

Nanotechnology - An Emerging Tool for the Agricultural and Food Industry

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The Canadian Wheat Board Centre for Grain Storage Research

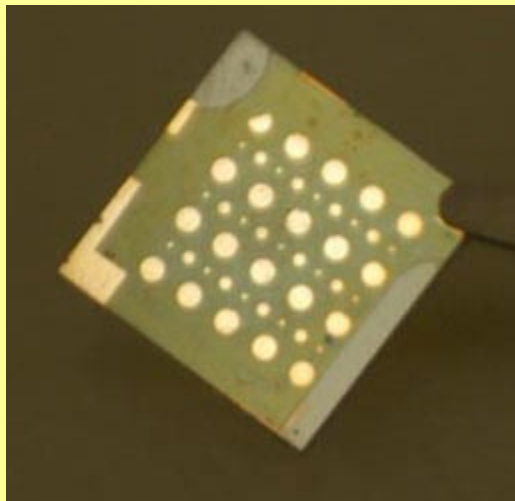
**Innovation for Growth - Trends and Successes
Redefining Agriculture**

Agricultural Institute of Canada Conference

5 - 8 November, 2006, Winnipeg



Spinach May Soon Power Mobile Devices !



Photosystem I

- biologically inspired photochemical device
- nanoscale photodiode from spinach leaves
- rechargeable energy source

Source: Massachusetts Institute of Technology



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Nanotechnology?

“ ability to work at the atomic, molecular and even sub-molecular levels in order to create and use material structures, devices and systems with new properties and functions”

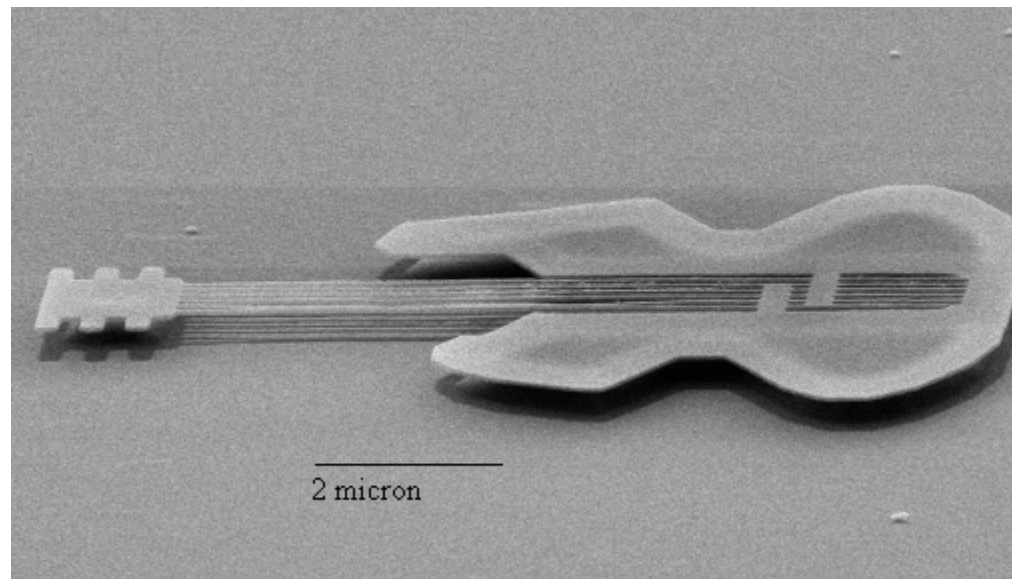
Source: National Science Foundation, USA



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Nanoguitar



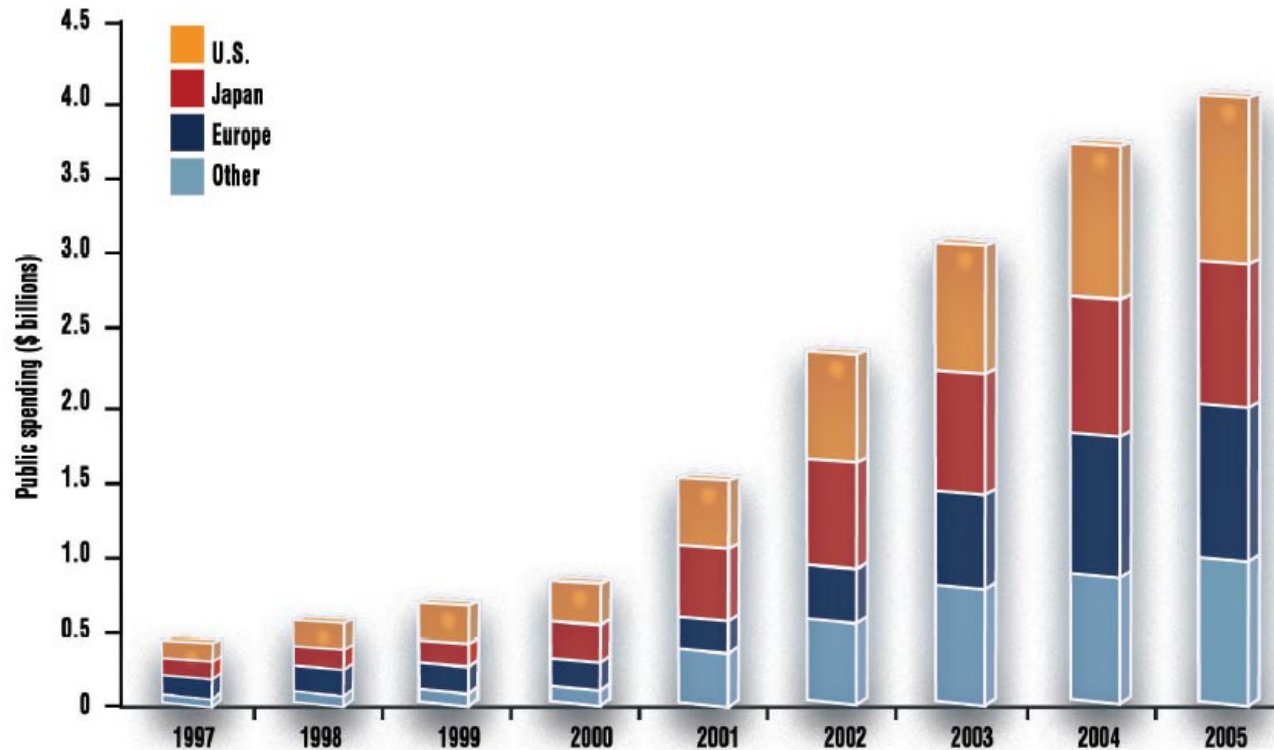
Source: Cornell University (www.cornell.edu)



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Why Nanotechnology is Important?



Worldwide spending on nanotechnology

Source: National Science Foundation, United States

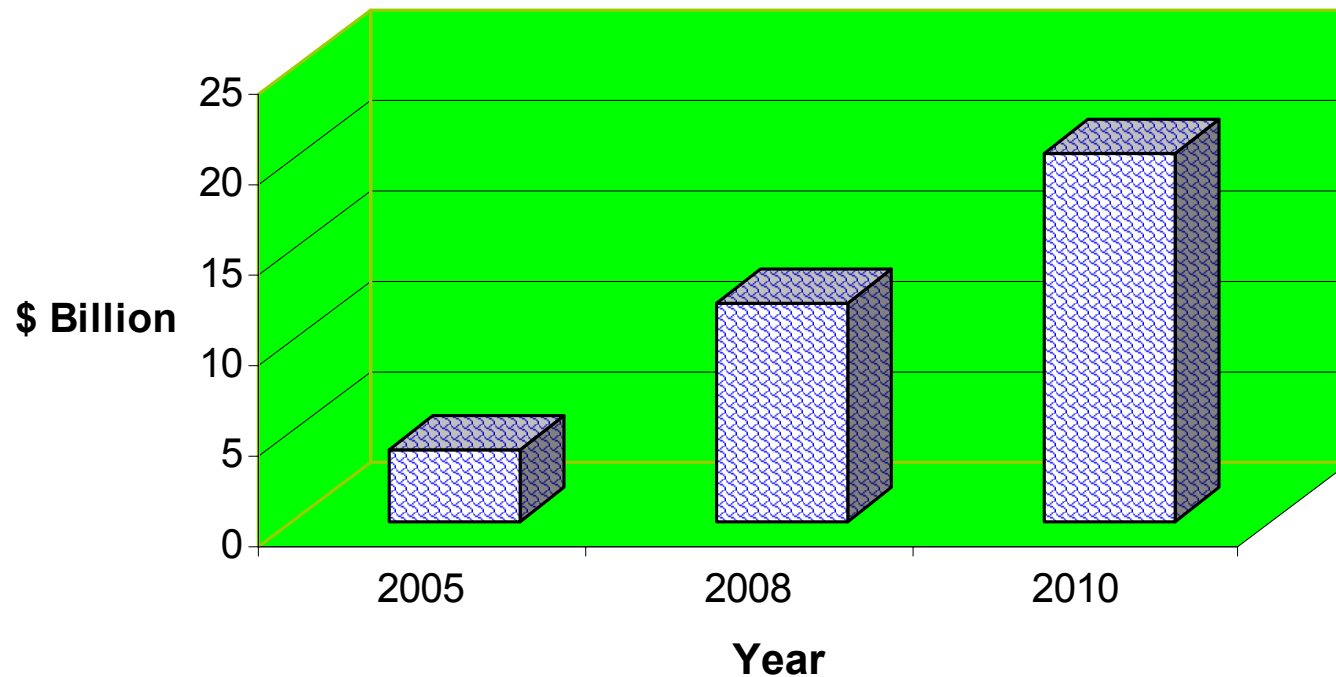


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Why Nanotechnology Is Important?

Nanofood Market



Source: Helmut Kaiser Consultancy, Germany

Agrifood Nanotechnology

- **Health and Nutrition**
- **Development of Novel Materials**
- **Food Processing**
- **Food Safety**



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Nano Encapsulation

'Tip-Top Up' - Omega 3 Bread



- nanocapsules with tuna fish oil
- nanocapsules break only in the stomach

Source: Tip Top Bakery, Australia

Canola Active Oil



- nanoencapsulation of fortified phytosterols
- reduce cholesterol intake by 14%

Source: Shemen Industries, Israel

Nano Composites



**Nano food-packaging film
(Bayer Polymer Inc)**

Lighter and stronger

**Minimizes loss of
CO₂ from Beer**



**Nanoclay particle based Beer Bottle
(Nanocor Inc)**



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NanoBioluminescence Detection Spray



Nanoengineered luminescent protein emits a visible glow to the surface of Salmonella and E.Coli

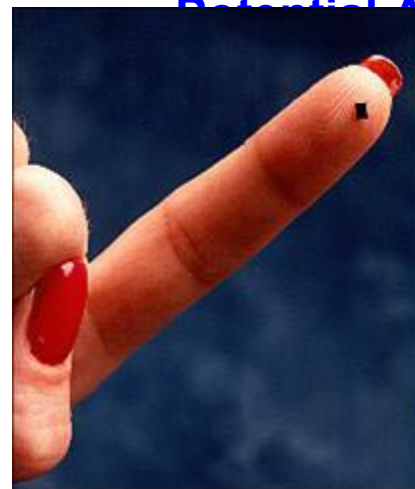
Source: AgroMicron Ltd.



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Smart Dust



Potential Applications:

measuring humidity,
temperature in the
environment

tracking onset of food
spoilage and food freshness

monitoring soil conditions and
crop growth for precision
farming

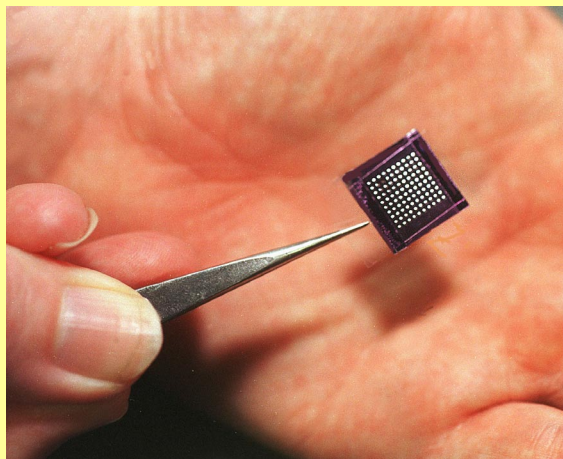
Source: University of California, Berkeley



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Nano-Electronic Tongue



Nano- Electronic Tongue



**Quality control for beverages
by electronic tongue**

Source: Kraft foods



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Nano This and Nano That

- **Biomicro-electromechanical systems**
- **Nucleic acid bioengineering**
- **'Smart' treatment delivery systems**
- **Animal Breeding by nanotubes**



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Challenges and Issues

- **Potential unforeseen risks**
- **More safety data needed before using nanotechnology in agriculture**
- **Concerns over the use and consumers safety**
- **Ethical Issues**



Conclusions

"The Next Big Thing Is Really Small"



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References

1. <http://web.mit.edu/newsoffice/topic/nanotech-archive.html>
2. www.foodproductiondaily.com/news/ng.asp?id=63704
3. Nanoparticles make Durethan films airtight and glossy, Bayer Polymers
4. www.ptonline.com/articles/kuw/12437.html
5. www.agromicron.com/BTP.htm
6. www.nanoforum.org
7. www.nanotechnow.com
8. Small Times Magazine
9. www.cornell.edu
10. www.mit.edu



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THANK YOU



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