
Nanotechnology: Lessons from the Frankenfood Debate

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21st Century S&T Policy Context

- **End of Cold War**
- **Globalization**
- **Information Revolution**
- **Increased Democratization & Rise of NGOs**
- **Eroding Public Trust in Government**

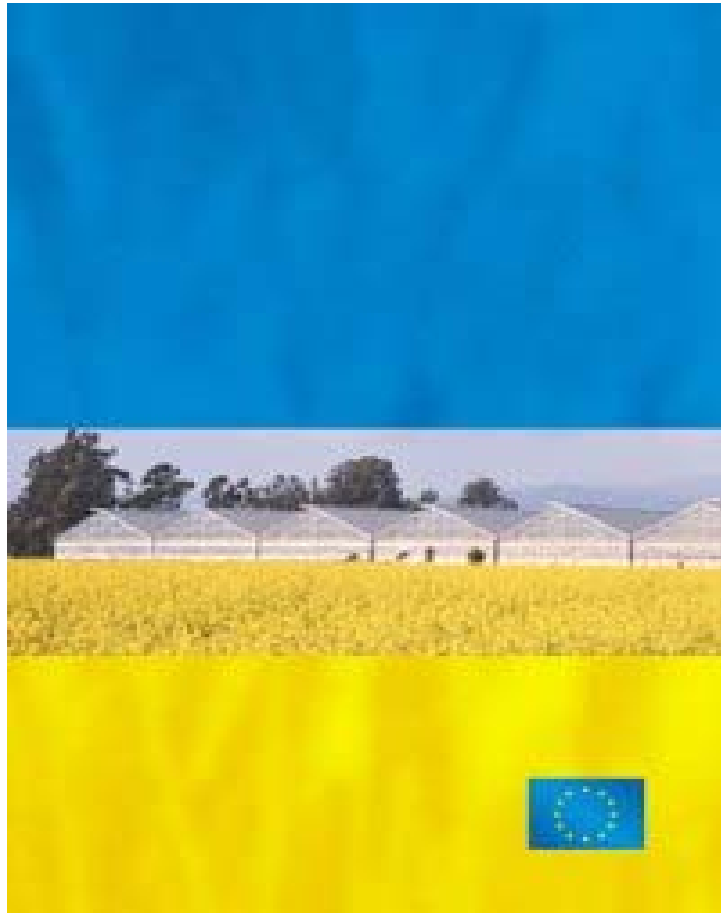
The Great GM Debate



GM Debate Myths

- **The public is ignorant of science**
- **Europeans don't care about feeding people in the Third World**
- **It's all the fault of the mad cow disease crisis**
- **Europeans are risk adverse, Luddites**
- **Blame the media!**
- **...**

Public Perceptions of Agricultural Biotechnologies in Europe



**Final Report of the PABE
Research project
Funded by the
Commission of
European Communities
December 2001**

**[www.lancs.ac.uk/dept/iepp
p/pabe](http://www.lancs.ac.uk/dept/iepp/p/pabe)**

Most Trusted Institutions on Biotechnology

Gaskell 2003

Europe

- **Consumer Groups – 49%**
- **Environmental groups – 46%**
- **Industry – 8%**

United States

- **FDA – 41%**
- **Farmers – 34%**
- **Scientists – 33%**
- **Industry – 5%**

Nanotechnology cures cancer!

Well, it might...

Science and technology

The Economist May 7th 2005 73



Also in this section

- 74 The effectiveness of acupuncture
- 74 The last Skylark rocket
- 75 How sunlight varies
- 75 A convention for time travellers

Oncology

Nanotechnology cures cancer!

Well, it might...

DRUG molecules not only have to be effective at treating disease, they also have to be robust enough to get from the place where they enter the body to the place where they are designed to act. Given that bodies devote a lot of effort to hunting down and destroying things that are in the wrong place—whether those things be molecules, viruses, bacteria or even errant body cells—designing drugs that can do this is no mean feat.

That is doubly true when the drug in

be an important advance.

RNAi works by mugging one of the cell's molecular messengers. The information needed to make proteins—the molecules that do most of the work in a cell—is stored as genes in the double-stranded DNA of a cell's nucleus. When a particular protein is needed, this information is copied into a single-stranded molecule called RNA. The RNA then carries the message to the places where proteins are made, and the message is translated into protein.

numbers. This is where Dr Hu, Dr Triche and Dr Davis come in.

Their solution is to wrap the therapeutic RNA inside a "nanoparticle" made of two polymers called cyclodextrin and polyethylene glycol, and coated with a protein called transferrin. It is the transferrin that provides the magic. Its usual job is to carry iron atoms, which cannot penetrate cell membranes by themselves, into cells. It does this by grabbing hold of those atoms and then latching on to a cell-membrane protein called a transferrin receptor, which escorts it into the cell. The researchers reasoned that transferrin and its receptor might perform the same trick for their nanoparticles, and they knew that tumour cells have more transferrin receptors than healthy ones. So they reckoned this might be a way to get the nanoparticles to concentrate in tumours. Once inside, the acidic environment of the cell would dis-

2004 NCSU Public Opinion Survey:

Leading Public Concerns About Nanotechnology

- **Loss of privacy due to surveillance – 32%**
- **Nanotechnology arms race – 24%**
- **Nanoparticles accumulating inside humans – 19%**
- **Economic disruption with job loss – 14%**
- **Uncontrollable spread of self-replicating nanobots – 12%**

(Cobb et al., 2004)

Report of the Madison Area Citizen Consensus Conference on Nanotechnology

Key Recommendations:

- **Develop specific health and safety testing processes for nanomaterials**
- **Repeat testing of products that do not include nanoscale materials when such nanomaterials are added to the product**
- **Disclose/label substances in products using nanomaterials**
- **Do not assume that existing health and safety regulations are adequate**
- **Form government body, that includes wide spectrum of participants, responsible for regulation of public and private nanoscale research and development**
- **Create an international agency that would consider nanotechnology problems and issues**

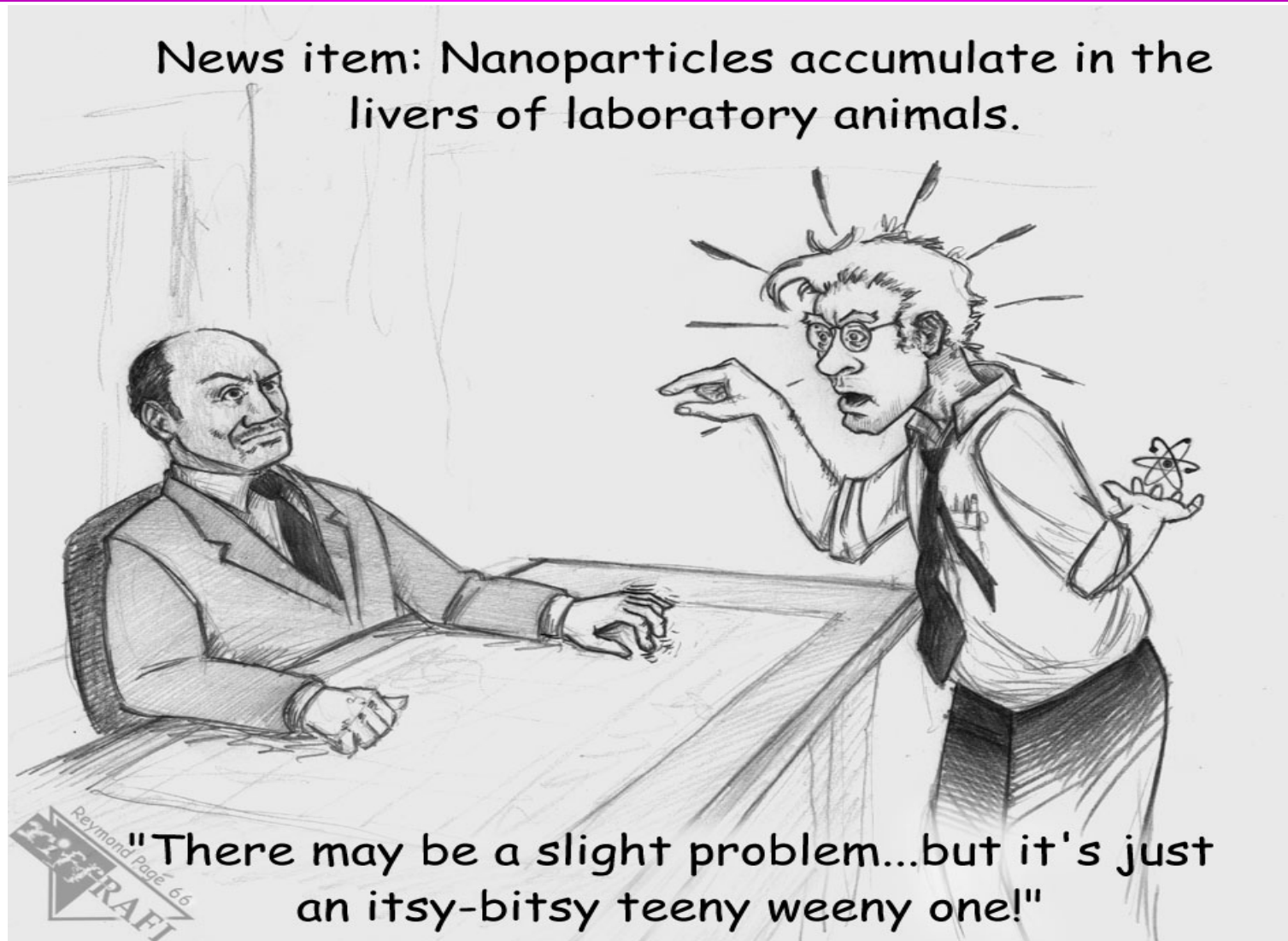
(Kleinman & Powell, 2005)

From Agbiotech to Nanotech: Lessons Learned

- **Build public trust in a strong, credible US and international regulatory process**
- **Make sure nanotechnology's environmental and health benefits and safety is confirmed by independent research**
- **Demonstrate concern for consumer choice**
- **Provide opportunities for public input into the technology's development and regulation**

End

News item: Nanoparticles accumulate in the livers of laboratory animals.



"There may be a slight problem...but it's just an itsy-bitsy teeny weeny one!"

End



UK Govt. Handling of Mad Cow Disease



Ag Secretary Feeds Daughter a Hamburger

- London Times 15 April 1996
- May 1990: Agriculture minister John Gummer attempts to allay public fears about the safety of beef by feeding his daughter, Cordelia, a hamburger on the steps of Parliament.

New 21st Technology Acceptance Model

- **Voluntary**
- **Perceived Usefulness**
- **Strong, Independent “Life Cycle” Risk Management**
- **Director Public/Consumer Benefit**
- **“Yuck” vs. “Cool” Factor**
- **Trust in Regulators**
- **Image (inc. Ethics & Culture)**
- **Comparative Price**
- **Scale**

Diffusion of Innovations

Technology Acceptance Model

- **Non-voluntary**
- **Presumed Benefits with Manageable Risk**
- **Early Adopters & Laggards**
- **Powerful Gatekeepers**
- **Poor Public Science Literacy**
- **Risk Communication**
- **“Bully” Factor**

(Ryan and Gross, 1973)

Science & Engineering Indicators 2004

- **Neither Americans nor Europeans got high marks in a 2001 quiz designed to measure their knowledge of science.**
- **More Americans (53%) now agree with the theory of evolution.**
- **Most Americans (two-thirds in 2001 NSF survey) do not clearly understand the scientific process.**
- **Studies seem to indicate that not many Americans are "technologically literate."**
- **Belief in various forms of pseudoscience is common in both the United States and Europe. For example, 60 percent of surveyed Americans said they believe in extrasensory perception, and 41 percent thought that astrology is at least somewhat scientific. More than half of surveyed Europeans said they believe in astrology.**