

# Anticipatory Governance: A Strategic Vision for Building Reflexivity into Emerging Technologies

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David H. Guston

Center for Nanotechnology in Society at ASU  
Consortium for Science, Policy and Outcomes  
School of Politics and Global Studies  
Arizona State University



# NSEC/Center for Nanotechnology in Society at Arizona State University



- **Research** the societal implications of nanotechnologies
- **Train** a community of scholars with new insight into the societal dimensions of nanoscale science & engineering (NSE)

- **Engage** the public, policy makers, business leaders, and NSE researchers in dialogues about the goals and implications of NSE
- **Partner** with NSE laboratories to introduce greater reflexiveness in the R&D process



# NSEC/CNS-ASU Research Programs

## Anticipatory Governance

Provides strategic vision

### 1. Foresight

All governance requires a disposition toward future

### 2. Engagement

Crucial normatively, strategically, pragmatically

### 3. Integration

Scientists know things we don't, and vice versa

### 4. Ensemble-ization

Because none of these works in isolation

## Real-Time Technology Assessment

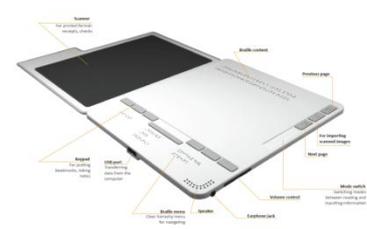
Provides methodological orientation

1. Research and Innovation Systems Analysis
2. Public Opinion and Values
3. Anticipation and Deliberation
4. Reflexivity and Integration

## Thematic Research Clusters

Provides thematic focus

1. Equity, Equality and Responsibility
2. Urban Design, Materials & the Built Environment (Nano & the City)



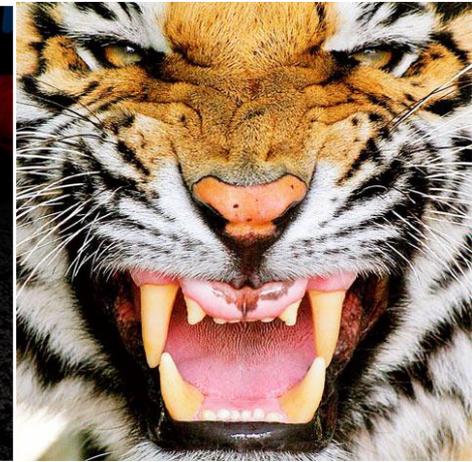
# Anticipatory Governance as Strategic Vision



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A broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible.

Anticipate: from *ante-* and *capere*, “to take [into possession]” “beforehand”; related to capable and capacity and not a synonym for “expect,” “predict,” or “foresee”

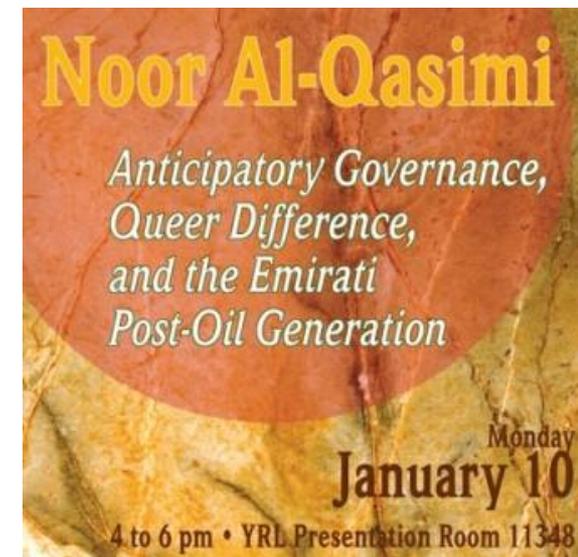
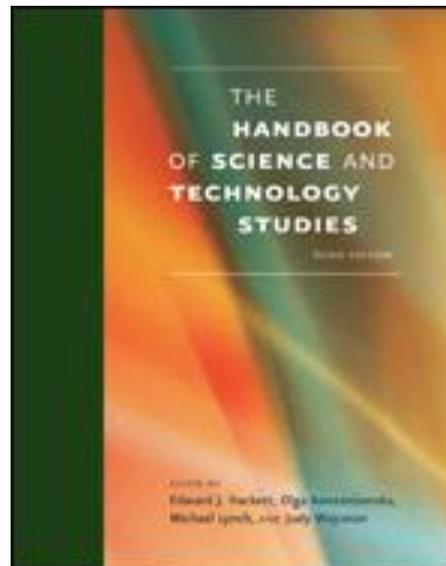
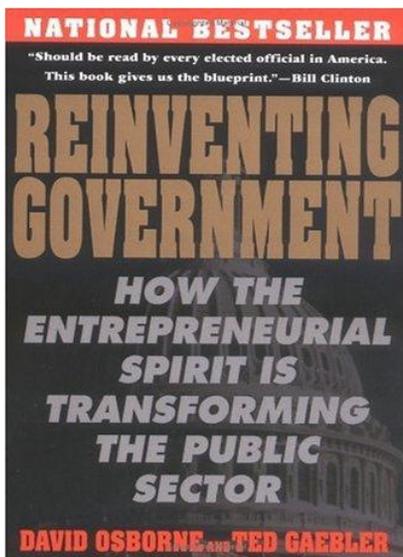
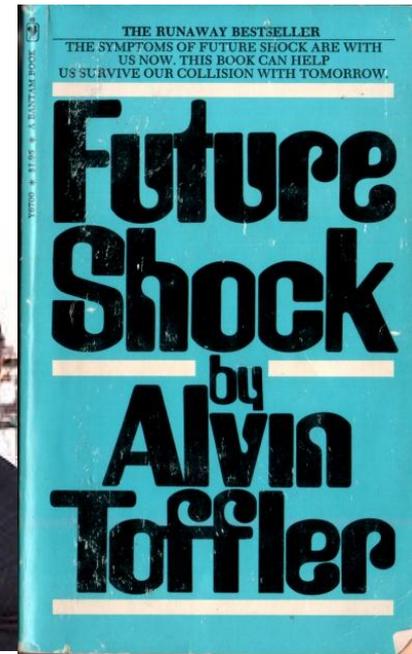
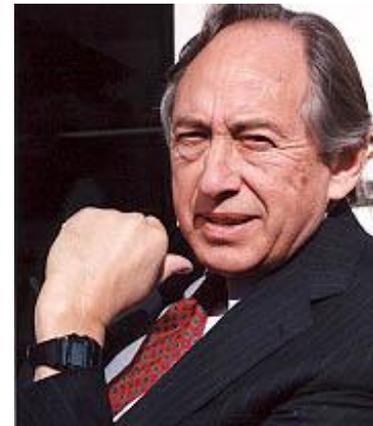


# Anticipatory Governance – Genealogy



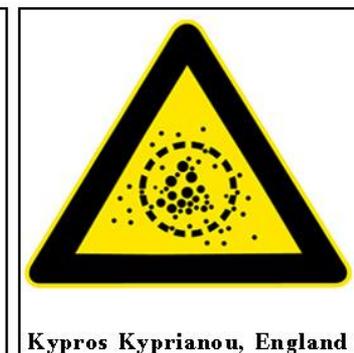
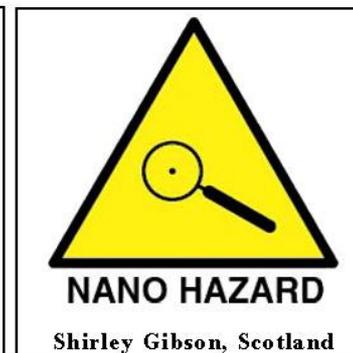
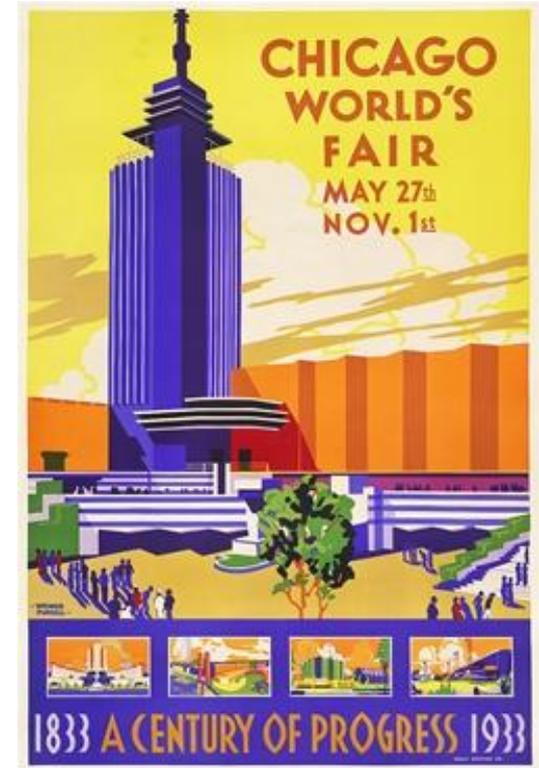
“Competent social scientists should work hand-in-hand with natural scientists, so that problems may be solved as they arise, and so that many of them may not arise in the first instance.”

Detlev Bronk



# Anticipatory Governance – Not Government

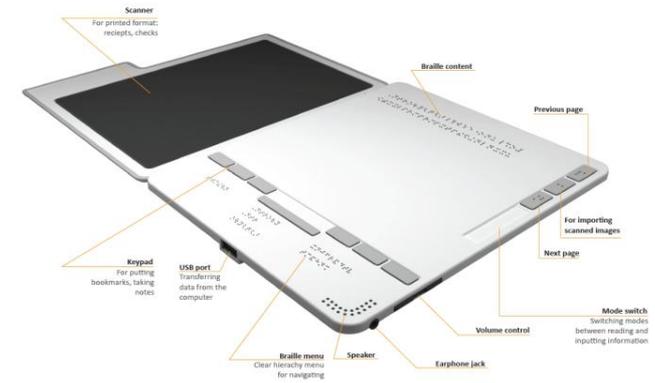
- Not “do” or “ban”
  - “Science finds, genius invents, industry applies, man adapts”
  - Moratoriums proposed by ETC Group and Friends of the Earth
- Wide array of mechanisms
  - Regulation
  - Licensing/restrictions
  - Liability/indemnification
  - Intellectual property
  - R&D funding & tax credits
  - Testing
  - Treaties
  - Public Understanding of Science
  - Informal Science Education
  - Public engagement
  - Public action
  - Routinization
  - Codes of conduct
  - Standards
  - Laboratory decisions



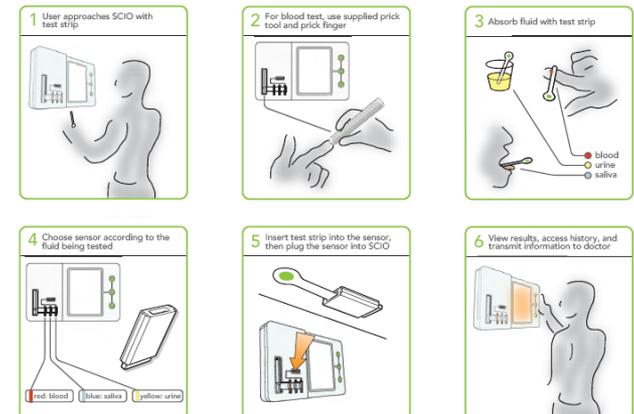
# Anticipatory Governance for Sustainability: Foresight and Reflection

## Scenarios Matrix

		Value to Society	
		HIGH	LOW
Responsibility for Health	Individual	 <p>Healthletes vs. Natural Lifers</p>	 <p>Docs R Us</p>
	Institutional	 <p>Unlimited Hope in a Box</p>	 <p>Doc Blue AI</p>

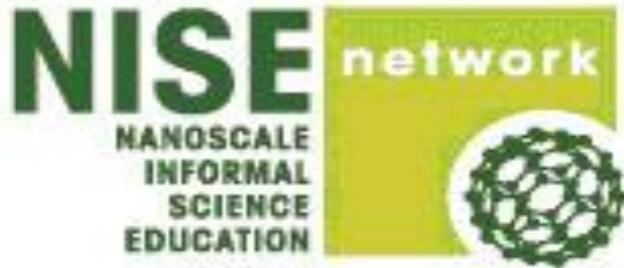


### User Experience Storyboard



Outcomes: changed research agenda  
and strategy

# Anticipatory Governance for Sustainability: Engagement and Reflection



Outcomes: changed strategic focus and different communication on museum floor

Does nanotechnology belong in toys?

**Nanosilver is found in many consumer products.**

Silver is naturally antibacterial, and tiny nanosized silver particles are especially effective at killing germs. Nanosilver is used in bandages, cutting boards and washing machines—and at one time was even found in a toy bear.

Exposure to nanosilver products probably won't harm you, but widespread use of nanosilver could contaminate water supplies, kill fish or lead to highly resistant "superbugs."

Any technology has risks and benefits. When one person or group benefits, others may be put at risk. Who should make decisions about whether to use nanotechnologies? Does it make sense to use nanosilver catheters to prevent infections in hospitals? What about using a nanosilver washing machine at home?

## Regulatory Issues

**WHO WATCHES OUT FOR POTENTIAL RISKS POSED BY NANOTECHNOLOGY?**

There is no one regulatory agency that oversees nanotechnology, but the U.S. government's Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) are currently developing ways to monitor the effects of nanotechnology. Because nanotechnology is so difficult to identify, and is still an emerging science, we don't really know yet how safe or dangerous it is—for people or things. So far, the government hasn't regulated anything specifically because it was enhanced by nanotechnology, but it has weighed in on its use in some products.

Samsung's "SilverCare" washing machine, for instance, claimed that its product used silver ions to "kill" 99.9% of bacteria in clothes. This claim caught the attention of the EPA, which argued that because Samsung advertised that its washing machine "killed" bacteria, the product should be regulated under the Federal Insecticide Fungicide and Rodenticide Act (or FIFRA). The EPA required Samsung to substantiate the safety precautions the company had taken with SilverCare. Instead, Samsung decided simply to change its advertising to claim that the washer "eliminates" bacteria, which the EPA has chosen not to regulate.

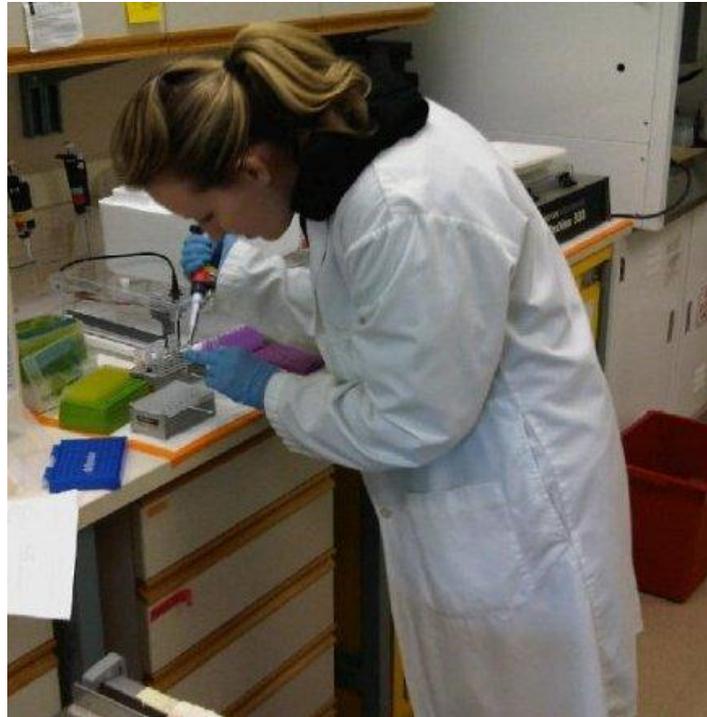
**WHO ELSE COULD HELP REGULATE NANOTECHNOLOGY?**

Another major group that could regulate nanotechnology is you—the public. Recently, a company called Pure Plushy sold a teddy bear that was embedded with silver nanoparticles to prevent dust mites, bacteria and mold from growing on it. By eliminating these organisms, the bear—known as Benny the Bear—could be enjoyed by children with severe asthma and allergies. Benny became famous when Andrew Maynard of the Woodrow Wilson International Center asked publicly whether it was safe for a child to chew on a bear that had nanosilver embedded in it, which the company assured that it was.

Scientists know that nanosilver can be very dangerous for fish and other aquatic life, but there haven't been any studies showing that nanosilver can be bad for people. In fact, people have been using colloidal silver as an antibiotic treatment for many illnesses and infections for centuries. Pure Plushy took this to mean that its product was safe. But as Maynard and others wrote more articles questioning whether enough research had been done to be confident in its safety, Pure Plushy realized that their position on Benny's safety didn't matter as much as the public's perception. Without specific studies to support their claim, Pure Plushy decided to change their marketing to avoid potential lawsuits as well as public backlash against nanotechnology.

**LEARN MORE**  
 The NISE Network [www.whatnanono.org](http://www.whatnanono.org) Nanotechnology-based consumer products [www.nanoandme.org/inventories/consumer](http://www.nanoandme.org/inventories/consumer) nano & me: Nanotechnology in our lives [www.nanoandme.org/regulation](http://www.nanoandme.org/regulation)

# Anticipatory Governance for Sustainability: Integration and Reflection



## CORRESPONDENCE

### Research thrives on integration of natural and social sciences

Emerging collaborations between social and natural scientists face challenges, as you acknowledge (*Nature* **462**, 825–826, 2009). But, like A. D. Manning and J. Fischer in Correspondence (*Nature* **463**, 425; 2010), you sidestep a practical question that keeps many laboratory doors closed: what if interactions with ‘soft’ scientists harm the quality of my ‘hard’ research?

Rather, efforts to enhance scientific creativity and societal responsiveness can be mutually reinforcing.

**Erik Fisher** School of Politics and Global Studies, Arizona State University, PO Box 873902, Tempe, Arizona 85287-390, USA

e-mail: [efisher1@asu.edu](mailto:efisher1@asu.edu)

**Simon Biggs** School of Process, Environmental and Materials Engineering, University of Leeds, UK  
**Stuart Lindsay** The Biodesign Institute, Arizona State University, USA

**Jie Zhao** School of Materials Science and Engineering, Dalian University of Technology, China

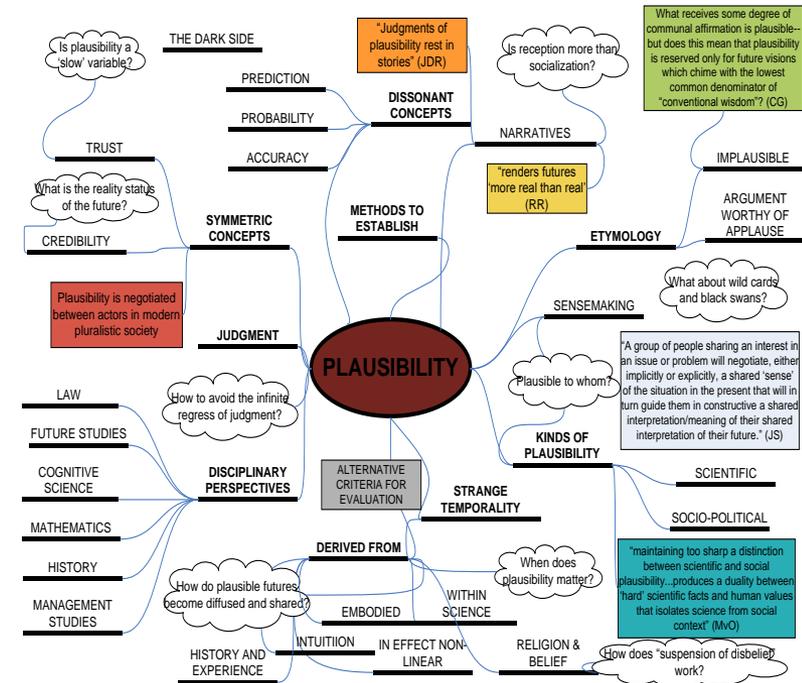


Outcomes: “midstream modulation” -- changed discursive and material practice in laboratories

# Anticipatory Governance for Sustainability: Risk & Plausibility

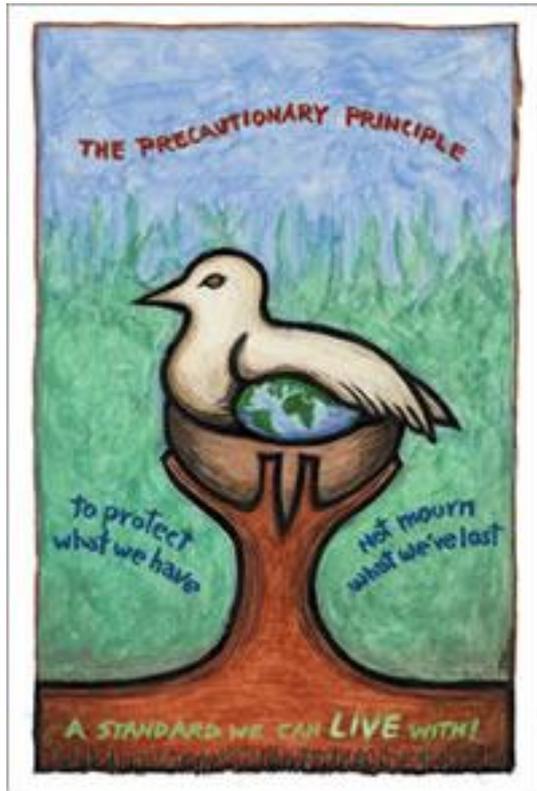
**NATIONAL ACADEMY OF SCIENCES  
RISK ASSESSMENT PARADIGM  
FOR MICROBES**

- HAZARD IDENTIFICATION**  
Types of microorganisms and disease end-points
- DOSE-RESPONSE**  
Human feeding studies, clinical studies, less virulent microbes and healthy adults
- EXPOSURE**  
Monitoring data, indicators and modeling used to address exposure
- RISK CHARACTERIZATION**  
Magnitude of the risk, uncertainty and variability



Plausibility helps address uses, contexts, and complexities of socio-technical systems that we do not handle well in the risk paradigm

# Anticipatory Governance for Sustainability: Precaution & Anticipation



Citizens should have anticipatory, engaged, and integrated experiences with emerging technologies, as do scientists.

# Resources for Anticipatory Governance

- Guston. 2010. “Anticipatory Governance of Emerging Technologies.” *Journal of the Korean Vacuum Society* 19(6):432-41.
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- C. Selin (Foresight), J. Wetmore (Engagement), E. Fisher (Integration)