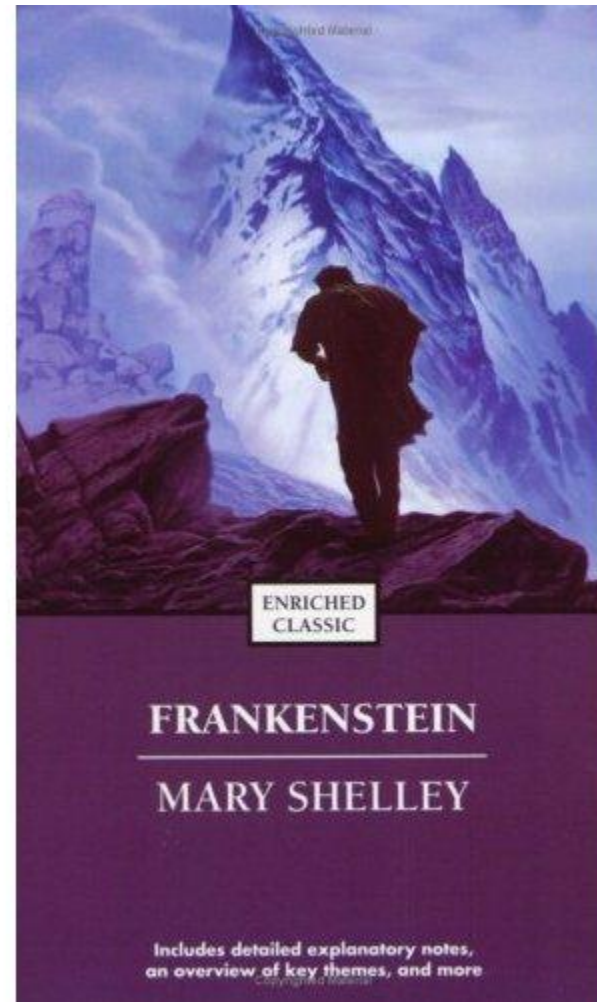
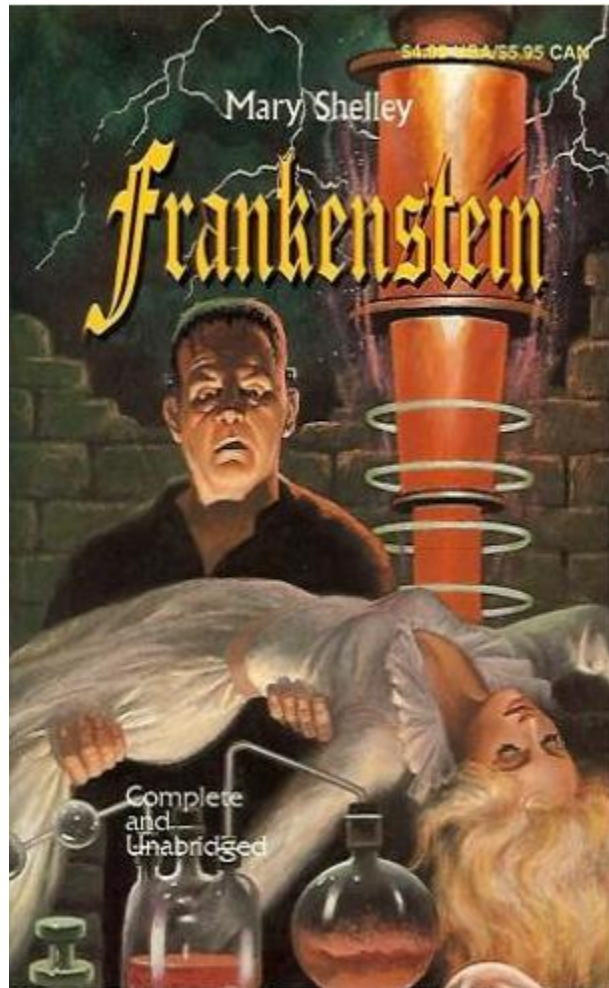
**Code of Conduct for Responsible  
Nanosciences and  
Nanotechnologies (N&N) Research  
European Commission (2008)**

**“Wisdom is to know,  
that you do not know”**

**(Socrates)**



# Nanoethics & Narrative



# Selected Resources

- University of Kentucky Bioethics on Film:  
<http://ukhealthcare.uky.edu/bioethics/films.htm>
- Bioethics in Commercial Films:  
<http://highschoolbioethics.georgetown.edu/bibliographies/Commercialfilmsandbioethics.htm>
- Sandra Shapshay, *Bioethics at the movies* (Johns Hopkins University Press , 2009)
- Dónal P. O'Mathúna, *Nanoethics: big ethical issues with small technology* (Continuum, 2009)

