Small Science; Small Politics

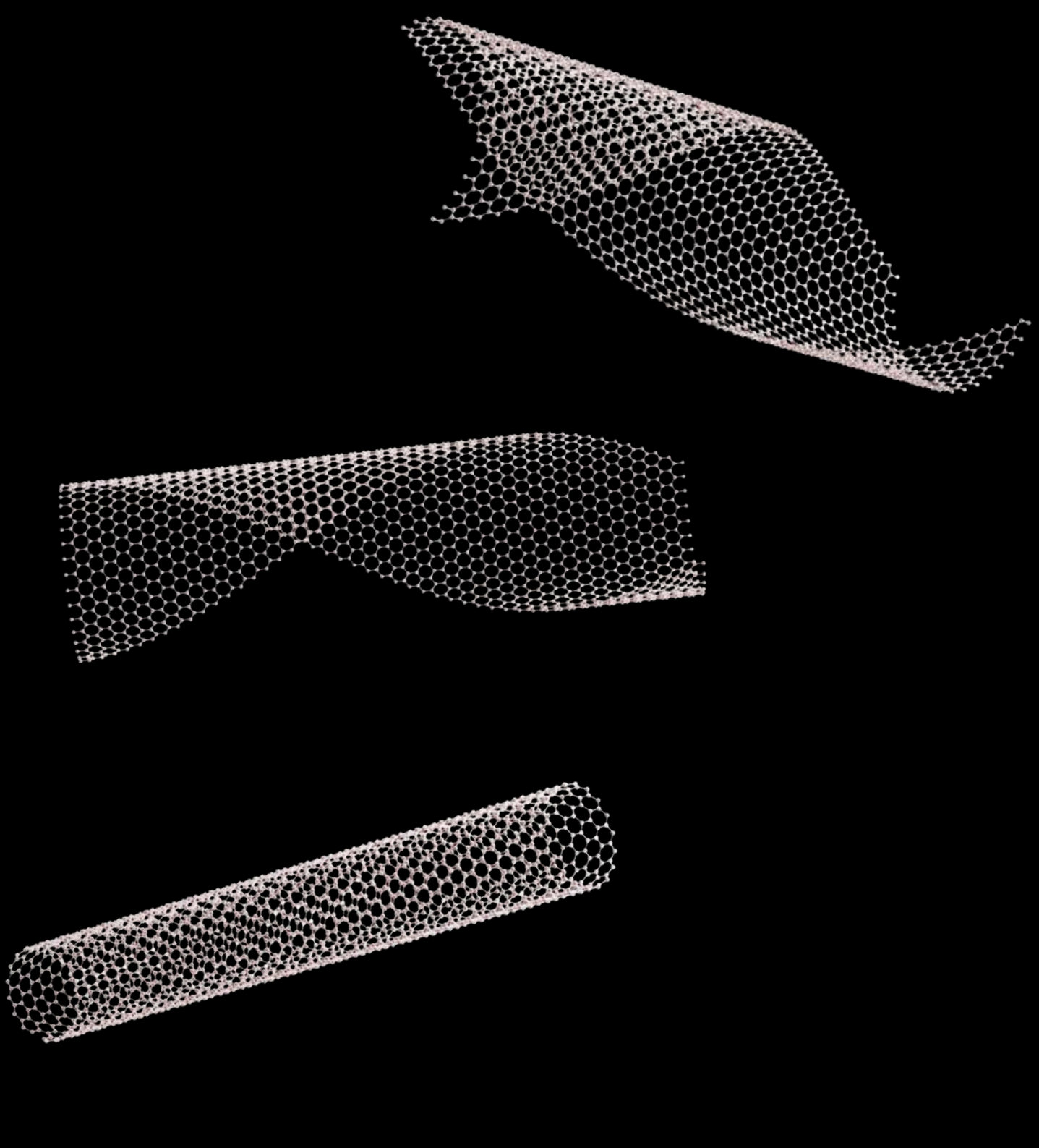
A Washington DC Perspective on Nanoscience and Nanotechnology

Andrew D. Maynard

Chief Science Advisor, Project on Emerging Nanotechnologies

Woodrow Wilson International Center for Scholars (in partnership with the Pew Charitable Trusts)

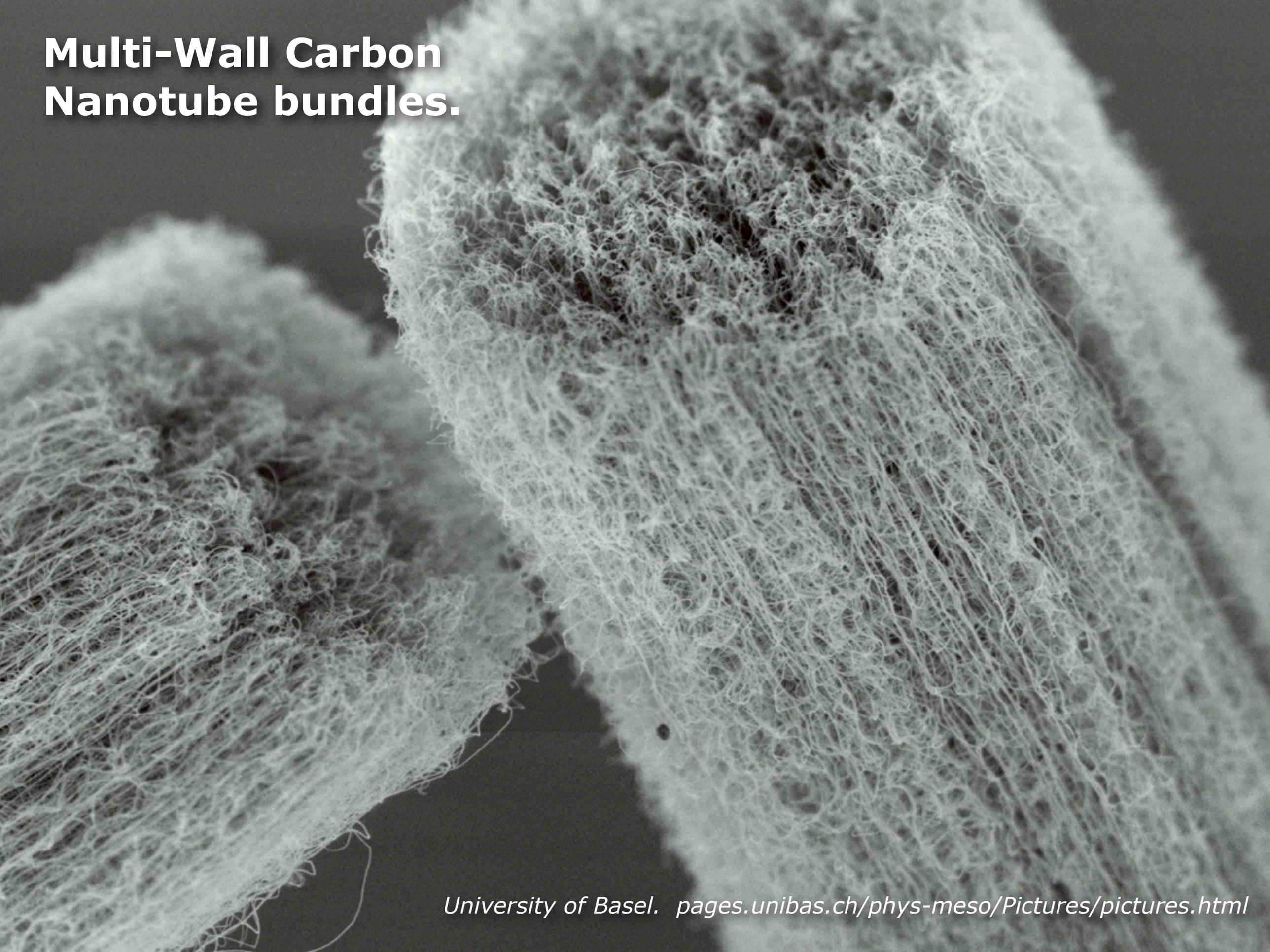
CEINT, Duke University, 1/22/09



HiPCO Single Walled Carbon nanotubes

Spinning CVD-grown Multi-Walled Carbon Nanotubes

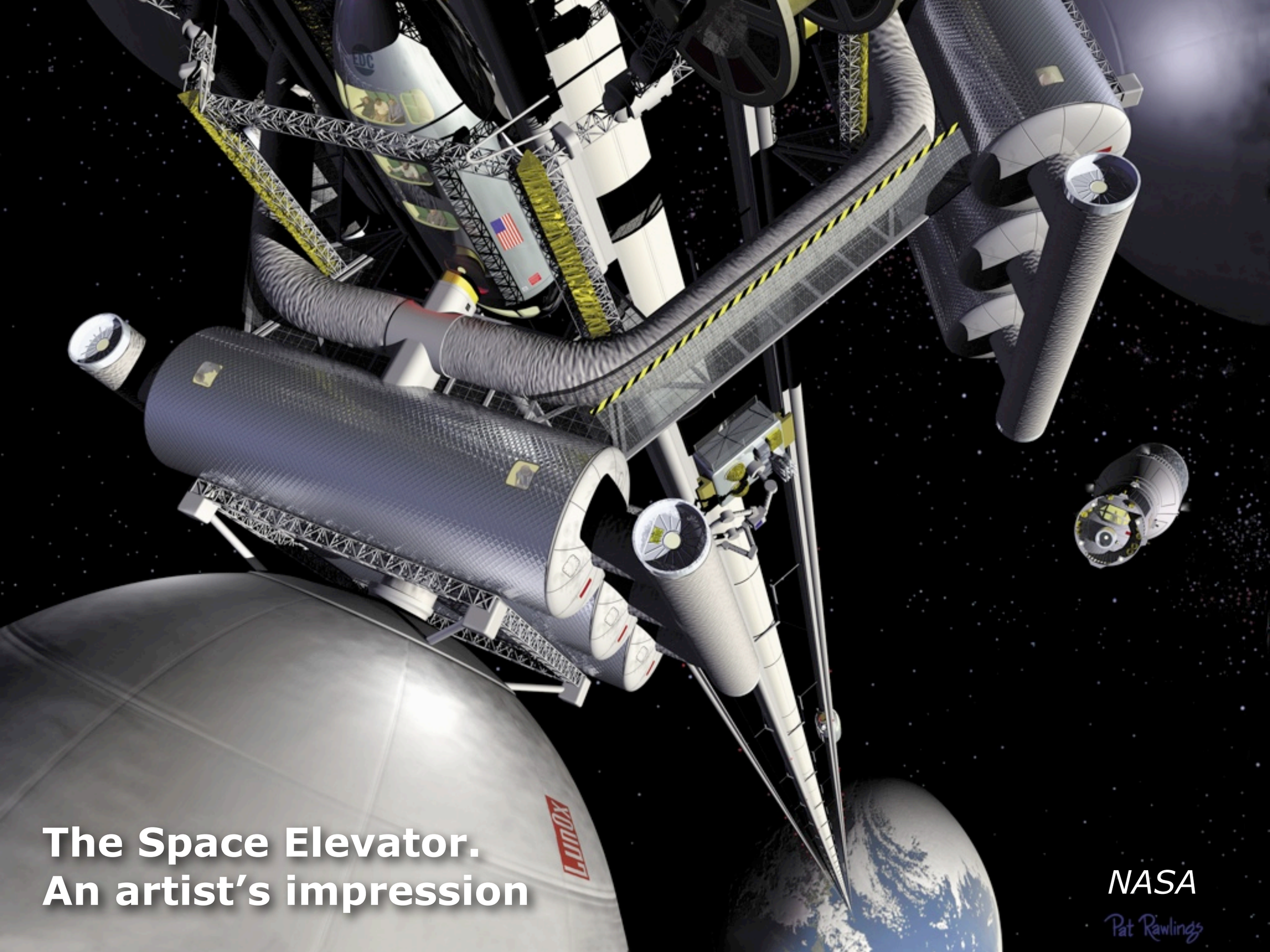
Multi-Wall Carbon Nanotube bundles.



University of Basel. pages.unibas.ch/phys-meso/Pictures/pictures.html

Nanotube composite bike frame

www.nanotechproject.org/inventories/consumer/browse/products/bmc_racing_fourstroke_fs0


The Space Elevator.
An artist’s impression
NASA
Pat Rawlings

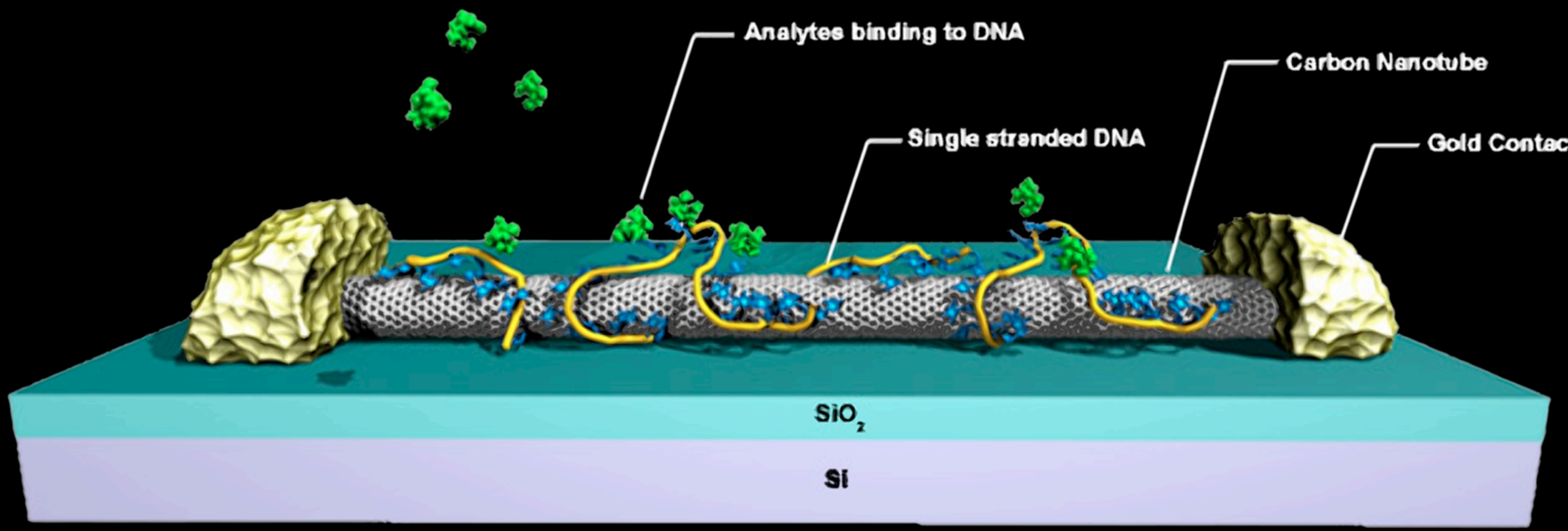
"We are actually making elastic smoke, which we can then wind up into a fibre"

Professor Alan Windle
University of Cambridge

Times Online, Jan 18 2008

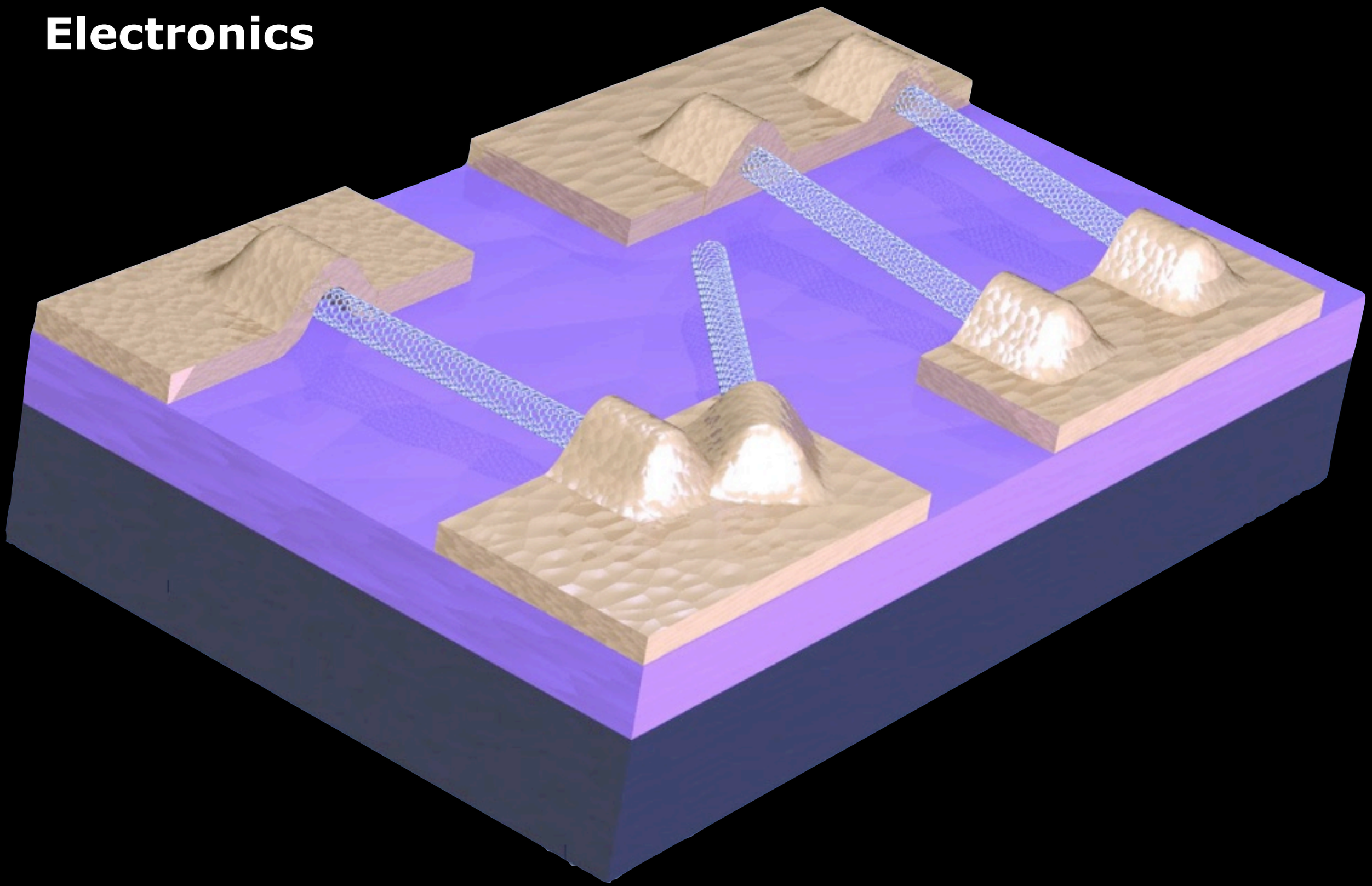
http://www.timesonline.co.uk/tol/driving/features/article5529668.ece?token=null&offset=0&page=1

Nanotube Sensor



Robert Johnson and A. T. Charlie Johnson , University of Pennsylvania.
http://www.lrsm.upenn.edu/~nanophys/biosensors.html

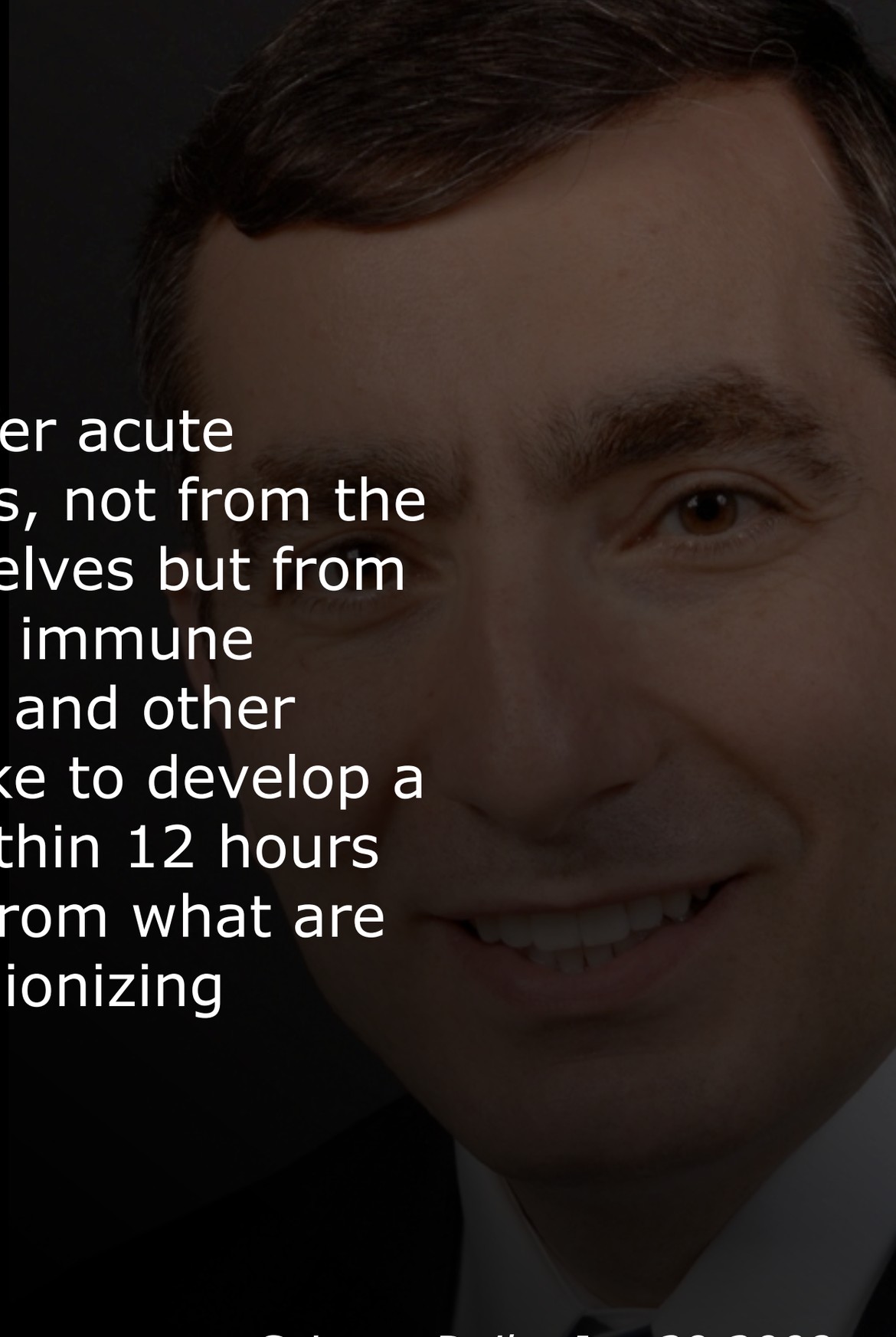
Nanotube Electronics



http://www.upenn.edu/pennnews/article.php?id=825

Jim Tour

Rice University

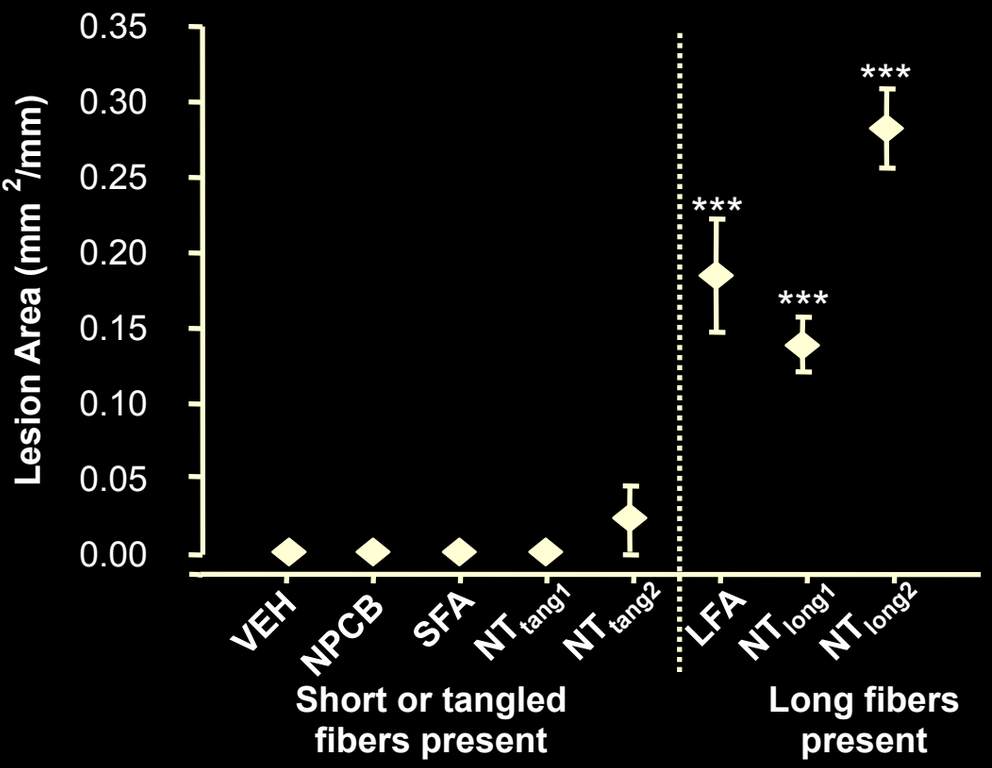


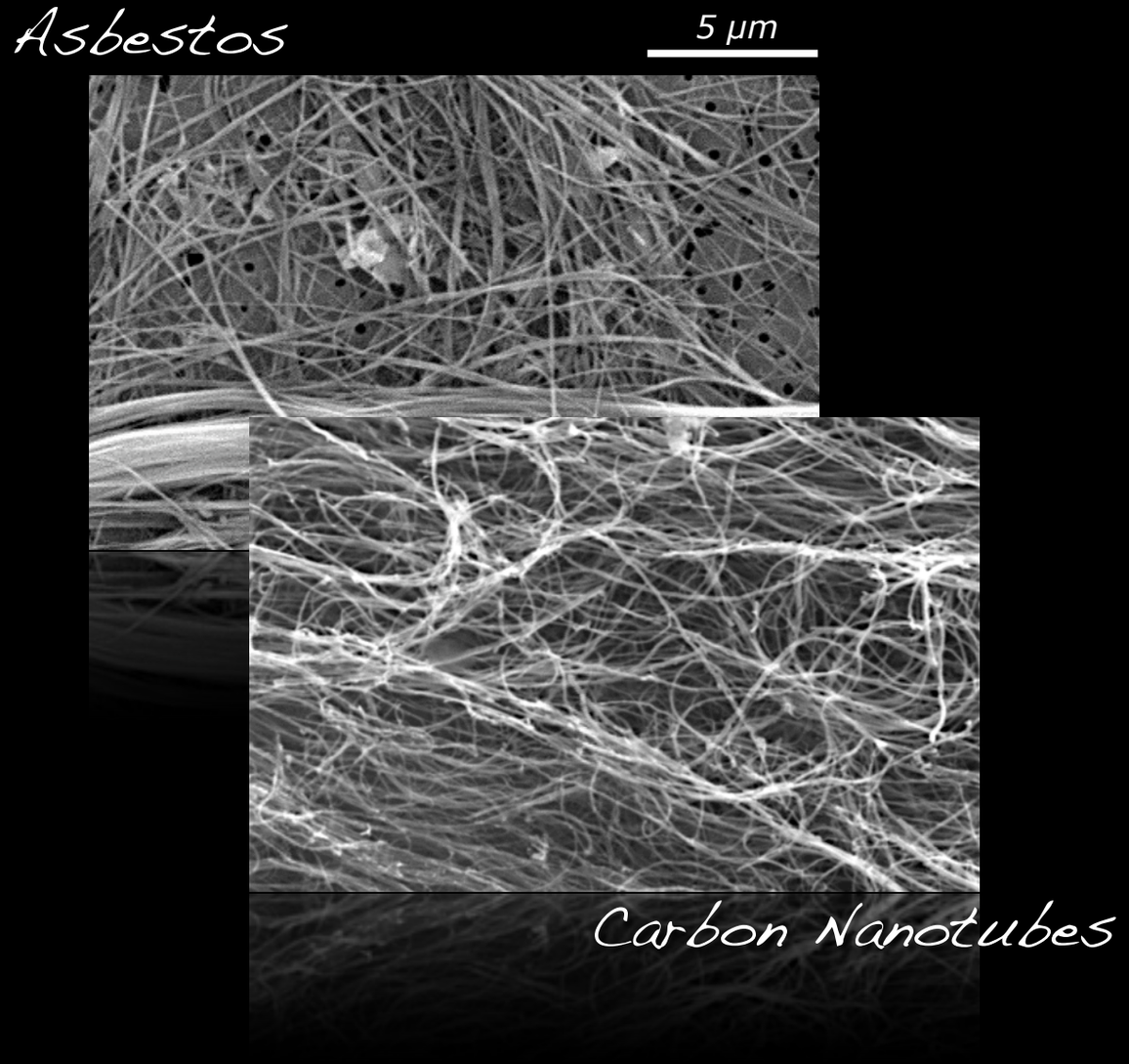
"More than half of those who suffer acute radiation injury die within 30 days, not from the initial radioactive particles themselves but from the devastation they cause in the immune system, the gastrointestinal tract and other parts of the body. Ideally, we'd like to develop a drug that can be administered within 12 hours of exposure and prevent deaths from what are currently fatal exposure doses of ionizing radiation..."

Science Daily, Jan 29 2008
http://www.sciencedaily.com/releases/2008/01/080128084415.htm

Possible Risks?

Fiber-like behavior





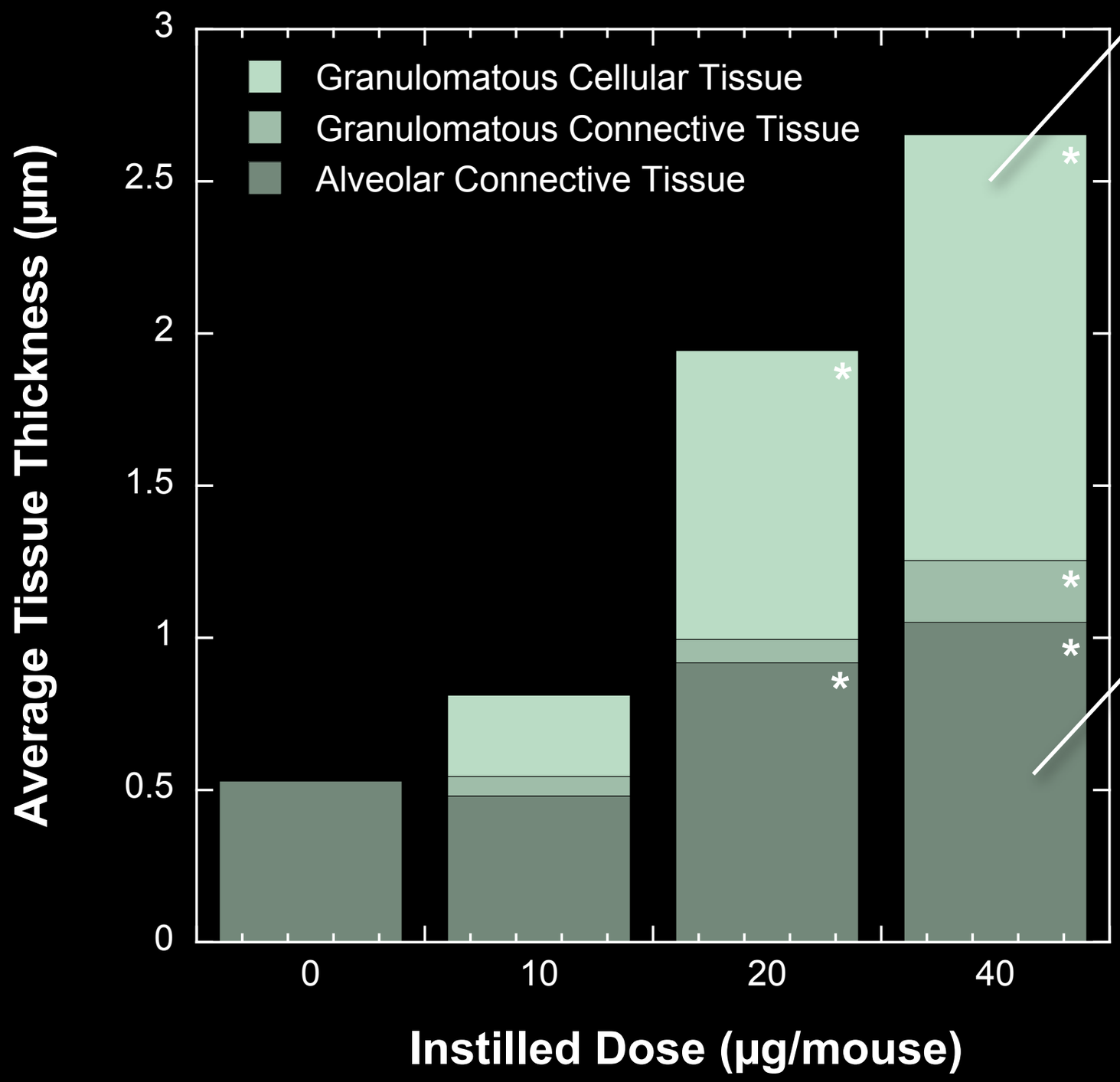
Carbon nanotubes that look like harmful asbestos fibers, behave like harmful asbestos fibers

Source: Craig Poland

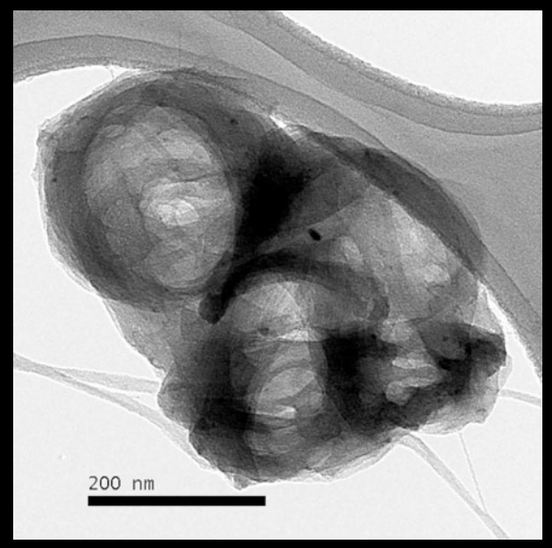
Poland, C. A., R. Duffin, I. Kinloch, A. Maynard, W. A. H. Wallace, A. Seaton, V. Stone, S. Brown, W. MacNee and K. Donaldson (2008). "Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study." Nature Nanotechnology doi:10.1038/nnano.2008.111.

Possible Risks?

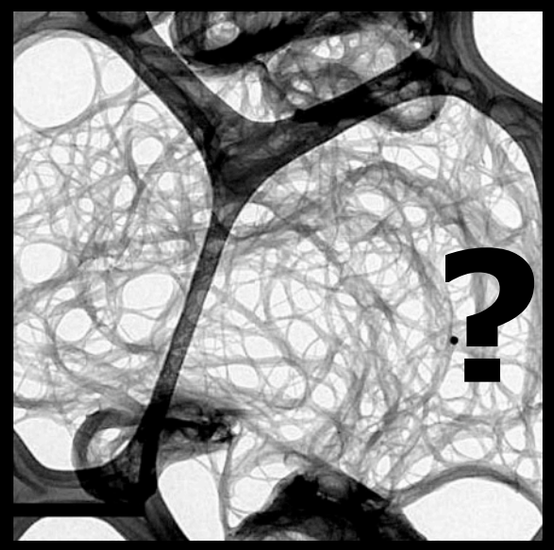
Chemistry and morphology



Proximal region of lung
Visible SWCNT clumps



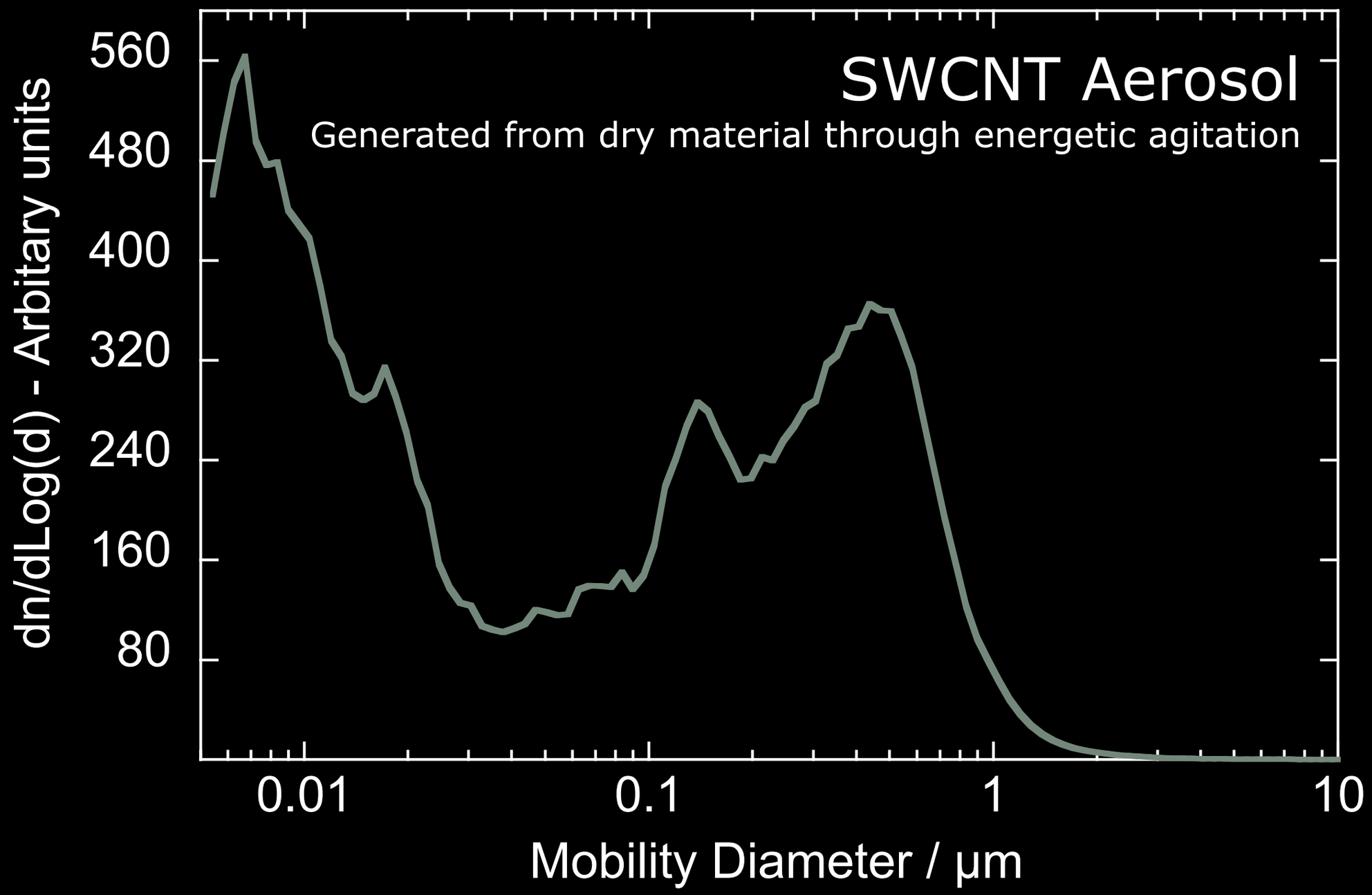
Distal region of lung
No SWCNT visible



Shvedova, A. A., et al. Physiol.-Lung Cell. Mol. Physiol. 289, 698-708, 2005.

Possible Risks?

Exposure potential



Maynard, A. D., P. A. Baron, et al. (2004). J. Toxicol. Environ. Health 67(1): 87-107.

1 - Identification of substance:

Chemical Name: Carbon Nanotubes
Formula: Carbon
Chemical Family: Synthetic Graphite
Synonyms: C
CAS Number

- **Manu**

Cheap
112 M
Brattle
802.25

www.

Revisic

Metall

2 - CNT Composition/Data on components:

- **Chemical characterization:**

Description: (CAS#)

Compo

Synthetic g

3 - CNT Hazards identification

Potential CNT Health Effects

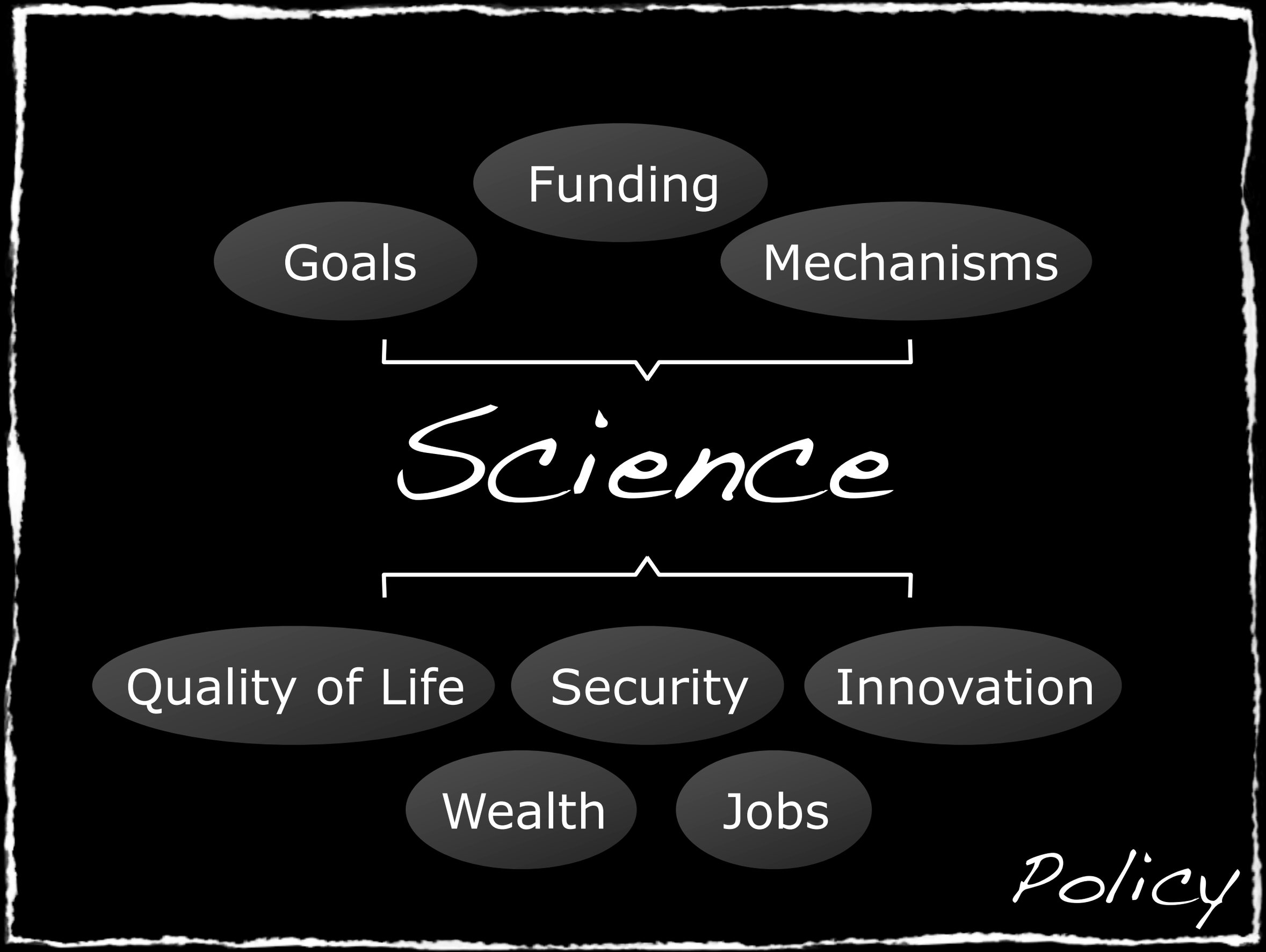
Eye Contact: May cause eye irritation
Skin Contact: No known hazards, but may be mildly irritating
Inhalation: May cause irritation to respiratory tract
Ingestion: No known hazards, but may irritate gastrointestinal tract
Acute and Chronic High concentration of dusts may be irritating to eyes, skin,
Health Effects: mucus membranes and respiratory tract.

- **Information pertaining to particular dangers for man and environment**
  R 36/37 Irritating to eyes and respiratory system.

Challenge:

How do you develop and introduce
an important new technology...

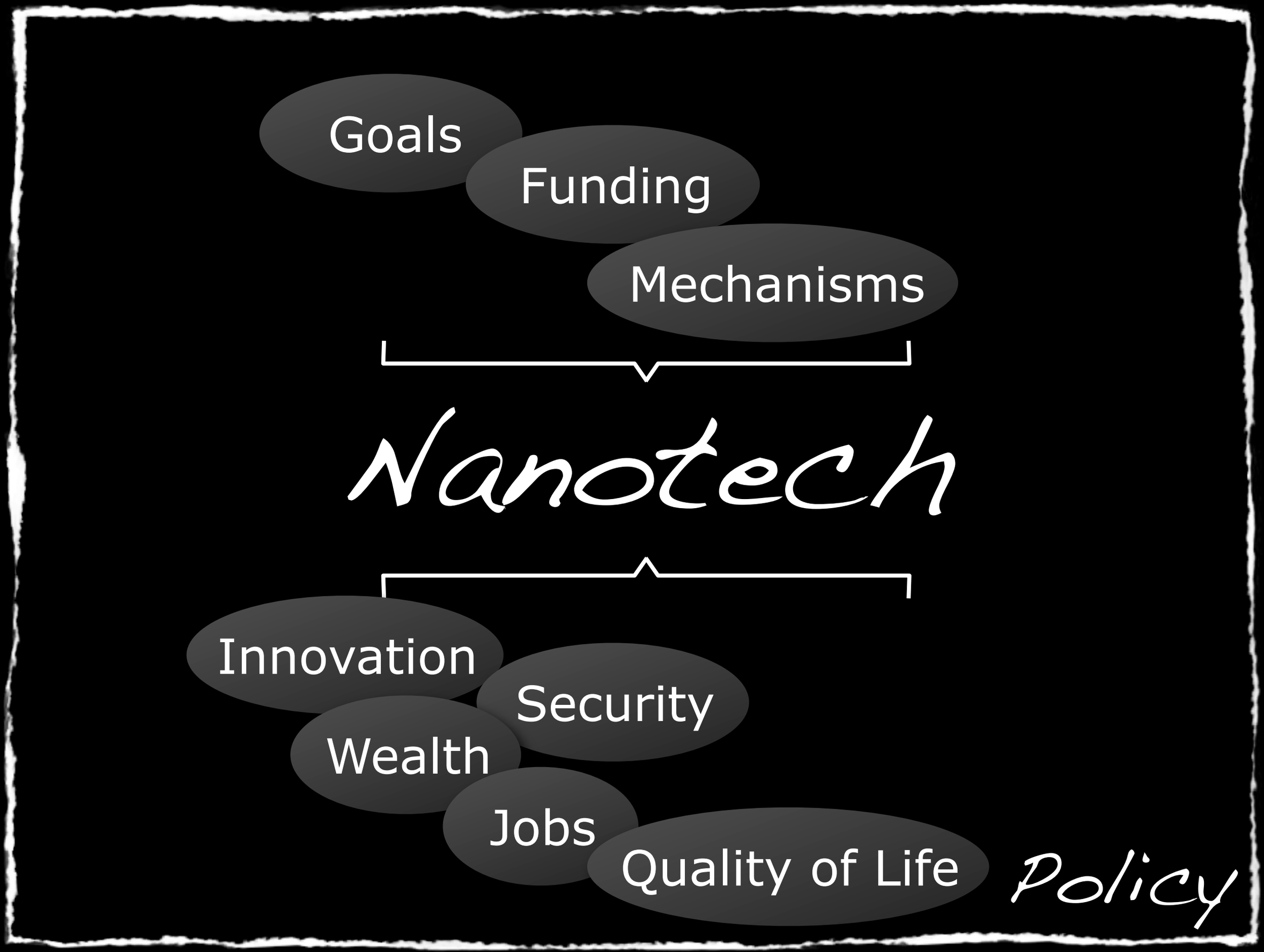
...without creating more problems
than you solve?



A simple perspective...

Policy
One definition:

The art of making impossible decisions



Another simple perspective...

#1 NEW YORK TIMES BESTSELLER

MIC
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"TERRIFYING . . . IR
New York

etc group

Volume 7, No. 1

No Small Matte

Industry and government reg
nanoscale materials do not w
environmental impacts. In th
matters!

ETC Group, P.O. B
Tel: 20

The Washington Post

For Science,
Poses Big U

Rick Weiss, Feb 1

The risks of nanoparticles ma
minor and avoidable, experts
that industry supporters blam
with popular fiction -- such as
selling thriller "Prey," in which
deadly havoc -- activists have
the science.

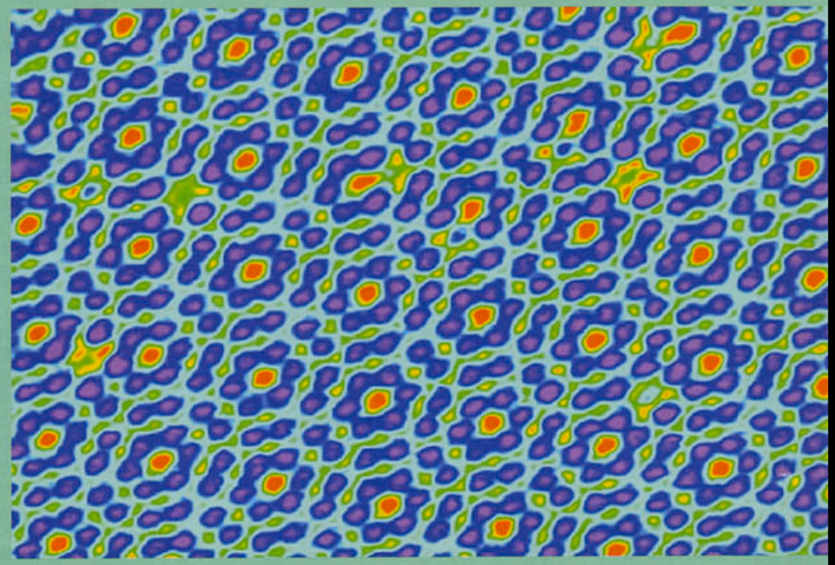
Last year alone, hundreds of
made in U.S. labs and factori
sheets of tightly woven carbo
around the cores of tennis ba
escaping. New fabrics have b
nanofibers that keep stains fr
sunscreens have ultraviolet-a
small they cannot reflect ligh
Tennis rackets and airplane b
nanomaterials whose atoms h
to make them especially stro

THE ROYAL SOCIETY

RA Eng
ROYAL ACADEMY of ENGINEERING

Nanoscience and nanotechnologies: opportunities and uncertainties

Summary and recommendations



RS Policy document 20/04
RAEng Policy document R2.19

July 2004

ISBN 0 85403 605 9

This report can be found
at www.royalsoc.ac.uk
and at www.raeng.org.uk

2004

NEHI

Nanoscale Environment and Health Implications Working Group

Charter

To improve communication of information related to environmental and health aspects of nanotechnology by the National Nanotechnology Coordination Office (NNCO), the NSET Subcommittee, and individual agencies.

To assist in the development of information and strategies as a basis for the drafting of guidance in the safe handling and use of nanoproducts by researchers, workers, and consumers.

To support, with input from the NSET Subcommittee and other appropriate interagency groups, the development of tools and methods for identifying and setting priorities among specific research to enable risk analysis of and regulatory decision-making regarding nanoproducts.

To support development of nanotechnology standards, including nomenclature and terminology, by consensus-based standards organizations.

2005

Office of Science and Technology Policy

Principles for Nanotechnology Environmental, Health, and Safety Oversight

Purpose

Federal oversight approaches should be cognizant of the potential benefits of nanotechnology, including health, economic and environmental benefits, while recognizing uncertainties surrounding the evolving science and technology. The purpose of considering environmental, health and safety oversight approaches in the context of nanotechnology is to protect human health and the environment...

http://www.ostp.gov/galleries/default-file/Nano%20EHS%20Principles%20Memo_OSTP-CEQ_FINAL.pdf

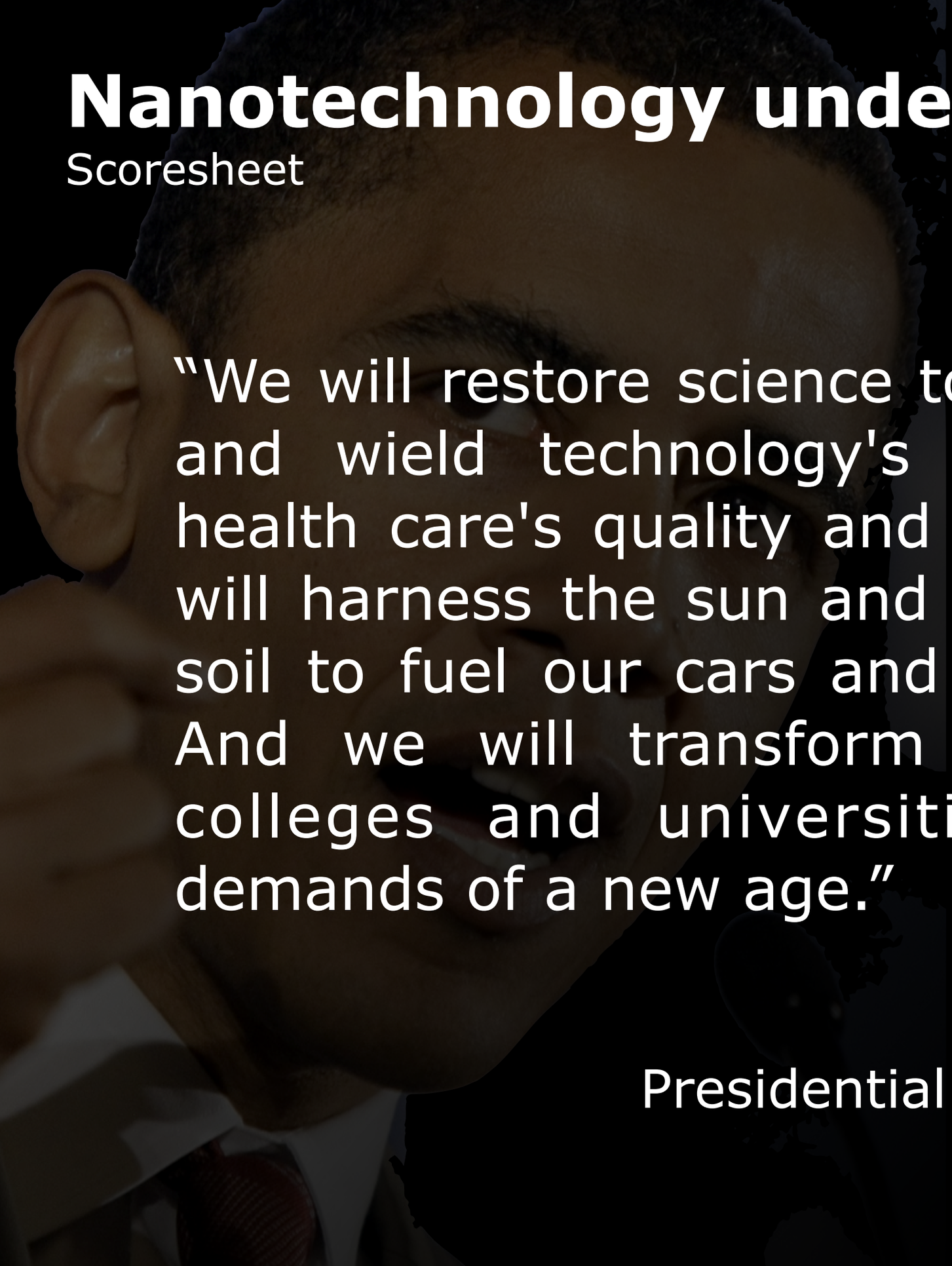
Nanotechnology under Bush

Scoresheet

- Knowledge Generation: **A**
- Maximizing Benefits: **B-**
- Understanding Challenges: **C**
- Managing Risks: **C-**
- Involving Stakeholders: **C**

Nanotechnology under Obama

Scoresheet



“We will restore science to its rightful place, and wield technology's wonders to raise health care's quality and lower its cost. We will harness the sun and the winds and the soil to fuel our cars and run our factories. And we will transform our schools and colleges and universities to meet the demands of a new age.”

Presidential Inauguration Speech

January 20 2009

Nanotechnology under Obama

Scoresheet

- Knowledge Generation: **?**
- Maximizing Benefits: **?**
- Understanding Challenges: **?**
- Managing Risks: **?**
- Involving Stakeholders: **?**

House Science Subcommittee on Research & Science Education

October 31 2007

Developing a Robust Risk Research Policy

(A partial perspective)

Goals

Short Term
Identify
Assess
Manage

Long Term
New knowledge
New questions

Mechanisms

Targeted research

Exploratory research

Knowledge Transfer

Partnerships

Quality of Life

Translating science into life-improving decisions

Funding

$50M - $100M New Funding Per Annum

Strategic Resource Allocation

Topless Humans Organized for Natural Genetics (THONG)

Goals

Funding

Mechanisms

Nanotech

Innovation

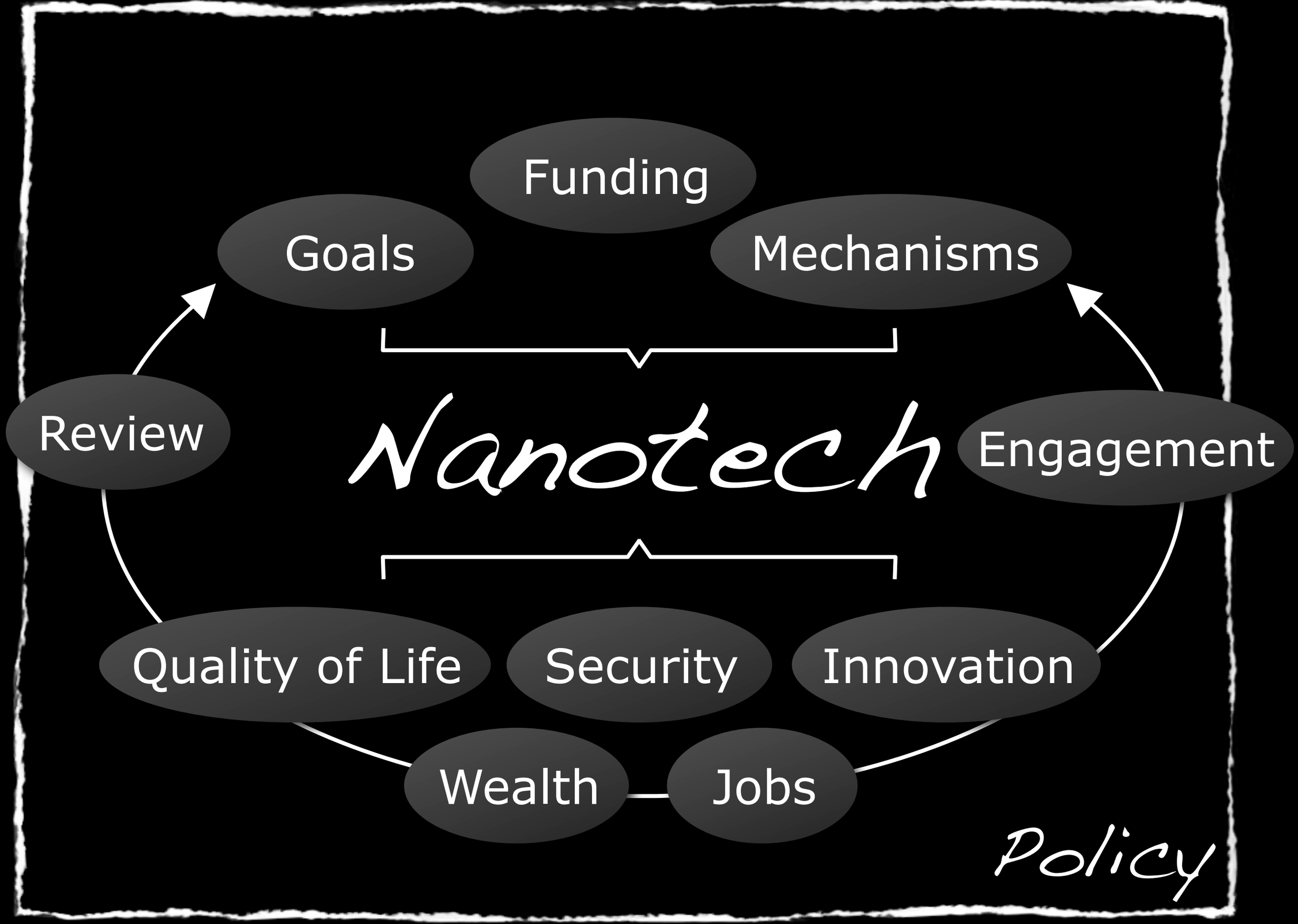
Security

Wealth

Jobs

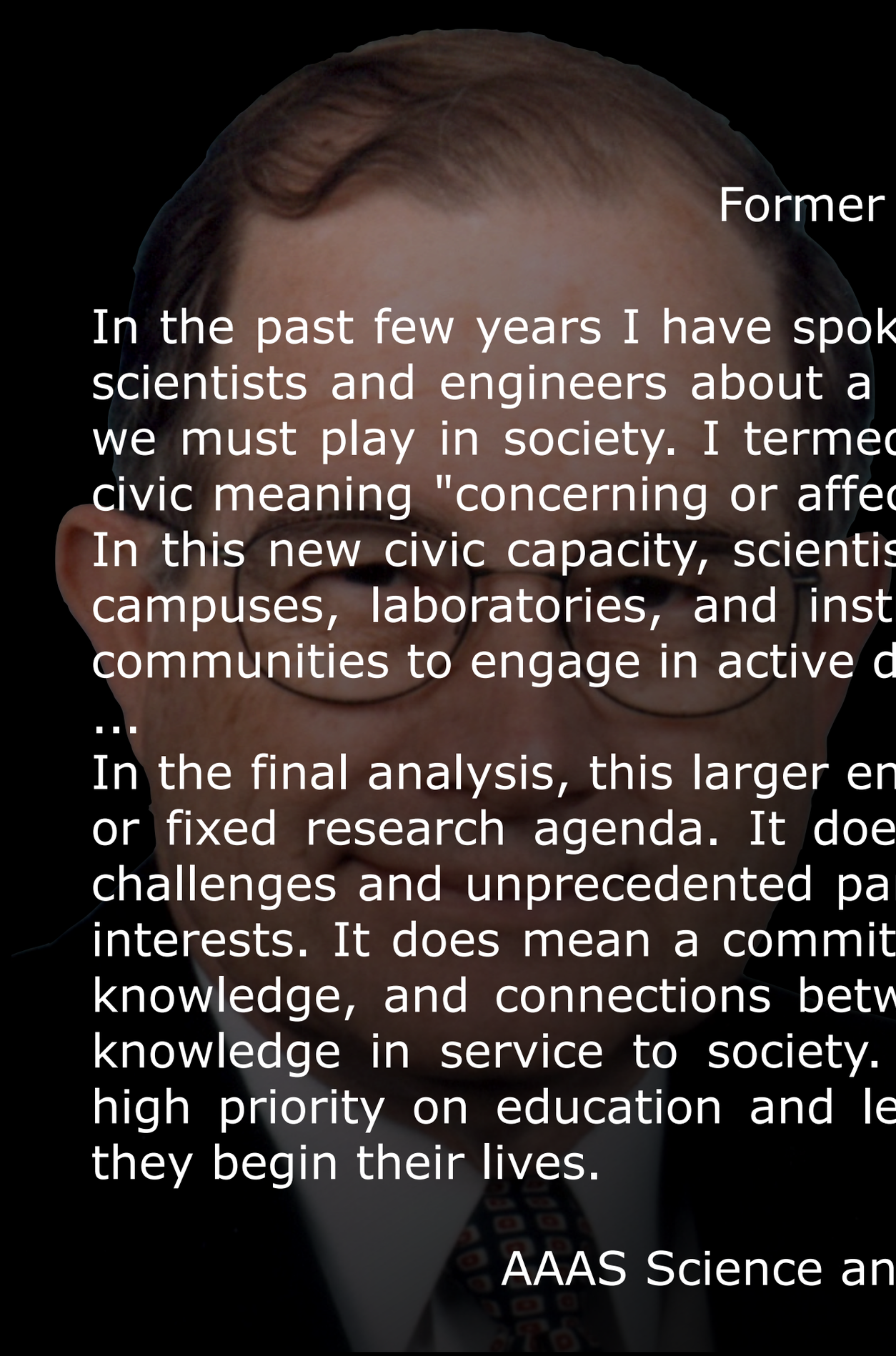
Quality of Life

Policy



Still something of a simple perspective...


© CSIRO



Neal Lane

Former science advisor to President Clinton

In the past few years I have spoken to many groups of my colleague scientists and engineers about a new, additional role that, I believe, we must play in society. I termed this role the "civic scientist," with civic meaning "concerning or affecting the community or the people." In this new civic capacity, scientists and engineers step beyond their campuses, laboratories, and institutes and into the center of their communities to engage in active dialogue with their fellow citizens.

...

In the final analysis, this larger engagement does not mean a focused or fixed research agenda. It does mean openness to new research challenges and unprecedented partnerships among diverse fields and interests. It does mean a commitment to effective communication of knowledge, and connections between discovery and the use of new knowledge in service to society. And it especially means placing a high priority on education and learning for all youngsters wherever they begin their lives.

AAAS Science and Technology Policy Yearbook 1999

http://www.aaas.org/spp/yearbook/chap22.htm

2020 Science

Providing a clear perspective on developing science and technology responsibly

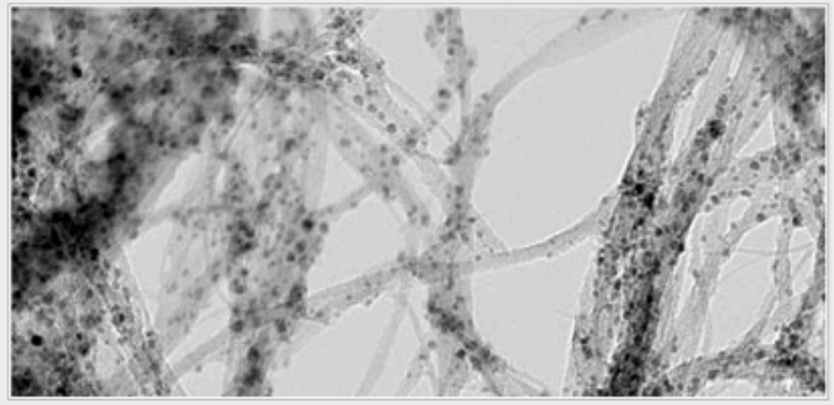
A red-letter day for science and technology

JANUARY 20, 2009 [EDIT]

As Barack Obama takes the oath and is inaugurated as the 44th President of the United States, many are anticipating a new era of socially relevant science and technology. Having run one of the most technologically savvy campaigns in recent times—possibly ever—Obama's transition teams continued to break new ground in using technology up open up the process of government. And throughout the campaign and transition, there has been an emphasis on scientific integrity, and using science and technology in the service of society.

The trick is going to be to maintain this momentum in the new administration. Obama has surrounded himself with a top-notch group of science and technology advisors, and this, combined with a desire to get science and technology back on track, bodes well for the new Presidency. As BBC News reported this morning, scientists are optimistic that Obama has what it takes to reposition science and technology within government and society. And yesterday's USA Today noted that "Scientists are hopeful that Obama, who has called for increased research spending, will bring a new dawn [to science]."

Of course, realizing the promise of a new scientific dawn will not be easy. Where will the money come from? What should the top priorities be? Will robust long-term science strategies be established? How will citizens be effectively engaged in the science and technology enterprise?



Search

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Top Notes

Human & Environmental Exposure Assessment of Nanomaterials Workshop

February 24-25, 2009, Bethesda MD

Organized by the National Nanotechnology Initiative.

Your chance to contribute to the Nanotechnology Risk Research agenda - if you can make it and you have something to say, sign up here

2020 Science on Twitter

RT @tim_harper: TNTlog:, "Insuring Nanotech" - http://tinyurl.com/az4xj5 2 HOURS AGO

RT @nytimesscience: In Texas, a Line in the Curriculum Revives Evolution Debate http://tinyurl.com/devvr4 - come on people! 2 HOURS AGO

RT @nytimesscience: News Analysis: Scientists Welcome Obama's Words http://tinyurl.com/acrtqg 2 HOURS AGO

Insurers scrutinize nanotechnology (ES&T): http://bit.ly/gbjR 9 HOURS AGO

@joergheber love the inanity Stephen Fry has initiated :-) 10

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