

STIR Overview



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Socio-Technical Integration

Any process by which technical experts take into account the societal aspects of their work *as an integral part of this work*

US Nanotechnology Legislation

108TH CONGRESS
1ST SESSION

S. 189

AN ACT

To authorize appropriations for nanoscience, nanoengineering, and nanotechnology research, and for other purposes.

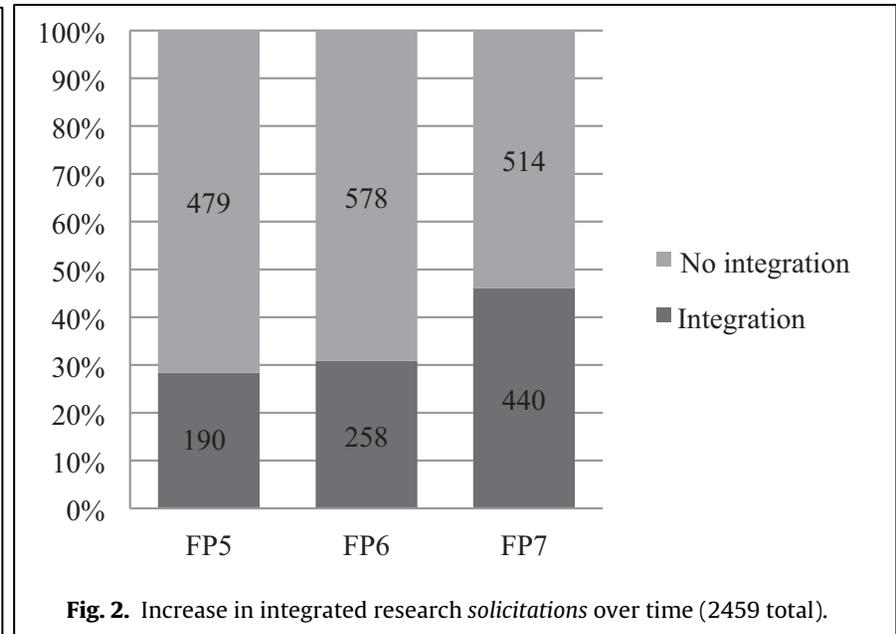
1 *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “21st Century

5 Nanotechnology Research and Development Act”.

European research solicitations



US law requires “integrating research on societal...concerns with...research and development” (Congress 2003) and social research that “influences the direction of ongoing nanotechnology research and development” (House Sci Comm 2003).

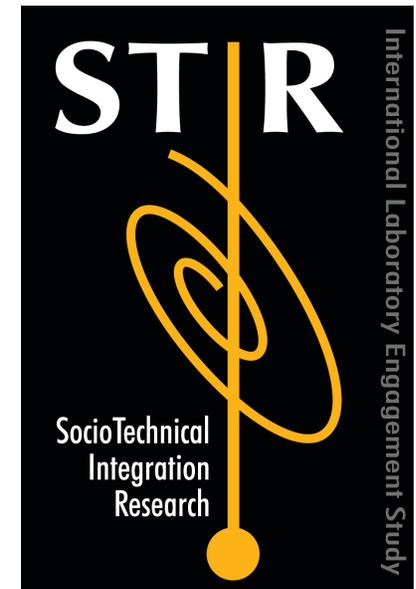
EU policy discourse for the “harmonious societal integration of new scientific and technological knowledge” (EU 2007) results in “an overall increase in solicitations for integration...[which] become significantly more pervasive” over time (Rodriguez et al. 2013).

(Fisher and Miracle 2014; Rodriguez et al., 2013)

Socio-Technical Integration Research

To investigate possibility and utility of socio-technical integration

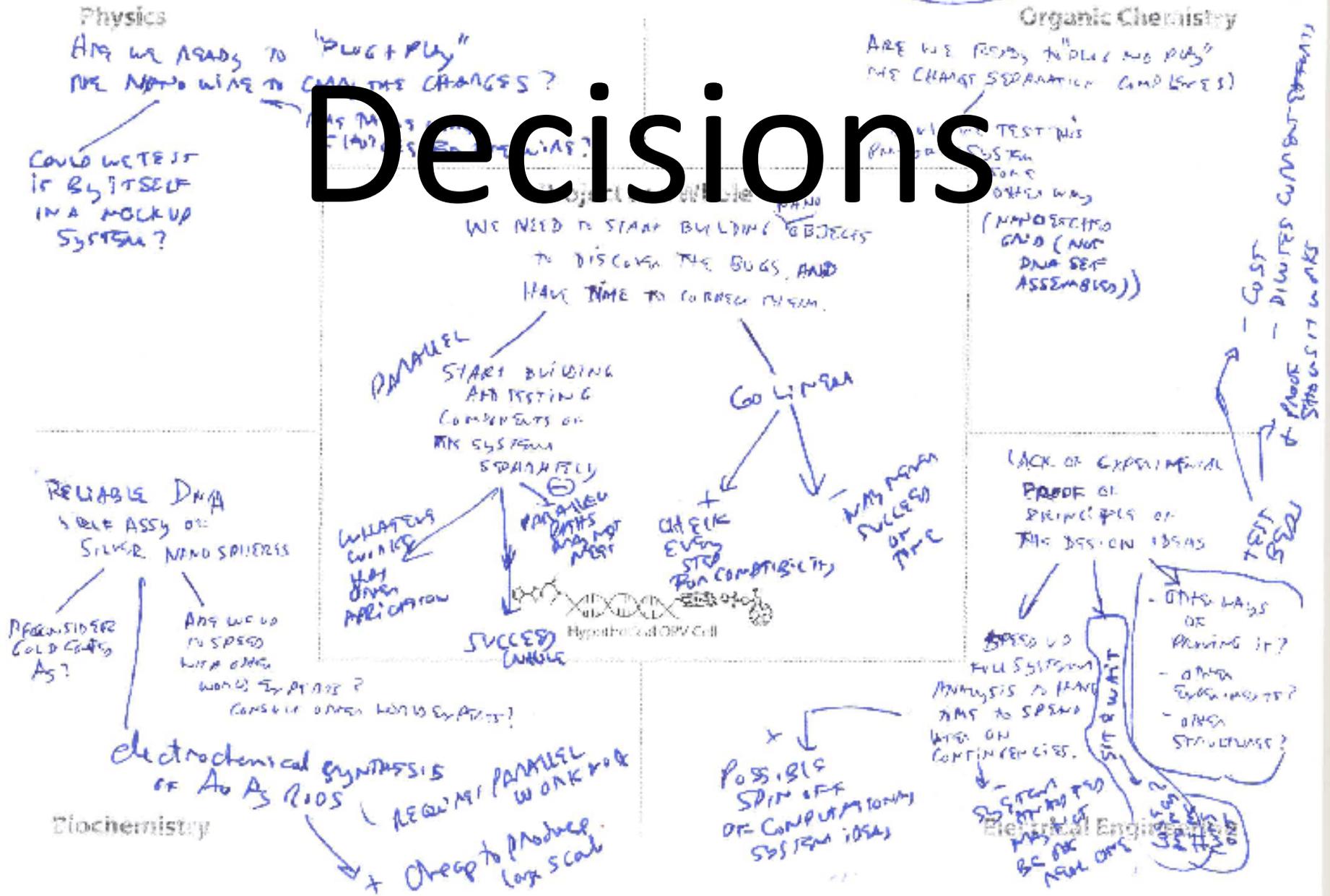
- Coordinated set of 30 studies
 - NSF 2009-2014 (\$540,000 PI: Fisher, co-PI: Guston)
 - Across 13 nations and 3 continents
 - 12 weeks in duration
- Laboratory engagement studies
 - Embedded humanist
 - Decision protocol
 - Midstream modulation



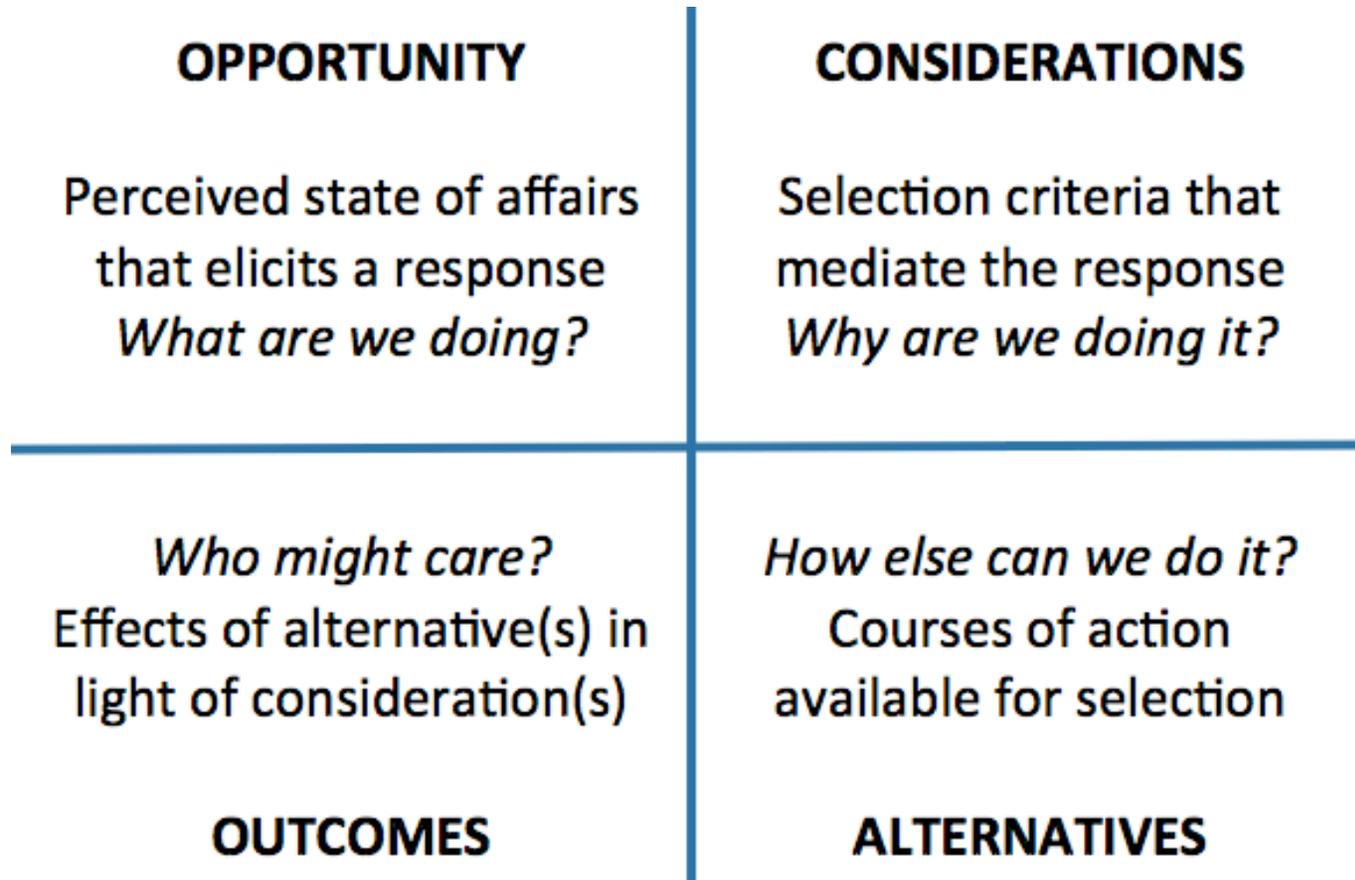
Socio-Material Layers STEP 1

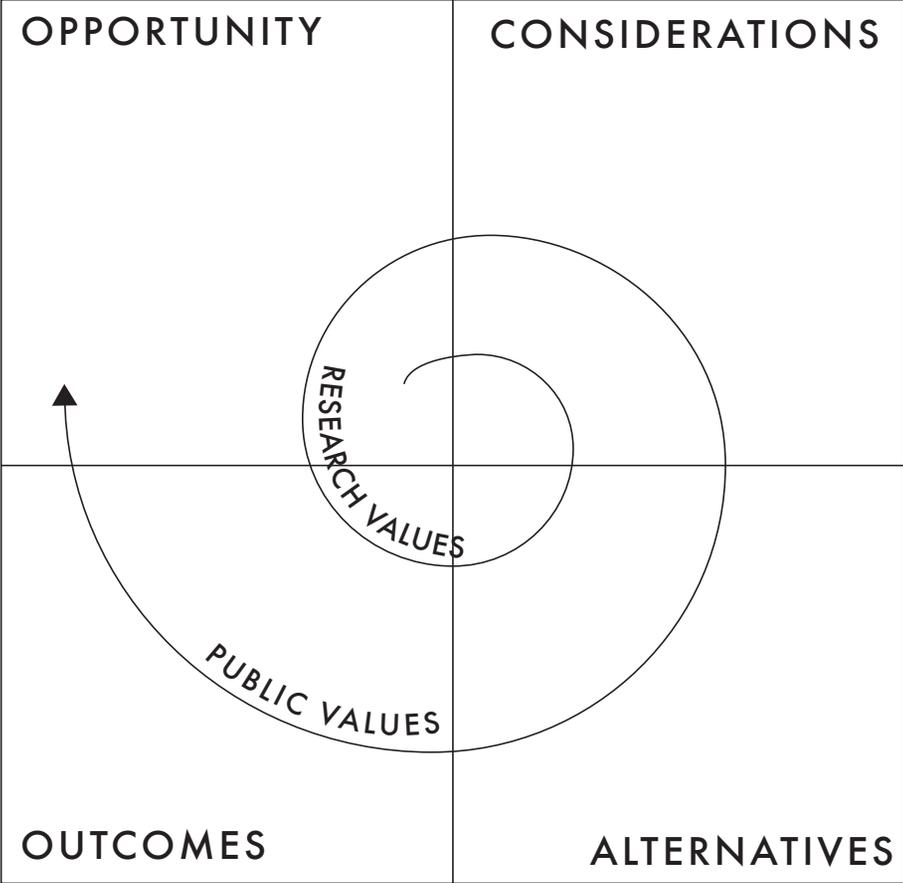
Please list key challenges and choices available to each of the groups and to the project as a whole.

Decisions



Decision Protocol





Opportunity

P.6.60

Measurement in the lab

↳

Flow good → for cell

→ 99% Considerations

Money → ~~less of~~ ~~SC water~~
Available equipment → just started
Money

→ Easy + Cheap + good result
high vac → thousands
↳ time and space

→ No choice → Natural barrier
↳ No time

Tech. available for metal deposition

active layer deposition

↳ ~~Electropolymerization~~

↳ ~~Spr coat~~ → ~~thin~~ → ~~depose~~

↳ ~~Dip coating~~

↳ ~~Langmuir-Blodgett films~~

→ 1st step
→ 2nd step

→ ~~Rad~~ technique

→ ~~Tedious~~

Useful for other stuff
Not for polymers

metal deposition

↳ ~~thermal evaporation~~

↳ ~~sputtering~~

↳ ~~Hg droplet~~

↳ ~~Not for~~

Alternatives

→ Doctor Blading (toast!)

Outcomes

Midstream Modulation

- *De facto modulation*
 - Research decisions are conditioned by socio-ethical factors
- *Reflexive modulation*
 - Researchers experience a heightened sense of de facto modulation
- *Deliberate modulation*
 - Reflexive modulation becomes a resource for research decisions

Embedded Humanist: Position

- A functioning member of the team
- Who maintains critical and normative distance
 - Goes “all but” native
 - Practices ethos of self-restraint



Embedded Humanist: Tasks

- Observe *de facto* modulation

“Take the journey”

- Facilitate *reflexive* modulation

“Share the experience”

- Document *deliberate* modulation

“Remember the ‘R’ in STIR”

Observed Outcomes

- **Reflexivity**
 - Socio-ethical learning
 - Expanding self-conceptions
- **Deliberation**
 - Value expansions
 - Value (re)considerations
 - Value anticipations
- **Adjustment**
 - Changes in practice
 - Material
 - Behavioral
 - Strategic



Responsiveness:
“A capacity to change shape or direction in response to stakeholder and public values and changing circumstances”

Reflexivity

“Contrary to their initial claims, participants came to acknowledge that broader socio-ethical dimensions permeated their research”

t₁ “We don’t make decisions”

t₂ “I guess this really is a decision”

Is integration “part of your job”?

- Pre-study: 1 of 5
- Post-study: 5 of 5



Deliberation & Adjustment

OPINION

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?

The Center for Nanotechnology

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

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Reflections on responsible innovation generate novel ideas for antenna structures and nanoparticle synthesis

Deliberation & Adjustment



Reflections on responsible innovation prompt laboratory to initiate patient outreach

A close-up photograph of a person's hand holding a small glass vial with a blue cap. The person is wearing a green lab coat. The background shows various laboratory equipment, including glass beakers and metal tubing. The text 'Deliberation' is overlaid in large white font at the top.

Deliberation

What does “messy” mean?

- Measurement
- Equipment
- Worker safety
- Public and environmental health

& Adjustment

- Researcher alters chemical catalyst, waste disposal, experimental setup

Deliberation

- I used to take care of my safety
- Lab group collectively debates safety practices

& Adjustment

- Laboratory collectively changes their safety practices



Woodrow Wilson
Internati
for 5

Residual effects

- Continued use of protocol
- Continued deliberations and responses
- Collaborative publications and presentations
- Written into grants and education programs

Findings

- Sustained interdisciplinary interaction can enhance reflexivity
- Enhanced reflexivity does not by itself lead to responsiveness
- Systematically explicating the reflexive nature of research decisions in real time does lead to responsiveness

Policy Uptake

NATIONAL SCIENCE FOUNDATION

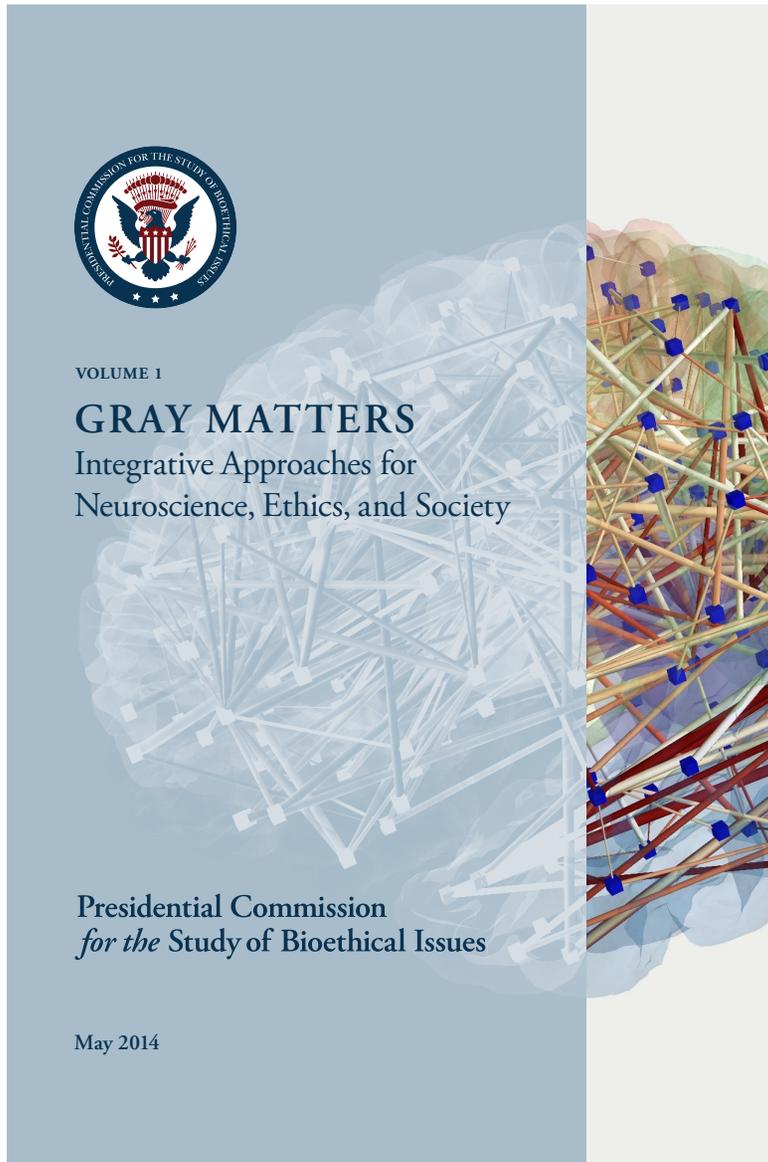
FY 2014 Budget Request to Congress



April 10, 2013

“a project to embed humanists and social scientists for greater collaboration in nanoscience around the world, providing a **model for future integration of ethicists and social scientists into nanotechnology R&D laboratories**” (p. 69)

Policy Uptake



“I think by asking the fundamental question[s]—[W]hy are you doing this? Why do you think your lab director wants to get this grant in particular? Why does your institution promote it in this way? Why did the funding agency write the solicitation in the following way?—by asking these questions you can really impact what’s already there, and in the process the scientists can take ownership rather than the moral expert insisting on what the logical case is. ... [i]t’s a subtle move, but it allows for a co-responsible approach.... I would suggest that the word ‘curiosity’... is potentially an engine for both ethical care and scientific creativity.”

Fisher, E., Associate Director for Integration, Center for Nanotechnology in Society; Assistant Professor, School of Politics and Global Studies and the Consortium for Science, Policy and Outcomes, Arizona State University. (2014). How the Inclusion of an Ethicist on a Research Team Might Affect Change in Scientific Research. Presentation to the Presidential Commission for the Study of Bioethical Issues, February 11. Retrieved April 7, 2014 from <http://bioethics.gov/node/3379>.

STIR 1.0: Intervention for Research

STIR 2.0: Intervention for Change

STIR 2.0 Guidelines

- If you want to talk to scientists about ethics, talk to them about science
- Build moral capacity, rather than apply moral expertise
- Emphasize collaboration, not compliance
- Frame integration as co-inquiry, not as a support for scientific productivity

THANK YOU

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Any opinions, findings and conclusions are those of the author and do not necessarily reflect the views of the National Science Foundation.

