

Nanoscience in the Advanced Foods and Materials Network (AFMNet)

IFT International Food Nanoscience Conference
1 August 2007

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Réseau des aliments et des matériaux d'avant-garde
ADVANCED FOODS & MATERIALS NETWORK

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Outline

- Overview of Networks of Centres of Excellence
- Overview of AFMNet
- Overview of nanoscience activities within AFMNet
- Overview of Canadian activities in nanoscience
- Lack of Progress
- Concluding Remarks



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Networks of Centres of Excellence

(NCE) Program Mission (1989):

“To mobilize Canada’s research talent in the academic, private and public sectors and apply it to developing the economy and improving the quality of life of Canadians.”

NCE Government Sponsors:

Federal Research Granting Councils:

Canadian Institutes of Health Research (CIHR)

Natural Sciences and Engineering Research Council (NSERC)

Social Sciences and Humanities Research Council (SSHRC)

Industry Canada



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NCEs: Canada-wide networks linking universities, public and private sectors.

21 NCEs in 4 broad areas:

Health and Biotechnology

e.g., Food (AFMNet), Arthritis (CAN), PrioNet

Information and Communication Technology

e.g., Robotics (IRIS)

Engineering and Manufacturing

e.g., Automobiles (Auto21), Smart structures (ISIS)

Natural Resources and Infrastructure

e.g., Clean water (CWN)



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AFMNet NCE:

- Funded for a maximum of two 7-year cycles
- 20 Projects in 3 Themes
- 75 Professors in 24 Universities
- ca.100-150 HQP (Students, PDF's, Res. Associates)
- ca. 20 Companies
- ca. \$4 Million per year from NCE
 - industrial partners cash and in-kind (\$3.5M)
 - individual research grants



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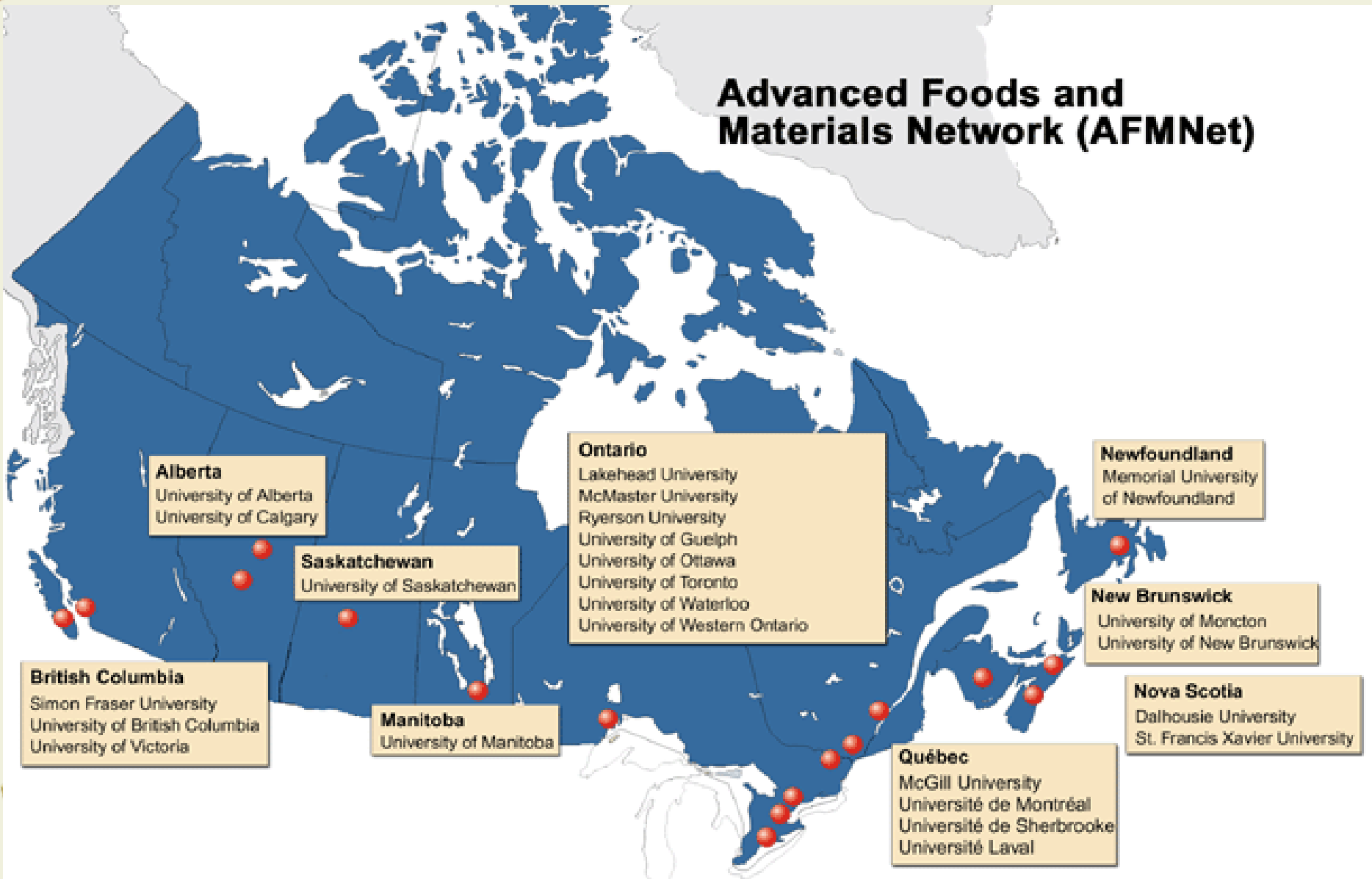


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Network Breadth

Advanced Foods and Materials Network (AFMNet)



Research Program

3 Interrelated Themes: *Research continuum from fundamental to applied; “Atom to Application”*

Theme I: Structure-Dynamics-Function of Foods & Materials

- [1] Bio-surfaces.
- [2] Bio-structures & Bio-products.

Theme II: Functional Foods and Nutraceuticals

- [1] Extraction and Identification.
- [2] Mechanism and Efficacy.

Theme III: Genetics, Ethics, Economics, Environment, Law and Society (GE³LS)

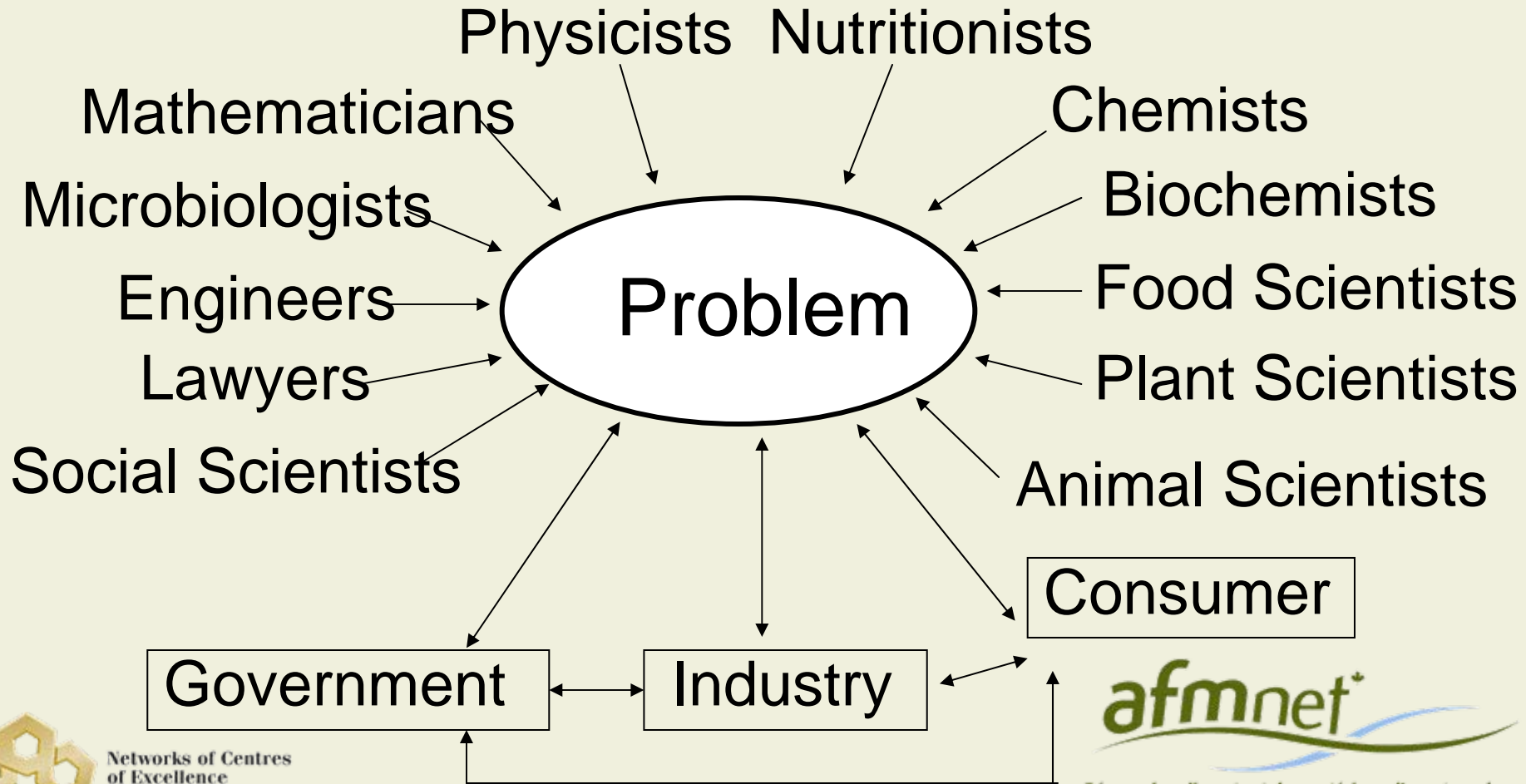
- [1] Consumer & Citizen Perception and Acceptance.
- [2] Regulation and Policy.
- [3] Risk Assessment and Management.



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AFMNet Research



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Nanoscience activities within AFMNet

- Embedded within our projects within each theme



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Structure Dynamics Function of Foods and Bio-materials

1	D. Rousseau	Ryerson	Biopolymer-based platforms for controlled release applications in foods and biomaterials
2	J. Dutcher	Guelph	Bacteria, Biofilms and Foods: Structure, Growth and Nanotechnology Applications
3	J. Lipowski	Guelph	Protein and Peptide Self-Assembly: Food-Derived Materials and Interactions with Nanostructured Surfaces
4	T. Gill	Dalhousie	Bacterial Porin Proteins: Their Importance in Uptake and Resistance to Cationic Antimicrobial Peptides
5	A. Hitchcock	McMaster	Resistance and control of biofilms on food and food processing surfaces
6	N. Low, M. Nickerson and D. Korber	Saskatchewan	Production, Characterization and Functionality of Plant-extracted Oligosaccharides Towards Enhancing the Health-promoting Properties of Encapsulated Probiotics
7	R. Hancock	UBC	Engineering new microbial agents for food safety
8	R. Aluko	Manitoba	Structure-function properties of novel bioactive peptides
9	B. Moffatt	Waterloo	Characterization of Plant-Derived Proteins and Carbohydrates and Their Use to Improve Frozen Food Quality



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Functional Foods and Nutraceuticals

10	A. El-Soheemy	Toronto	Nutrigenomics and Biomarkers of Chronic Disease
11	J. Friel	Manitoba	Bioactive Compounds in Human Milk
12	Y. Mine	Guelph	Nutrigenomic and Proteomic Approaches for the Study of Functional Peptides and Amino Acids to Improve Gut Health
13	A.Marette	Laval	The Beneficial Effects of Fish Nutrients on the Obesity-Linked Metabolic Syndrome and Cardiovascular Risk Profile. An Integrative Genomic and Metabolic Phenotyping Project.
14	P. Jones	Manitoba	Conjugated Linoleic Acid as a Nutraceutical for Health Promotion in Humans
15	B. Selinger	Lethbridge	Manipulation of Intestinal Bacterial Populations; an Investigation on the Impact of Dietary Fibre and Prebiotics



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Genetics, Ethics, Economics, Environment, Law & Society (GE³LS)

16	T. Henson	Guelph	Understanding Consumer Acceptance of Functional Foods and Nutraceuticals
17	H. Boon	Toronto	Natural Health Product Regulations: Perceptions and Impact
18	D. Castle and T. Caulfield	Ottawa and Alberta	Social Issues in Nutritional Genomics: The Design of Appropriate Regulatory Systems and Issues of Public Representations and Understanding
19	C. Forsberg and M. Fortin	Guelph and McGill	Omics for Novel Plant and Animal Food Product Assessment and Risk Identification
20	C. Brunk and S. Hartley	Victoria	Factors Accounting for Expert and Non-Expert Positions on the Ethical Issues in Animal Biotechnology and the Implications for Public Policy



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Commercialization

R2B – The TechNet Program

Objective:

“To aid & encourage commercialization of Canadian science by providing access to fundamental commercialization tools and modern business methods for AFMNet researchers and to the broader research community.”



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International Collaboration in Food Research

- Australia
 - National Centre of Excellence in Functional Foods
- New Zealand
 - Nutrigenomics New Zealand
 - Riddet Centre (Massey, Otago and Auckland)
- Greece
 - Laboratory of Agribusiness Management - Agricultural University of Athens
- Canada
 - AFMNet



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Strategic Directions

- Food and Health
 - Nutrigenomics
 - Gut Health
 - Pre-, probiotic
- Nanoscale science and technology
- Traceability/authentication
- Policy, regulation and attitude



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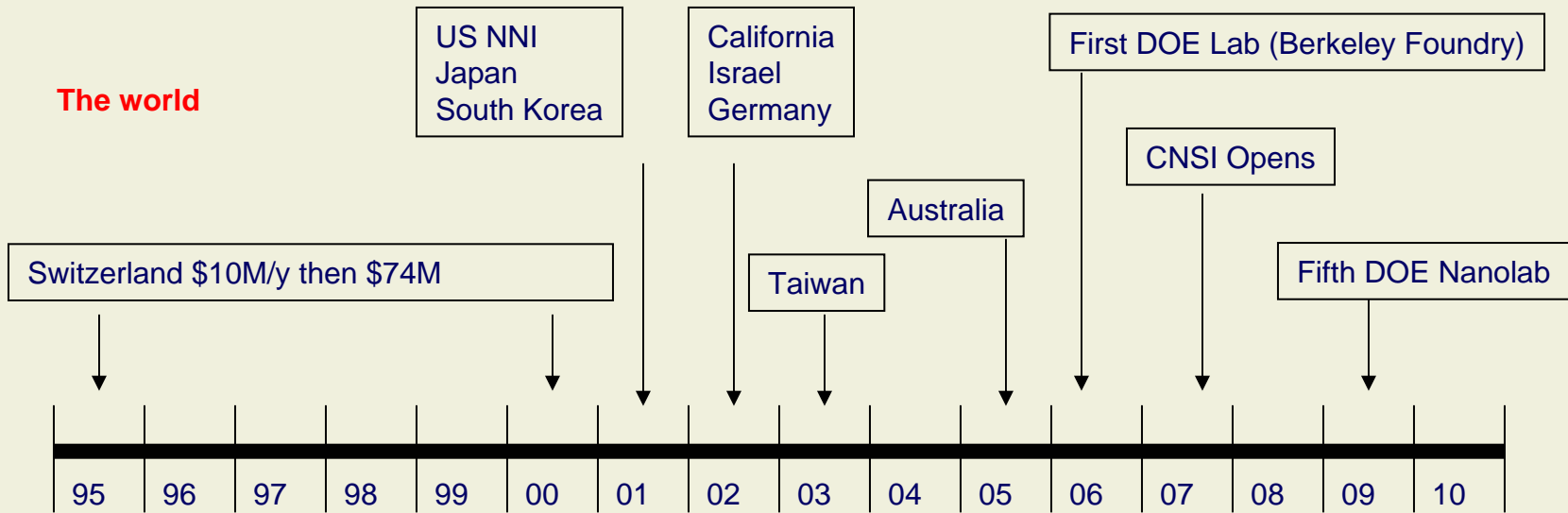


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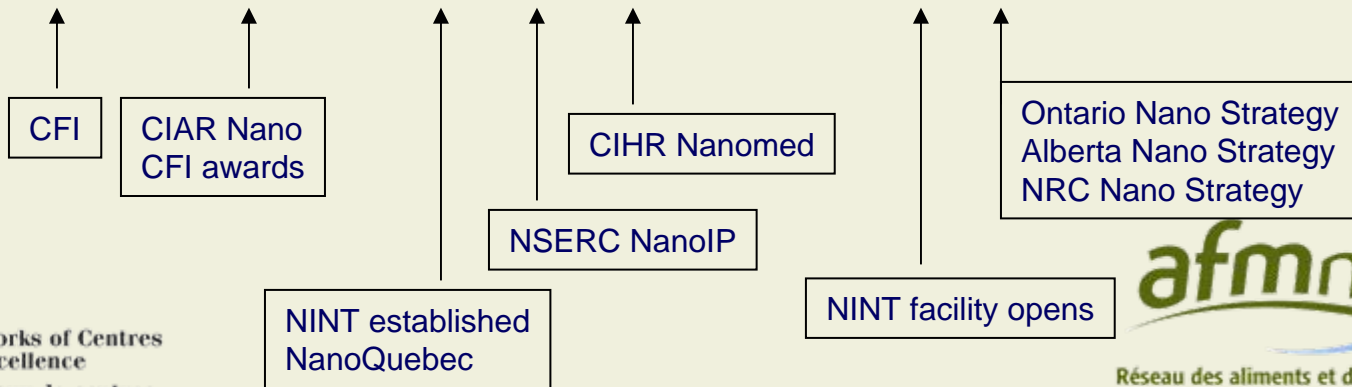
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Canada has been investing for some time

The world

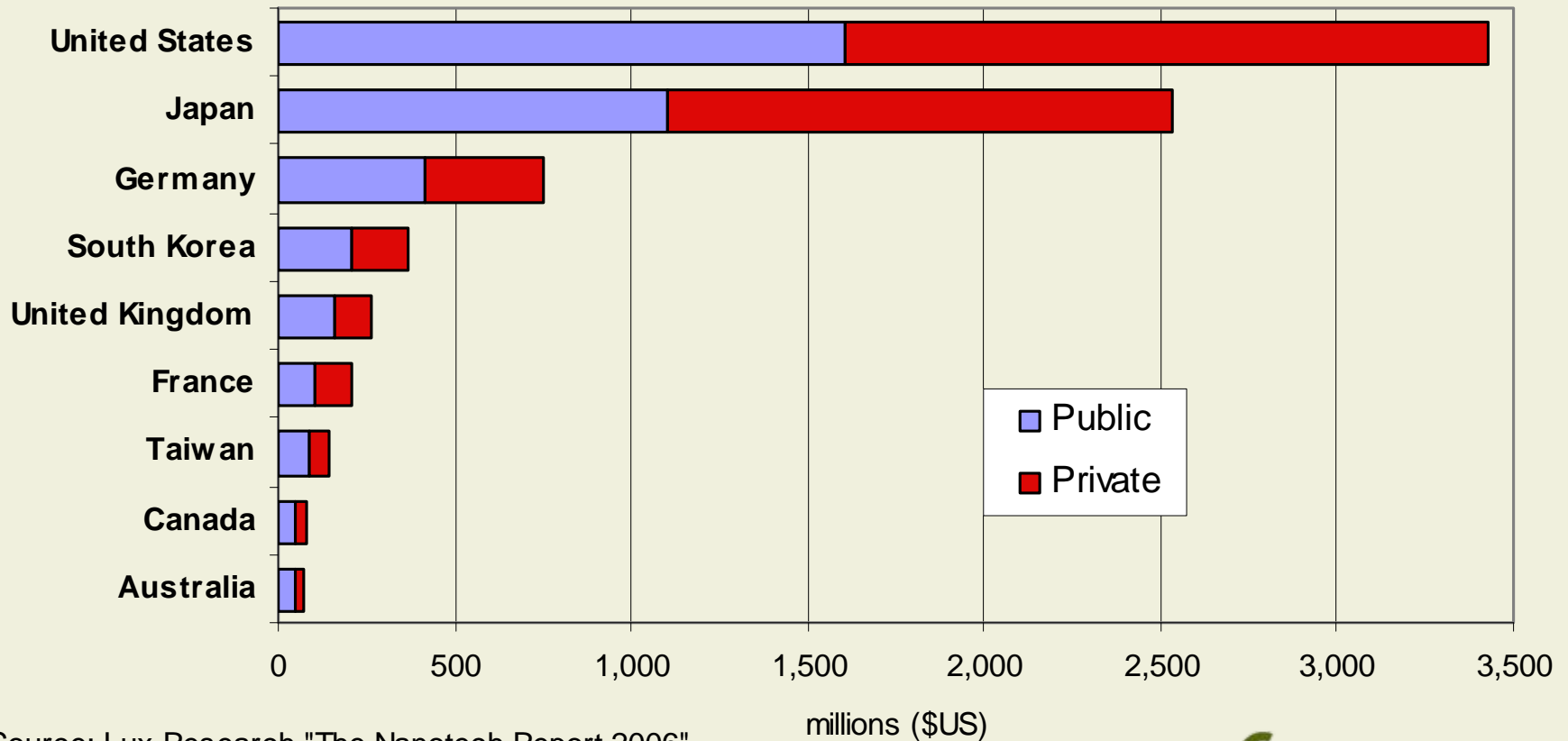


Canada



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Total Nanotechnology Funding (2005)



Source: Lux Research "The Nanotech Report 2006"

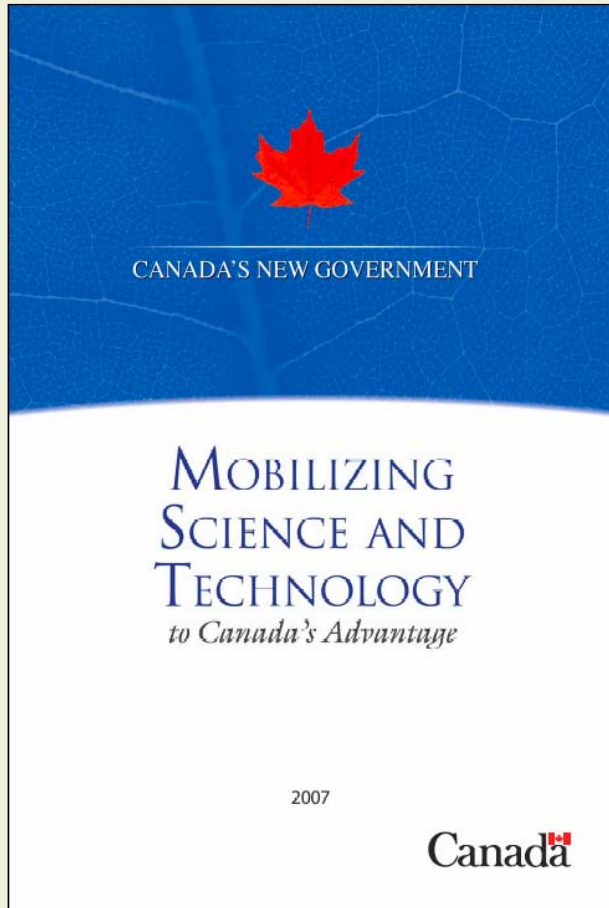


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Federal S & T Strategy



- No express recognition of nanotechnology as key strategic area.
- But, recognition that biotechnology & nanotechnology have **diverse regulatory, social and ethical implications**, and international competition to commercialize products is intense.
- There is a need for **strong science and effective regulation** to protect human health and the environment while supporting Canadian competitiveness.

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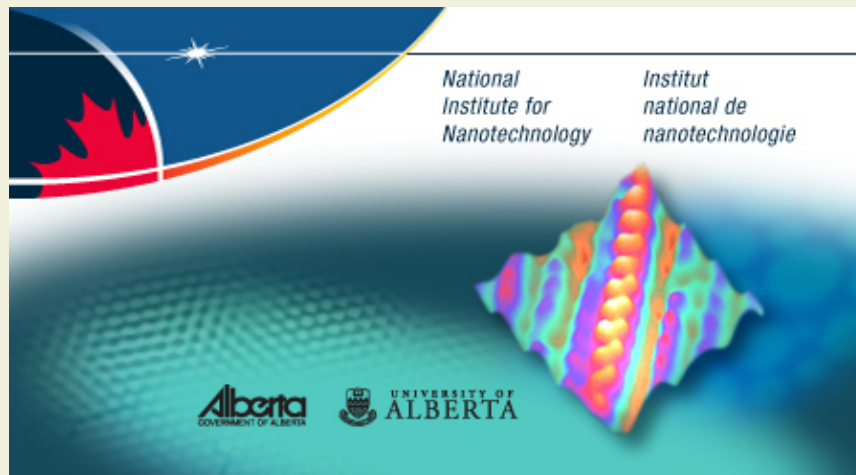
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National Institute for Nanotechnology (NINT)

- Established in 2001, partnership between the National Research Council and the University of Alberta, Edmonton Alberta
- Occupies 15,000 square metres of the building
- 120 NRC staff, as well as 45 guest workers from industry and universities. It will also provide training opportunities for 275 graduate and post-doctoral researchers.



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National Institute for Nanotechnology (NINT)

- Synthesis and characterization of nanocrystals and nanowires
- Synthesis of supramolecular-based nanomaterials
- Fabrication and characterization of molecular-scale devices and nanosensors
- Development of nano-scaled materials for catalysis and directed chemical reactions at semiconductor surfaces
- Development of nano-electronic and nano-fluidic systems to interface devices to the outside world
- Theory, modeling, and simulation of nanosystems on multiple length scales
- Development of quantitative imaging and characterization techniques that support nanotechnology research
- Examination of the ethical, environmental, economic, legal and social issues of nanotechnology
- Research on nano-bioengineering such as protein design and genetic engineering of novel behaviours
- Development of nanoelectricalmechanical systems (NEMS), such as lab-on-a-chip devices



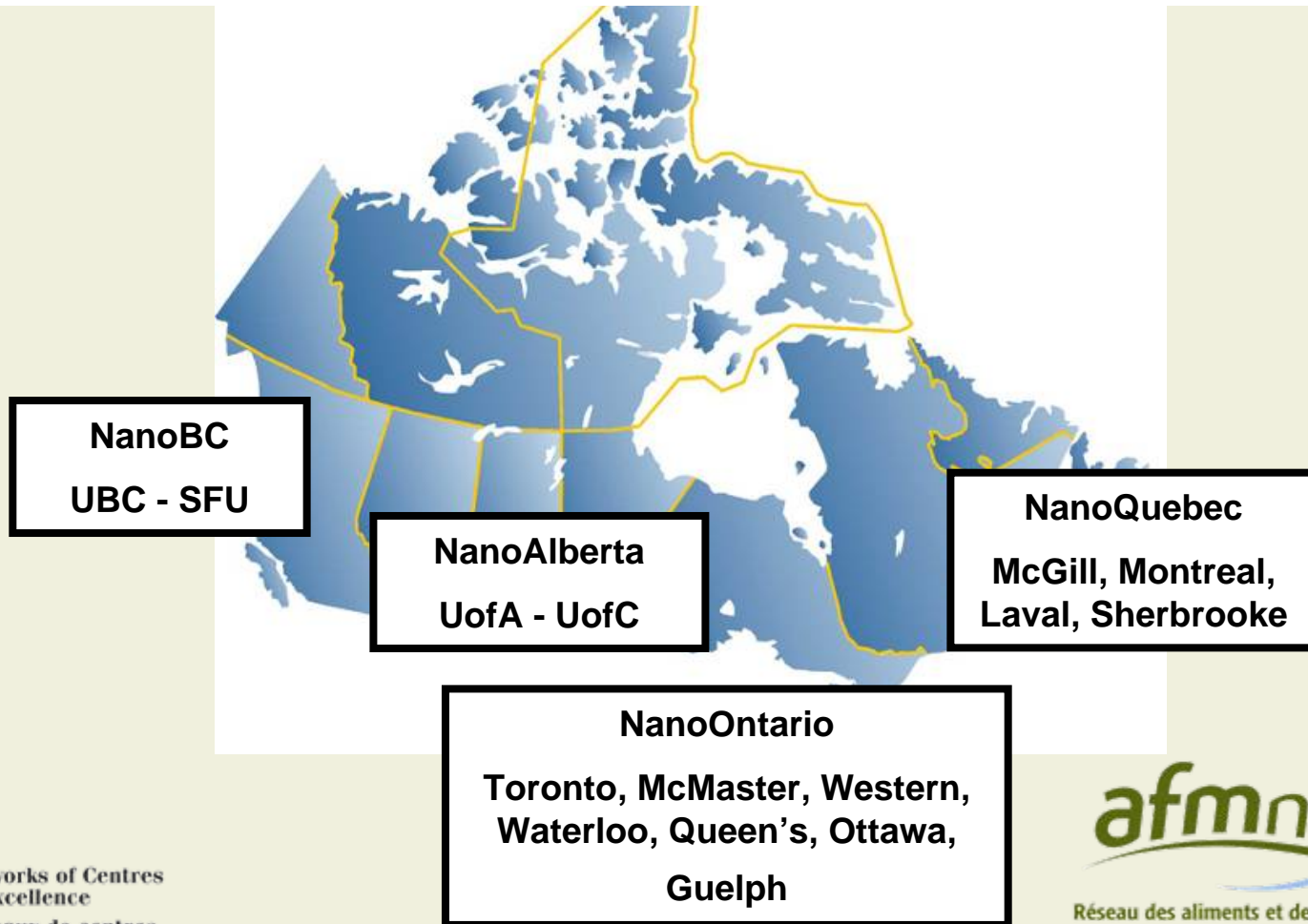
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Major University Activities in Nanotechnology in Canada

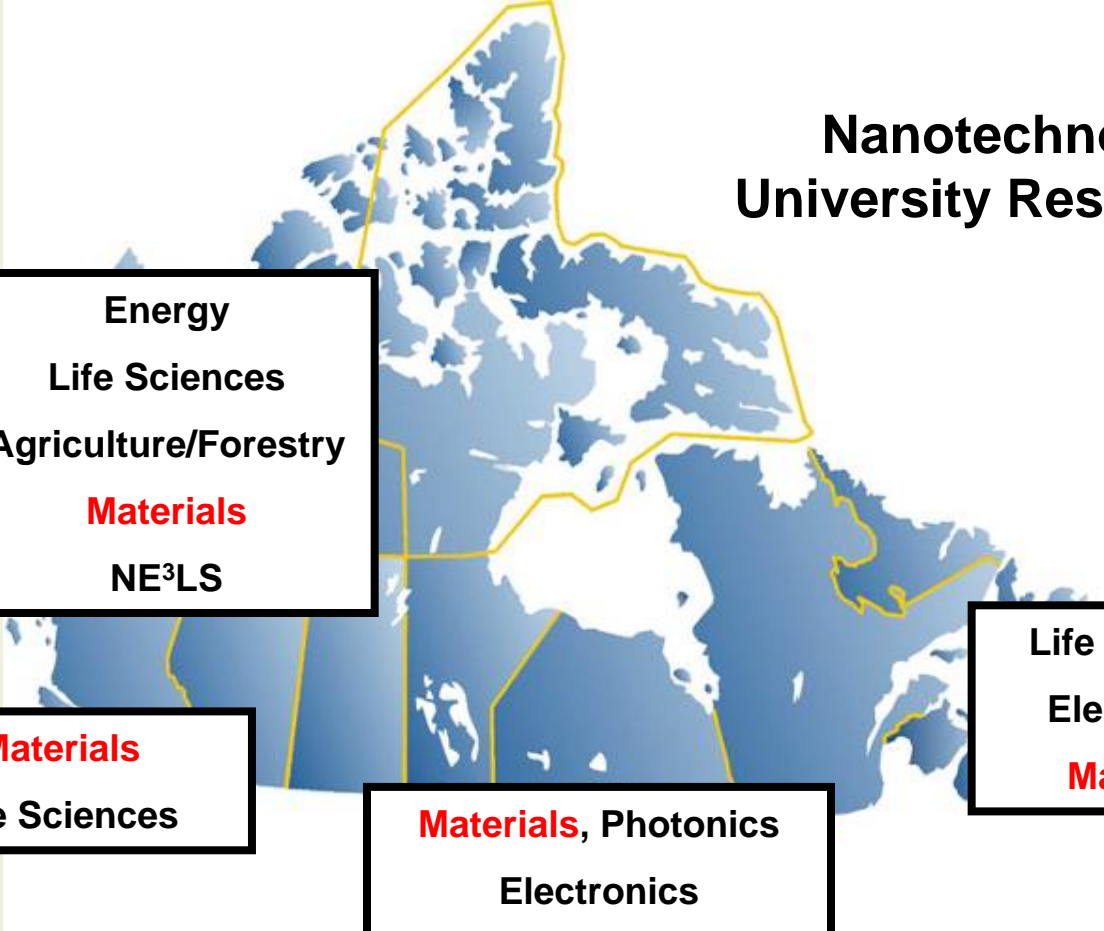


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Nanotechnology related University Research in Canada



Energy
Life Sciences
Agriculture/Forestry
Materials
NE³LS

Materials
Life Sciences

Materials, Photonics
Electronics
Agriculture/Food
NE³LS

Life Sciences
Electronics
Materials



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A Nanotechnology Consumer Products Inventory




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[IOGEAR® Laser Travel Mouse with Nano Coating](#)


Technology by IOGEAR®, Inc.
Electronics and Computers > Computer Hardware

[IOGEAR® Wireless Keyboard/Optical Mouse combo w/ Nano Technology](#)


Nano Technology by IOGEAR®, Inc.
Electronics and Computers > Computer Hardware

[100% Cotton Sheet Set](#) by AgActive 

Home and Garden > Home Furnishings

 **[16Gb NAND Flash Memory](#)** by Samsung® 

Electronics and Computers > Computer Hardware

[350TC Nano-Tex® Sheet Set by Studio](#) by JCPenney® Company, Inc.

Home and Garden > Home Furnishings



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A Lack of Progress

- Uncertainties re health and environmental impacts of nanoparticles & nanomaterials remain; more government investment required
- Proportionate regulation is not possible without information about hazard & risk
- Priorities have been identified but are not being addressed
- There is a lack of targeted government investment towards addressing these issues (ID center)
- There remains a need for a coherent research programme into the ethical, legal and social issues
- Government must engage outside scientists and social scientists to a higher degree



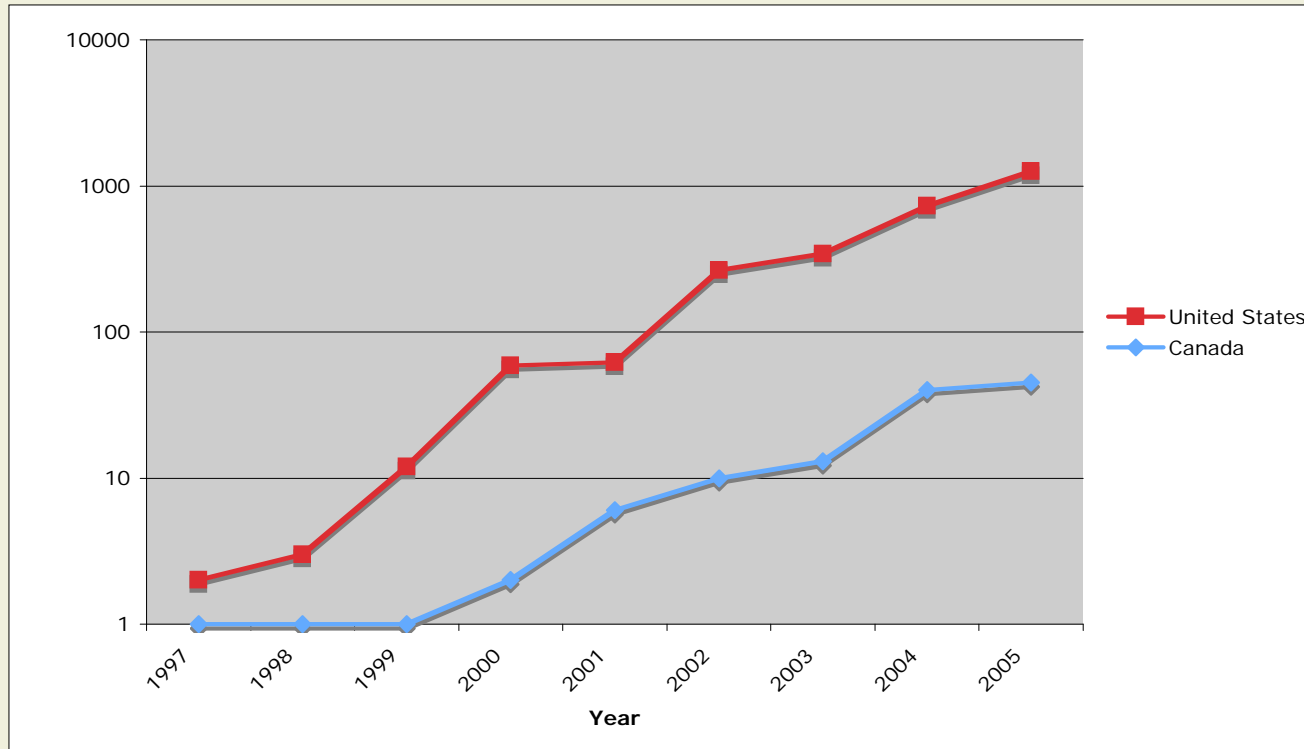
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Media Reports on “Nanotechnology AND Risk”, 1997-2006



Factiva, December 3, 2006



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Council of Canadian Academies panel to assess nanotech from a regulatory perspective (July 2007)

- an expert panel on the potential health and environmental risk of nanotechnology
- subsequent report — due in early 2008
- was requested by Health Canada and will be used to assess the state of knowledge for nanotechnology and establish appropriate regulations.



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Council of Canadian Academies panel to assess nanotech from regulatory perspective

- 15 member panel
 - 4 AFMNet funded researchers

Conrad Brunk

Director, Centre for Studies in Religion & Society, Univ of Victoria

David Castle

Canada Research Chair, Science & Society
Univ of Ottawa

Richard Gold

Director, Centre for Intellectual Property Policy, McGill Univ

Lorraine Sheremeta

Research Officer, National Institute for Nanotechnology



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Concluding Remarks

- Major gaps exist in our understanding of the health, safety, environmental and societal impacts of nanotechnology; filling these gaps is critically important to the long term success of nanotechnology.
- We know that nanotechnology will be used to enable controversial frontiers in science (e.g. reproductive and genetic technologies, regenerative medicine, synthetic biology, food science); it has sparked public interest.
- Public trust in the scientific enterprise depends on a coherent and rational approach to stewardship.
- Careful planning and strategic coordination is necessary if Canada is to be seen as a credible player in the game



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Acknowledgements

- Lorraine Sheremata, AFMNet Researcher and Research Officer, National Institute for Nanotechnology



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