LOST IN TRANSLATION?

Sharing Knowledge on the Technological Frontier

State Department, Washington DC
August 16, 2013

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Woodrow Wilson International Center for Scholars

Background on Our Work

Synthetic BIOLOGY PROJECT

Woodrow Wilson International Center for Scholars

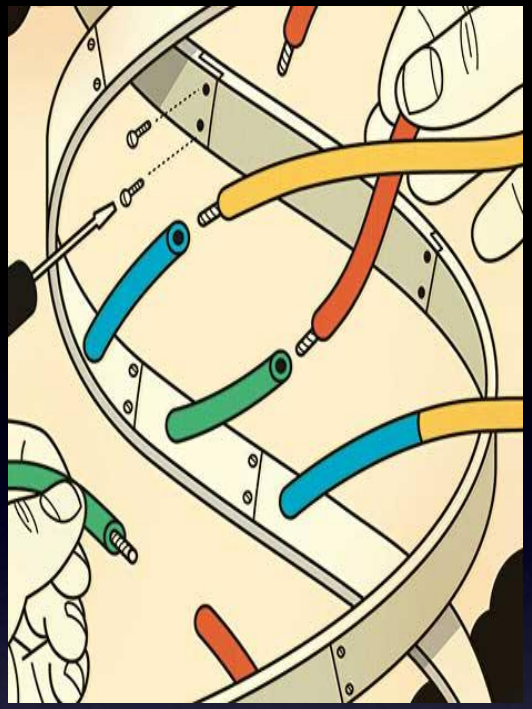
-Interviews with scientists in the Lab

-Ron Weiss, MIT
-Jim Collins, Boston University
-Michael Elowitz, Caltech

-Research on US Public Perceptions

-30+ hours of U.S.-based focus groups on synthetic biology
-Annual National Surveys (with Hart Research) on synthetic biology in 2008, 2009, 2010, 2013

- Research on Media coverage and framing of synthetic biology in the US and EU (2003-2011)



LOST IN TRANSLATION

-What Is Synthetic Biology?
(Also define what it isn't)

Genetic Engineers Who Don't Just Tinker (NYT, 2007)

"Most people in synthetic biology are engineers who have invaded genetics."

Synthetic DNA on the Brink of Yielding New Life Forms (Washington Post, 2007)

"Synthetic biology involves the large-scale rewriting of genetic codes to create metabolic machines [...] the creation of life forms driven by completely artificial DNA."

LOST IN TRANSLATION

-What happens in the Lab…

Interview at MIT (April 2012):

" …the misconception is that you think what we do is easy, we make Legos. And, that we're able to design organisms, in very predictable ways; the misconception arises by, invoking these engineering concepts which are not yet practices."

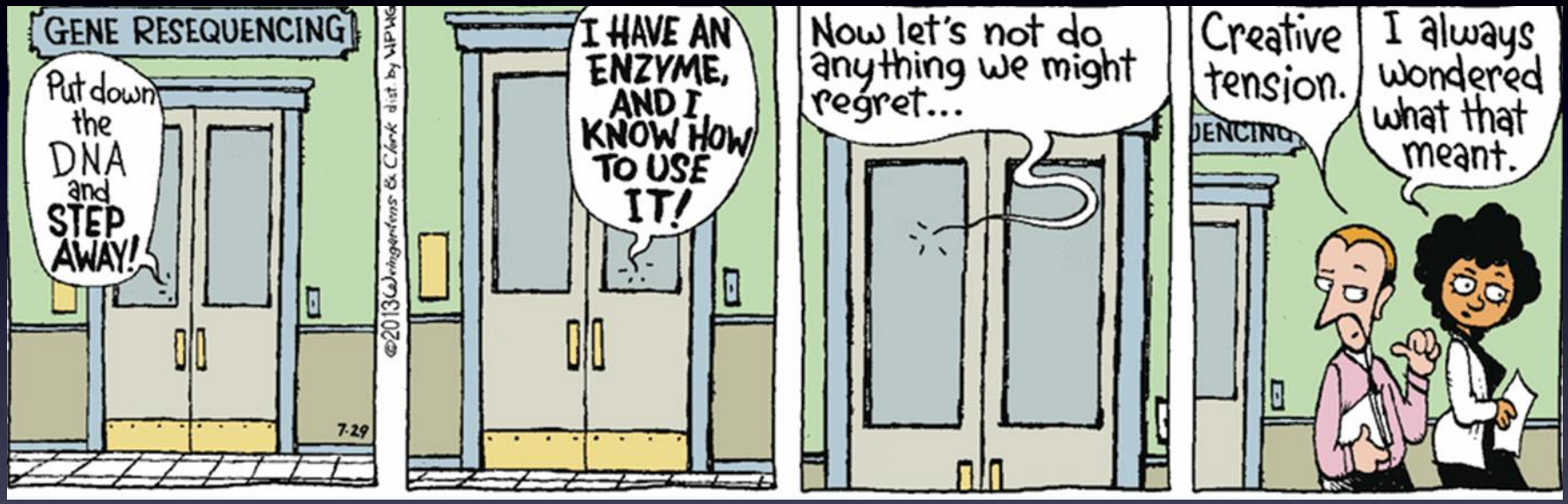
"… as we start building stuff, we're finding in general that our designs actually don't work very well.

And in part, the designs don't work very well because we don't understand the biology as well; we have to accommodate the biology. What could go wrong? What makes the system fail in the biological setting?"

LOST IN TRANSLATION

-View from outside of the Lab…

(Washington Post 2013)



→ **MEDIA INTERPRETATION**

→ **PUBLIC PERCEPTIONS**

MEDIA Hype…

“Biology is becoming a technology and will produce biovalue…” →

NPR (November 2012)
-“bacteria will create electricity,
-clean water from waste,
produce blood, vaccines,
fuels or whatever we fancy.”

The NYT Magazine (May 2012)
“Tiny bugs will save the world; custom bugs, designer bugs — bugs that only Venter can create. Bugs will have a mission: devour things, like pollution; generate food and fuel.”

MEDIA

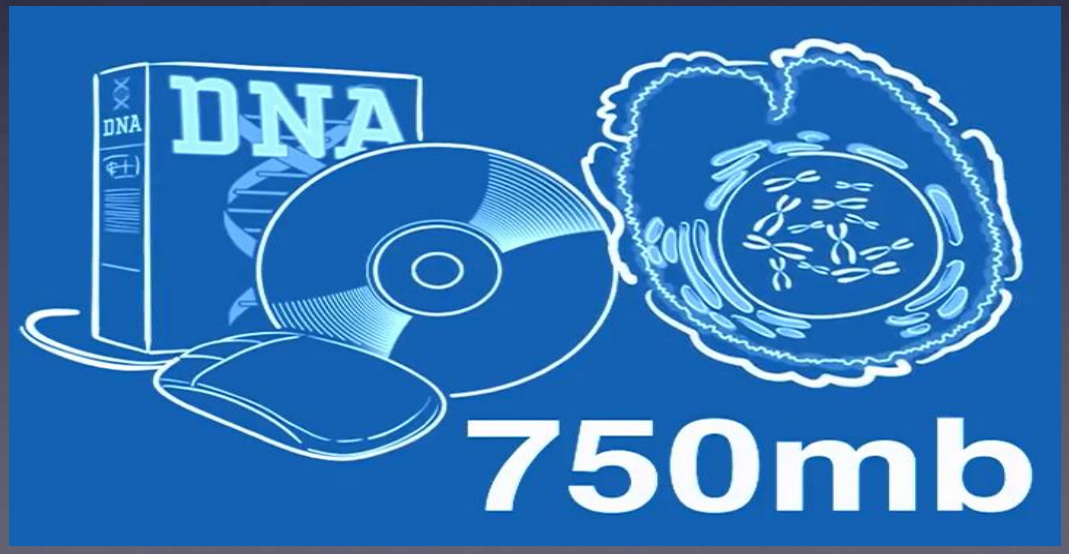
NARRATIVES OF CONTROL

"Life sciences are becoming information sciences…"

WIRED 2012:
"Venter is letting that "**genetic software" reprogram its host**."

"The geneticist and his team of scientists are already testing out a version of his **digital biological converter**…

« It's a **3-D printer for DNA**, a **3-D printer for life**,' Venter said… »



MEDIA

NARRATIVES OF CONTROL

The New Yorker, 2009

-"cells as hardware;" "genetic code as the software;" "write programs to control genetic components;" "alter nature;" "guide evolution;"

Nature 2012

-"What can synbio do for us? move genes around cells, create biological circuits, write new genetic programs that will change the world"

U.S. Congress, Science and Technology Committee (May 2010)

-"Because you have standardization, you know you can get Legos from anywhere and they are going to work together."

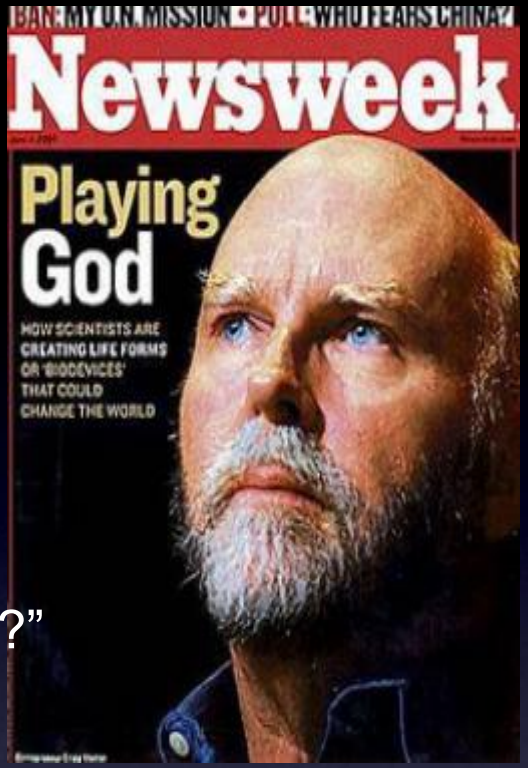
-"Booting-up a genome in a cell," "Writing the software of Life…"

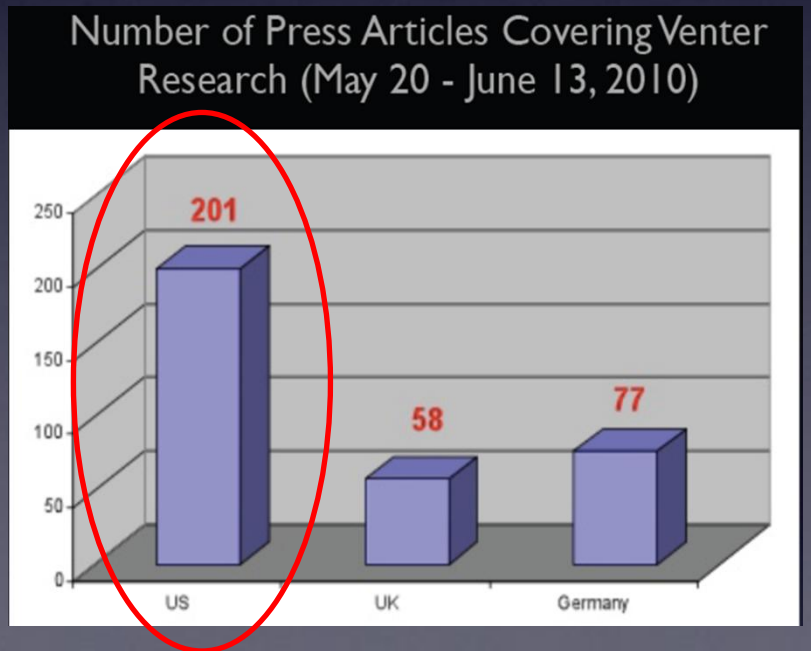
→ "Being able to reprogram a bacterial cell" (Congressman Waxman)

ENTREPRENEUR-SCIENTIST

"This is the first self-replicating species we have had on the planet whose parent is a computer."
(Craig Venter, Press conference, DC, May 2010)

"Is this man playing God by trying to create artificial life?"
(The Herald (Glasgow), August 11, 2011)





"Is Craig Venter going to save the planet? Or, is this more hype from one of America's most controversial scientists?"
(The Washington Post, May 22, 2010)

ENTREPRENEUR-SCIENTIST

Mail Online

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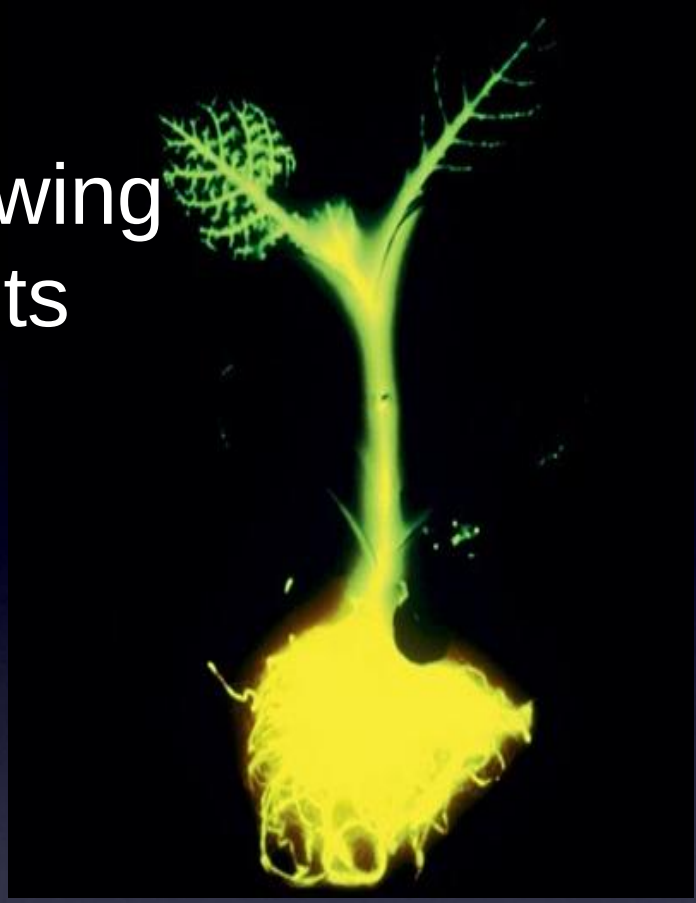
Wanted: 'Adventurous woman' to give birth to Neanderthal man - Harvard professor seeks mother for cloned cave baby

Science on the Colbert Report

CROWD-FUNDED BIO-GENIUS

Glowing Plants



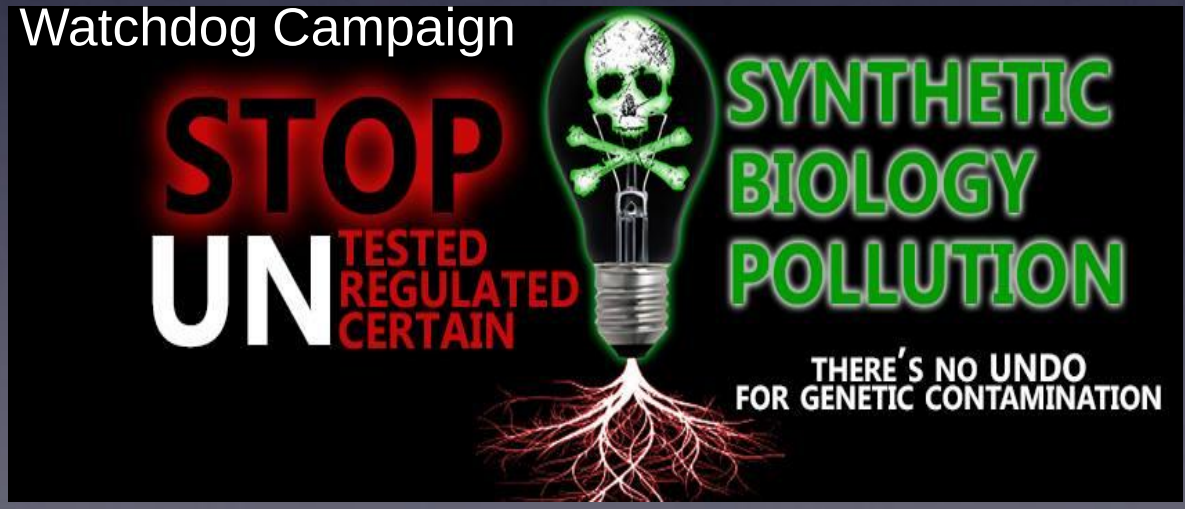
-On Kickstarter: half-million $ in 2 months

-EPA and USDA have no oversight

-Kickstarter Bans Genetically Modified Rewards for Future Projects

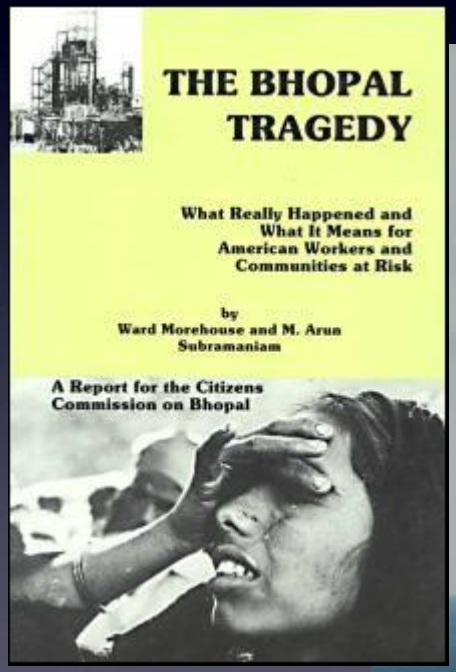
“It exposes the gaps and holes in the regulatory structure…”
(NYT, May 2013)

Watchdog Campaign



What do these stories have in common?

FAILURE TO CONTROL…



U.S. PUBLIC PERCEPTIONS

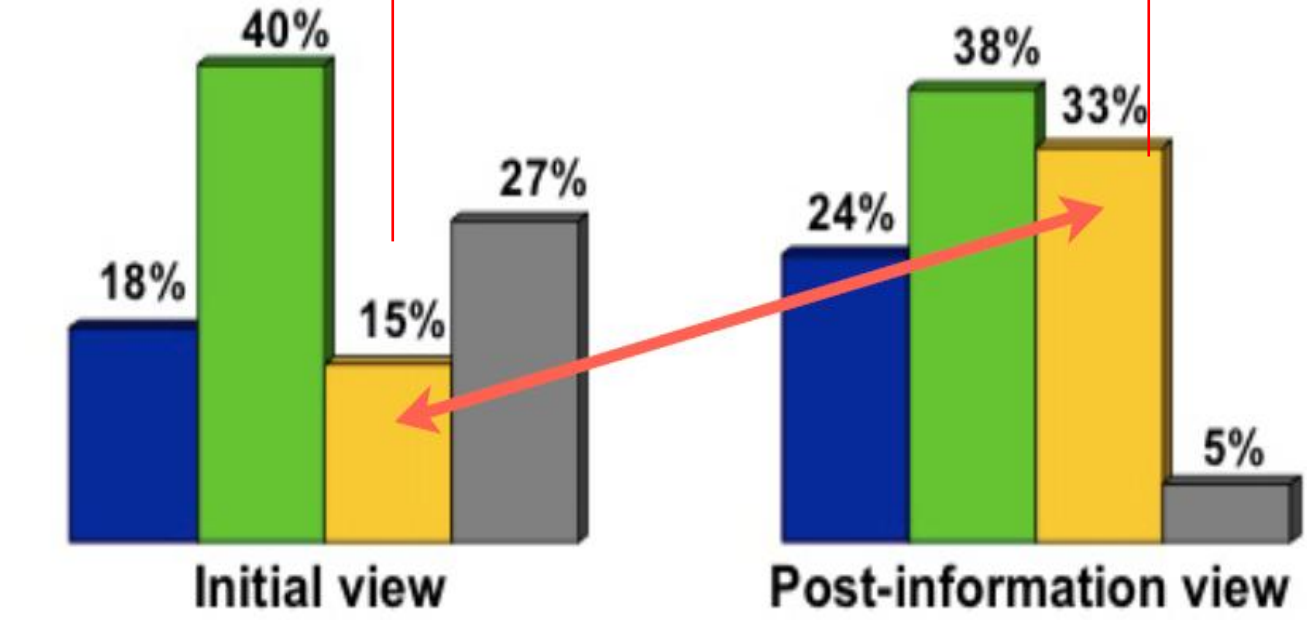
-Low Awareness:
23% in the US
17% in Europe

What do you think synthetic biology is?
(Volunteered Comments)

Unnatural, man-made, something that isn't real, artificial	32%
Reproducing/recreating life, cloning, genetic/ DNA manipulation	15%

-Survey Participants get more polarized as they hear about the science behind synthetic biology

Potential Risks will outweigh benefits



U.S. PUBLIC PERCEPTIONS

-**Applications** with high utility for society and the environment matter most

-Biosecurity and biosafety **concerns** with emphasis on long-term implications, “what if” scenarios and governance failure.

Percentage of Survey Participants Concerned by…

BIOSECURITY 28%

ETHICS 27%

BIOSAFETY 22%


The New York Times

Health

Amateurs Are New Fear in Creating Mutant Virus


Genetic switch to guard against escaped 'superviruses'

17:51 13 August 2013 by Priya Shetty

[redacted], visit the Bird Flu Topic Guide

NewScientist

“If a disaster happens, who is in charge? Can they fix it? How much is it going to cost?”

U.S. PUBLIC PERCEPTIONS

Comments from focus groups…

"I am worried about self-replication."

"How do you control that technology? How do you stop somebody from cloning a human being? Where does it end? How do you regulate that?"

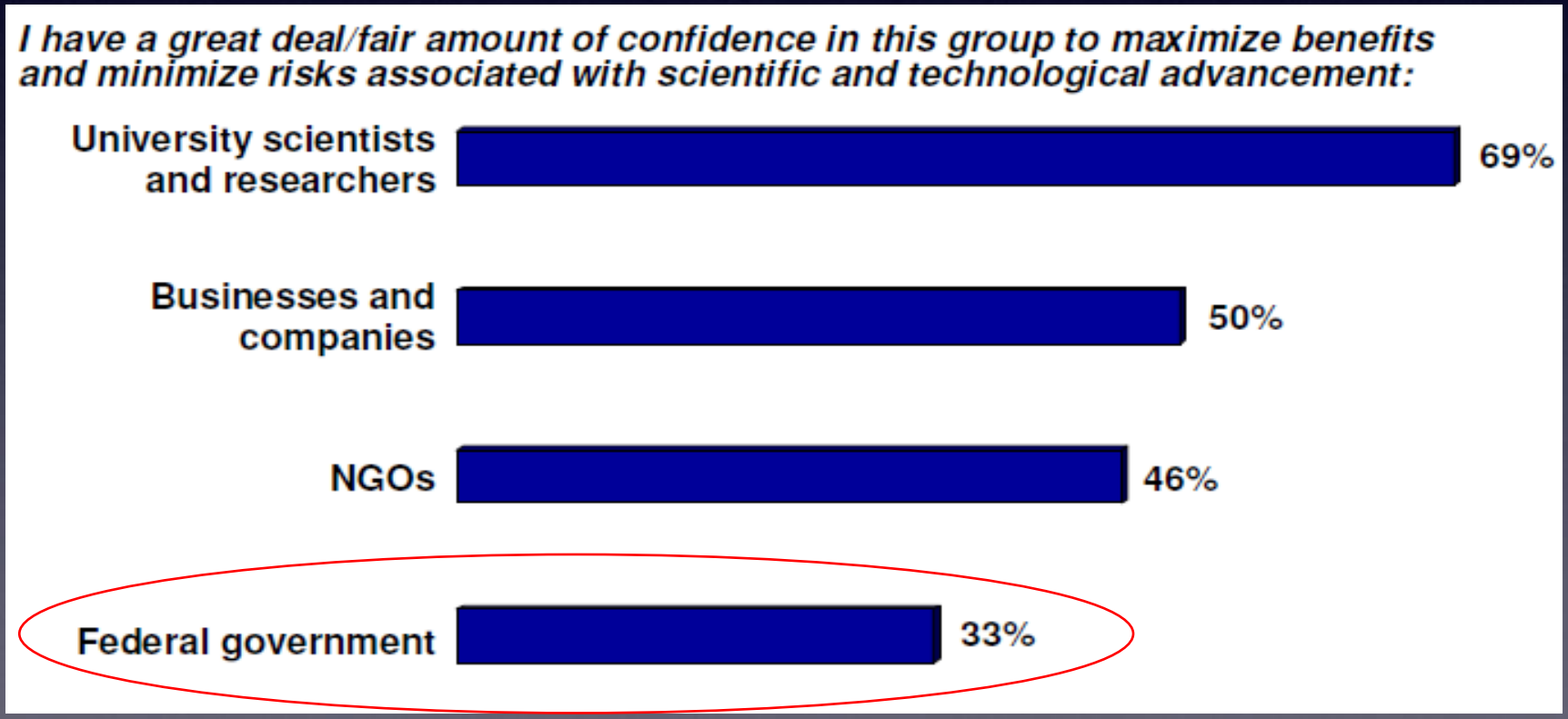
"But there are no safeguards, no clean understanding of the negative repercussions. What about people who have only profit in mind..."

"If there's not someone in their group that's asking 'Should we do this?' they need to include that person."

U.S. PUBLIC PERCEPTIONS

-What do members of the public ask for**?**
CONTAINMENT – OVERSIGHT – TRANSPARENCY - REGULATION – BENEFIT-SHARING…

-Who is trusted in 2013?



SOCIETAL & COMMUNICATION CHALLENGES

AVOID THREE MISCONCEPTIONS

"Too Soon too tell?"

→ Anticipatory Governance Upstream in Research

→ Trading Zones, mutual learning between ≠ disciplines

(Nature piece coming August 29, 2013)

"Just Secure Public Acceptance?"

→ To Tackle What's "Lost in Translation"

→ To Include Citizens in Innovation

"Inevitable Benefits for All?"

→ Reflection on ownership in international context

→ WWICS' New grant to promote international mobilization (4 million euros)

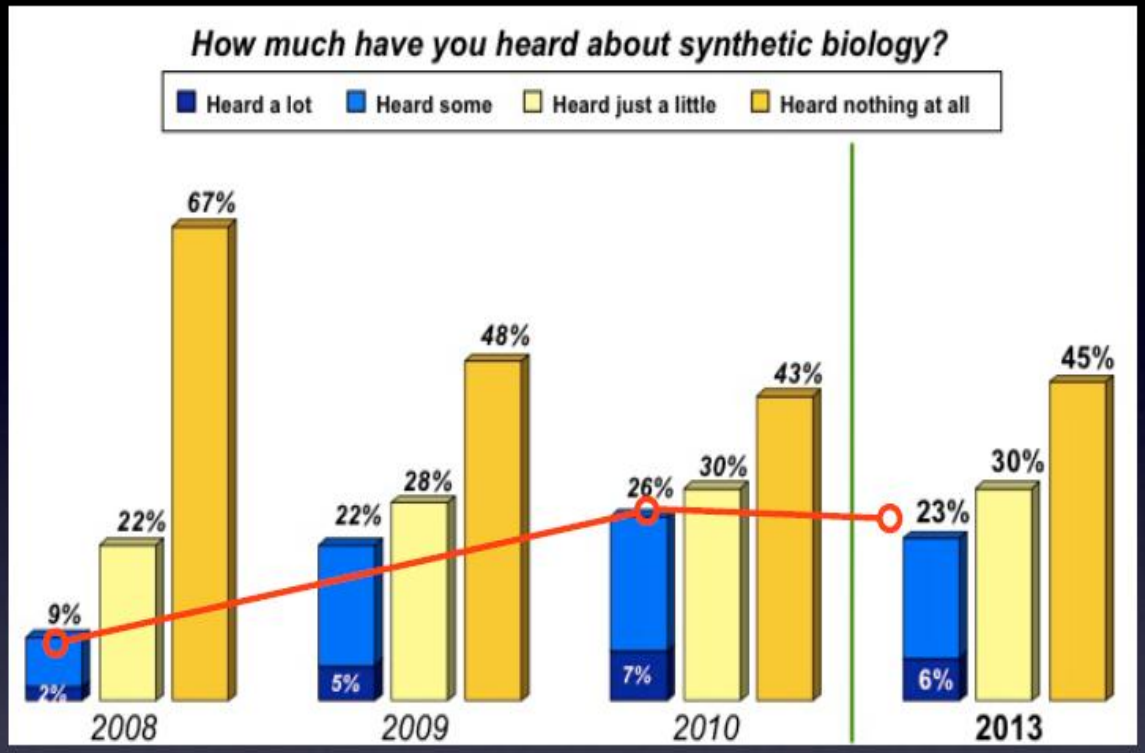
“[…]we don’t assemble because we agree, look alike, feel good, are socially compatible or wish to fuse together but because we are brought by divisive matters of concern…”

(Bruno Latour, From Realpolitik to Dingpolitik)

More information at:
www.synbioproject.org

APPENDIX

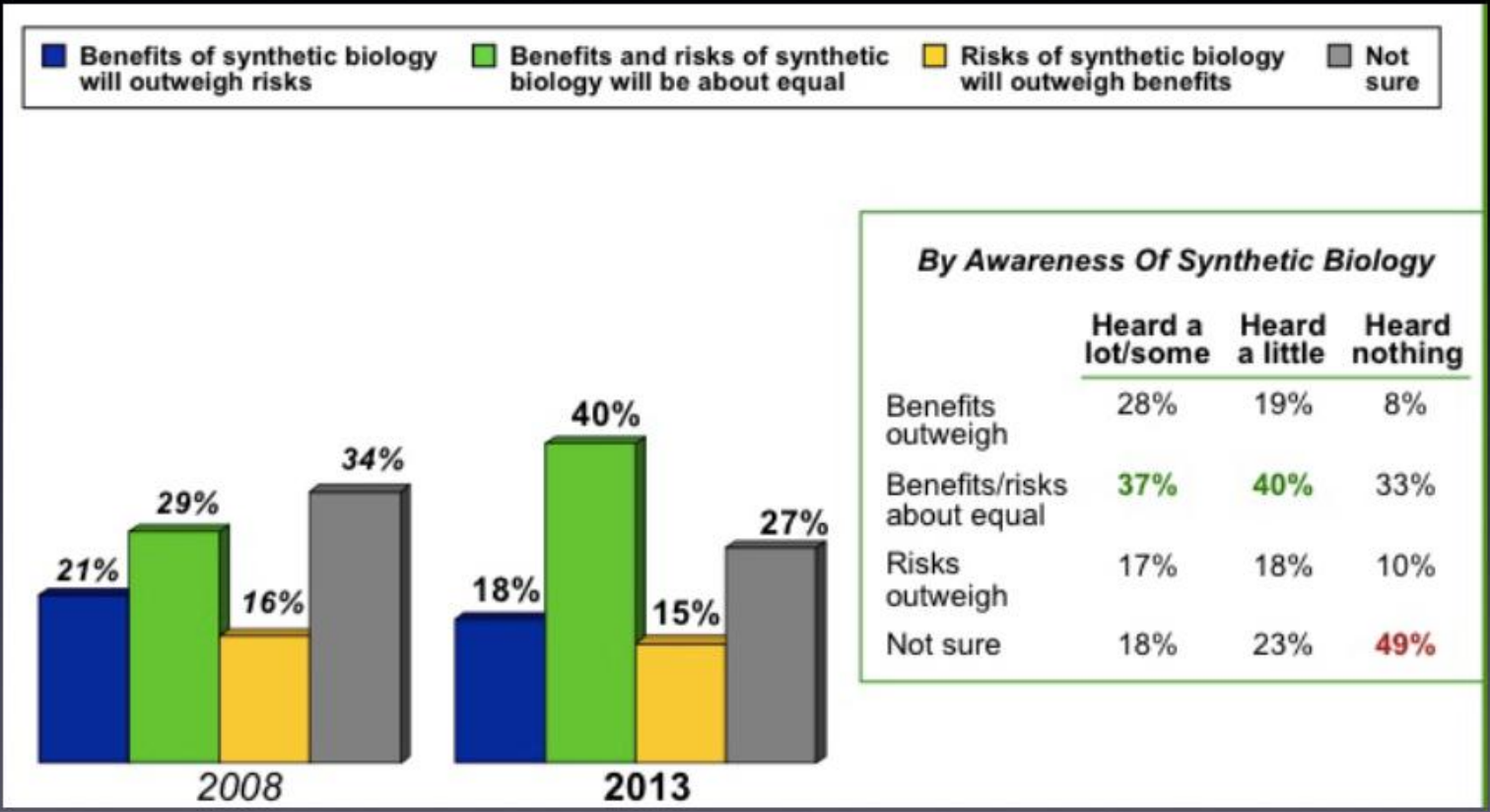
Has the Public Heard of Synthetic Biology (US)?



Who knows the most:
White
Male (18-49)
College educated
Income > $70K

APPENDIX

Risk versus Benefits: Pre-Information



By Awareness Of Synthetic Biology

	Heard a lot/some	Heard a little	Heard nothing
Benefits outweigh	28%	19%	8%
Benefits/risks about equal	37%	40%	33%
Risks outweigh	17%	18%	10%
Not sure	18%	23%	49%

APPENDIX

Description Of Synthetic Biology Given To Respondents

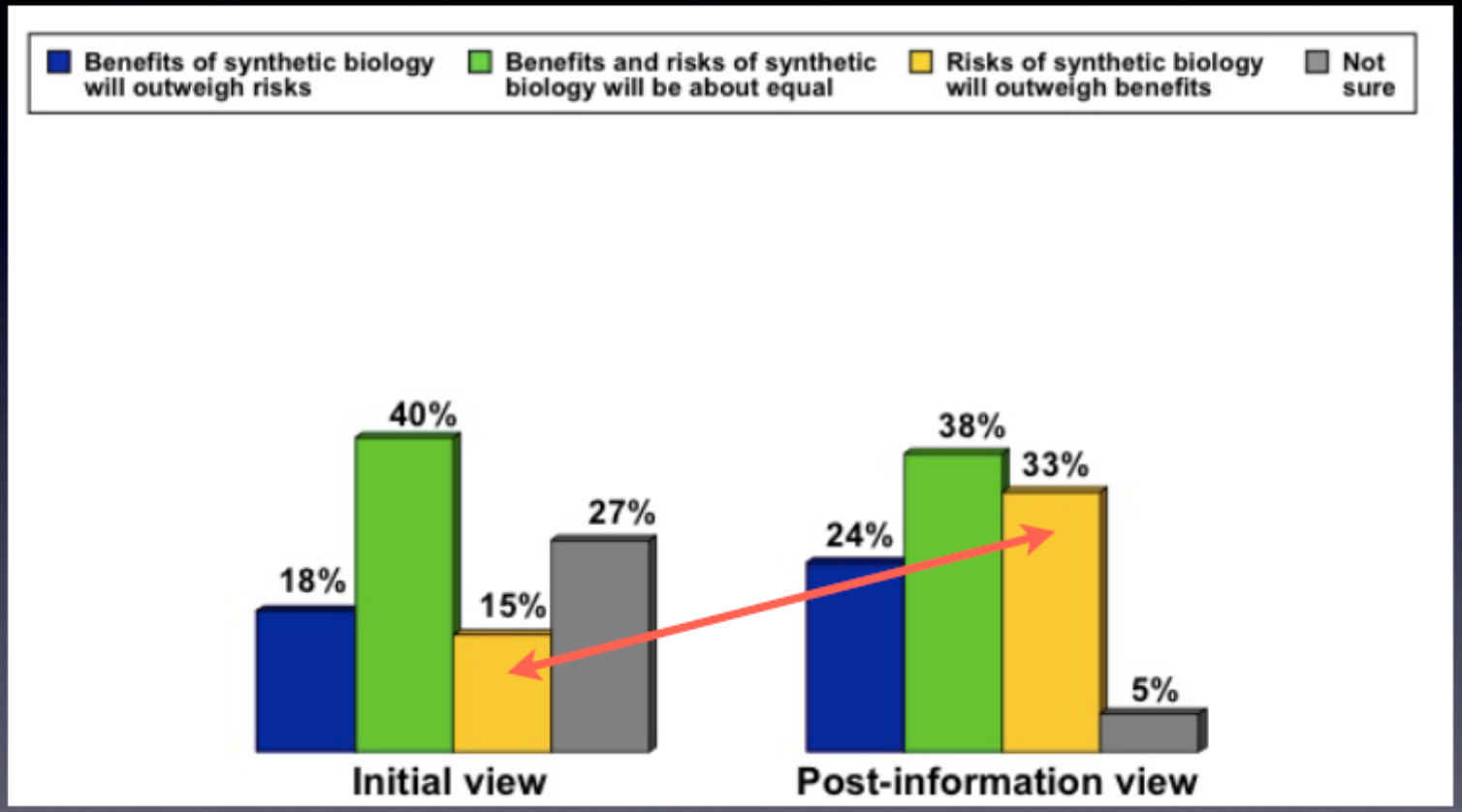
Synthetic biology is the use of advanced science and engineering to make or re-design living organisms, such as bacteria, so that they can carry out specific functions. Synthetic biology involves making new genetic code, also known as DNA, that does not already exist in nature.

The potential BENEFITS of synthetic biology include developing new micro-organisms to treat disease, including cancer, more effectively and to create new and less expensive medications. It also could be used to make new organisms that could provide cheaper and cleaner sources of energy than today's oil-based fuels, and to detect and break down environmental pollutants in the soil, air, and water.

While the potential RISKS of synthetic biology are not known, there are concerns that man-made organisms might behave in unexpected and possibly harmful ways and that they could cause harm to the environment. There also are concerns that, if these organisms fall into the wrong hands, they could be used as weapons. Additionally, the ability to create artificial life has raised moral and ethical questions about how life is defined.

APPENDIX

Risk versus Benefits: Post-Information



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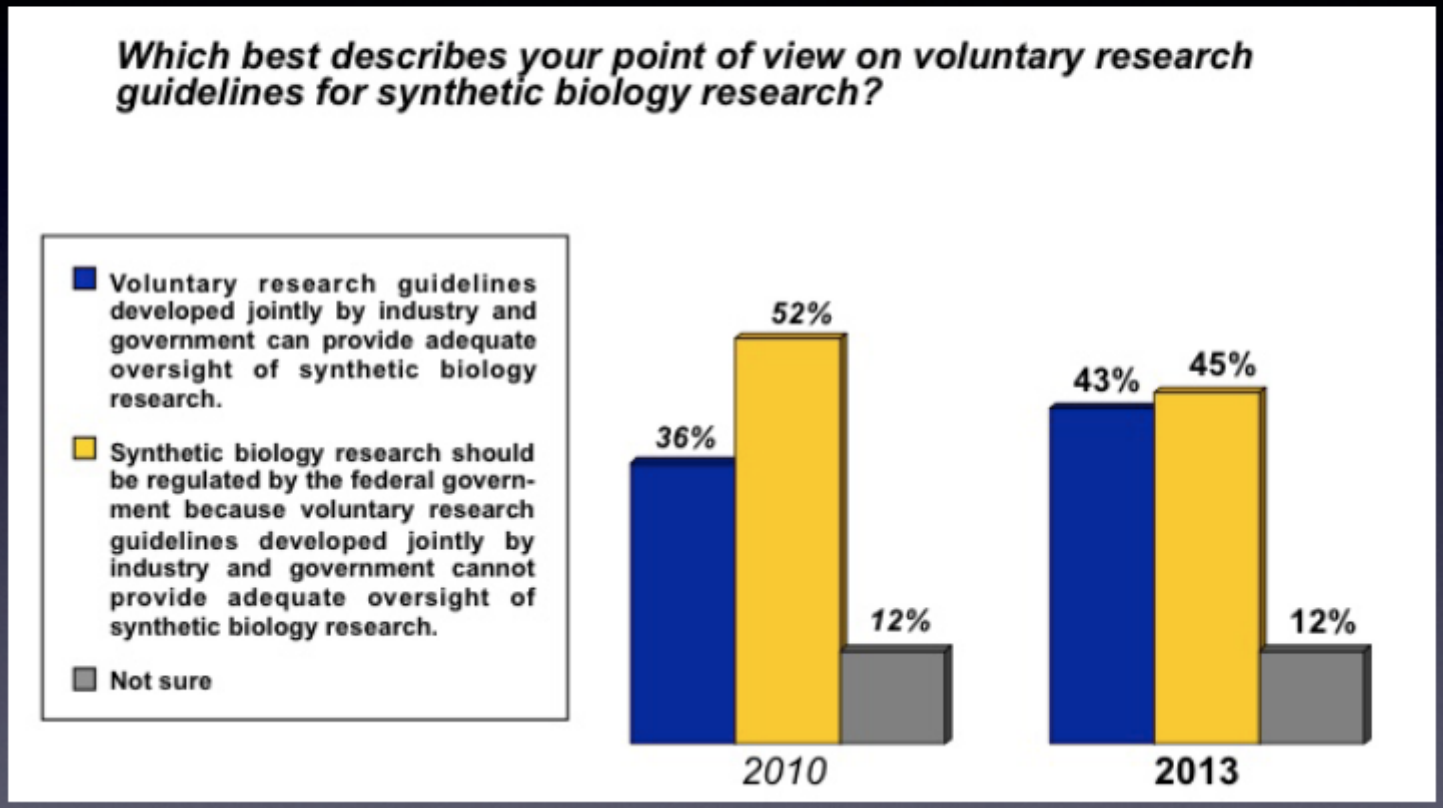
Voluntary or Mandatory Oversight?



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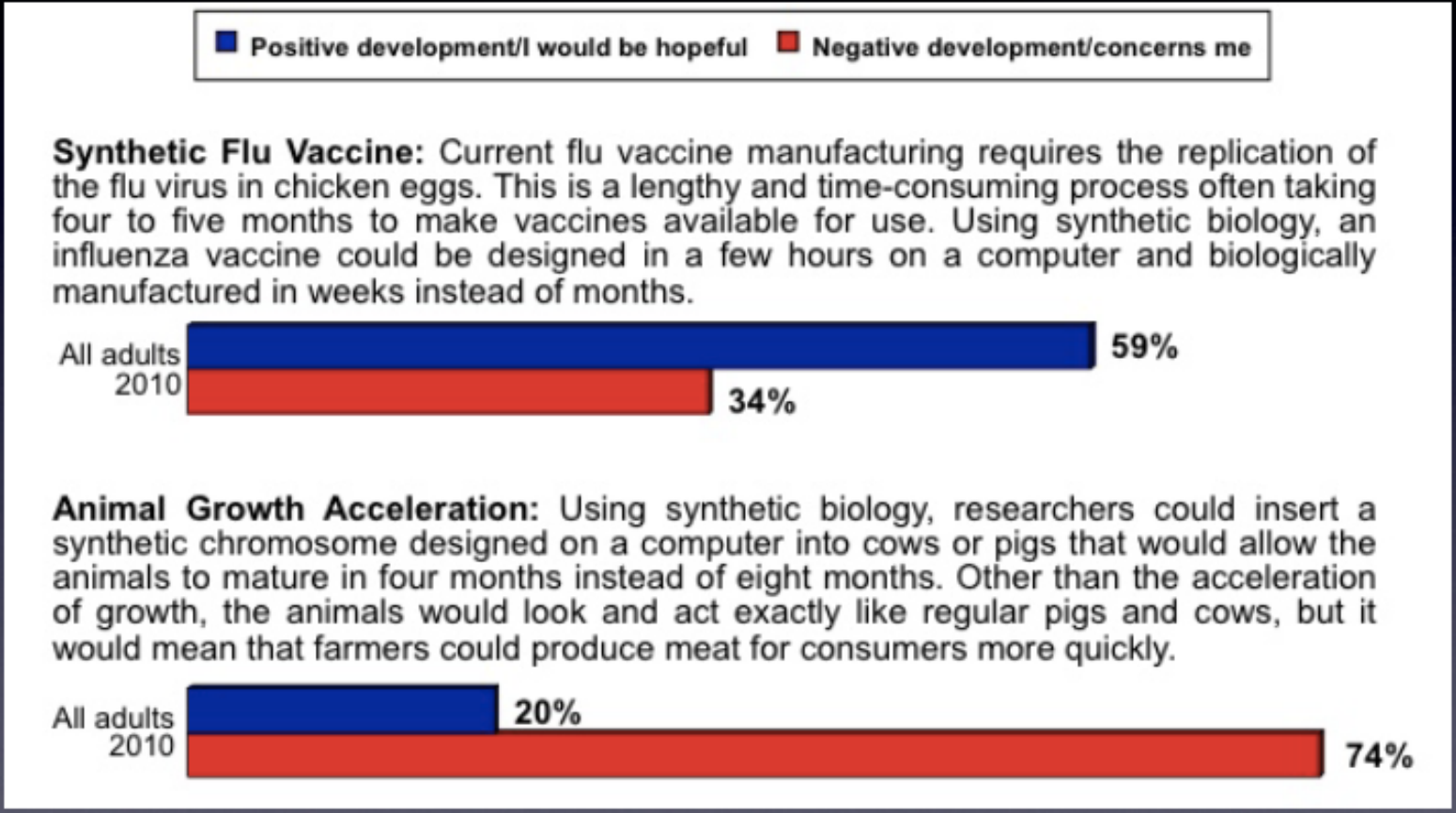
Applications Matter



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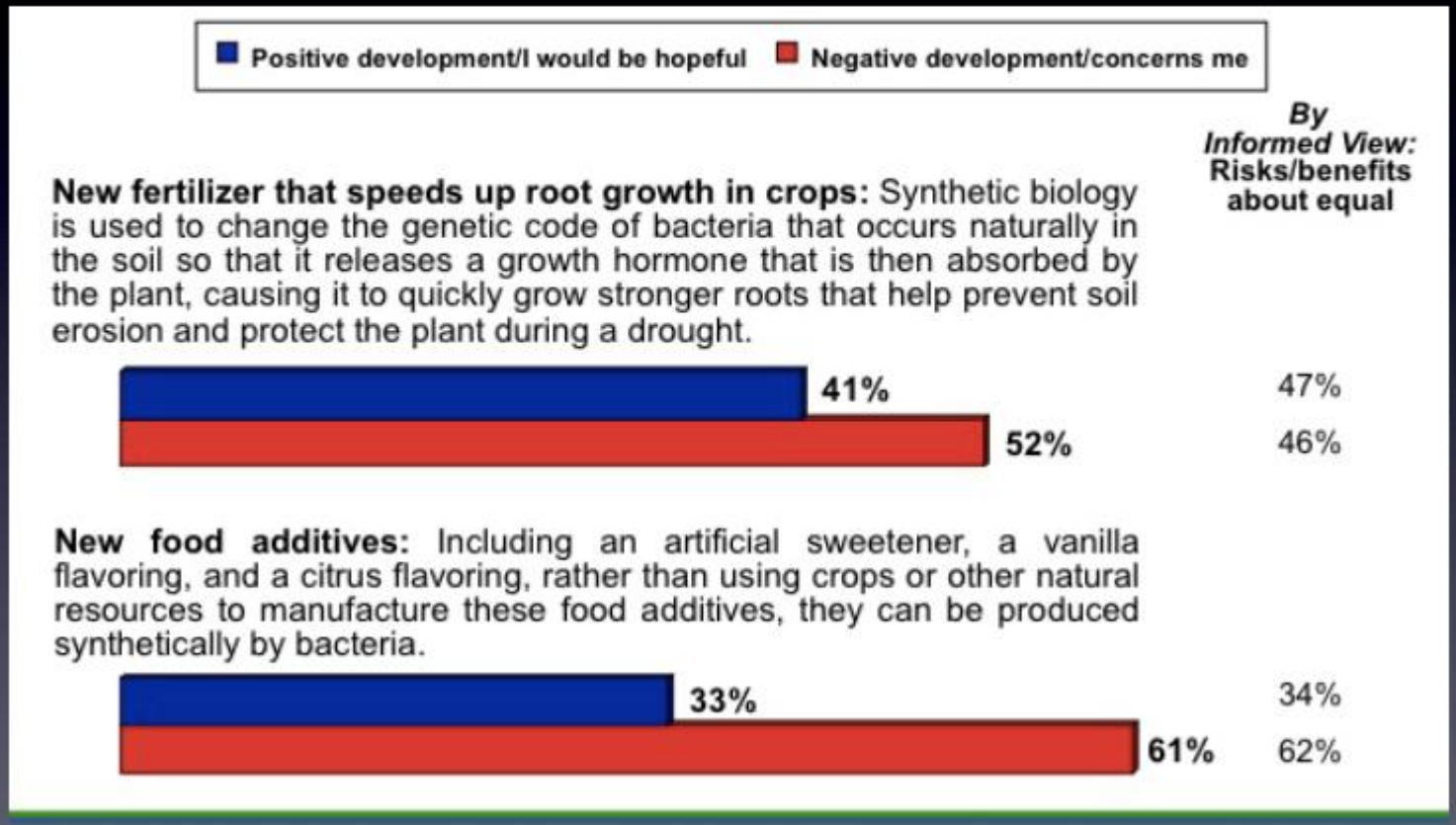
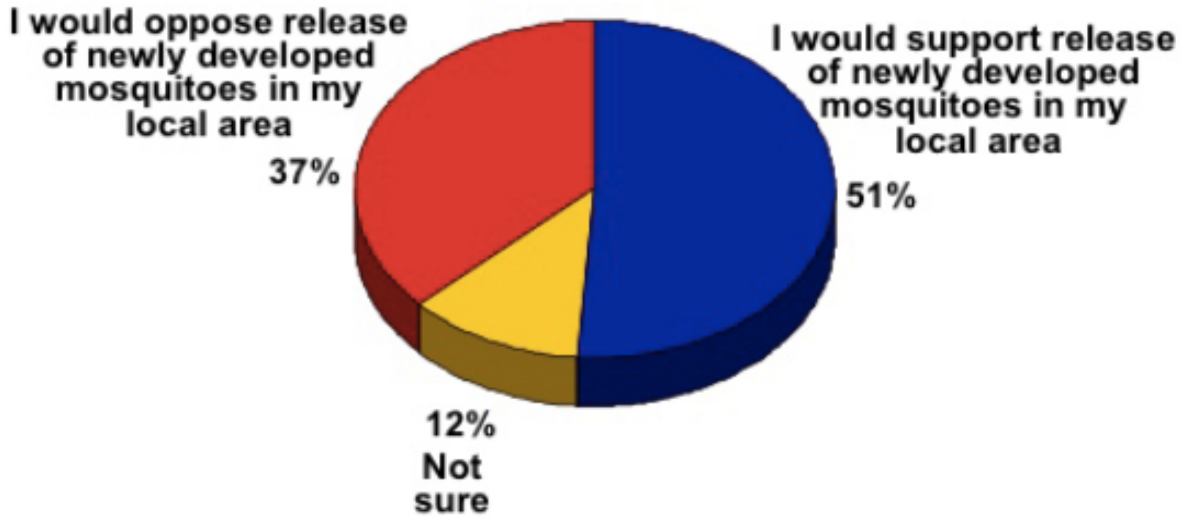
Food-related Applications



APPENDIX

Application: Mosquitoe-bourne Disease

Synthetic biology can be used to **engineer new versions of insects, such as mosquitoes, to help control diseases like West Nile virus**. The insects are modified using synthetic biology so that their offspring die or so that male insects are sterile, thus reducing insect populations that spread the disease. These new types of mosquitoes have already been released in Brazil and the Cayman Islands, and there is discussion of releasing them in Key West, Florida. If a mosquito-borne disease became an issue in my neighborhood:



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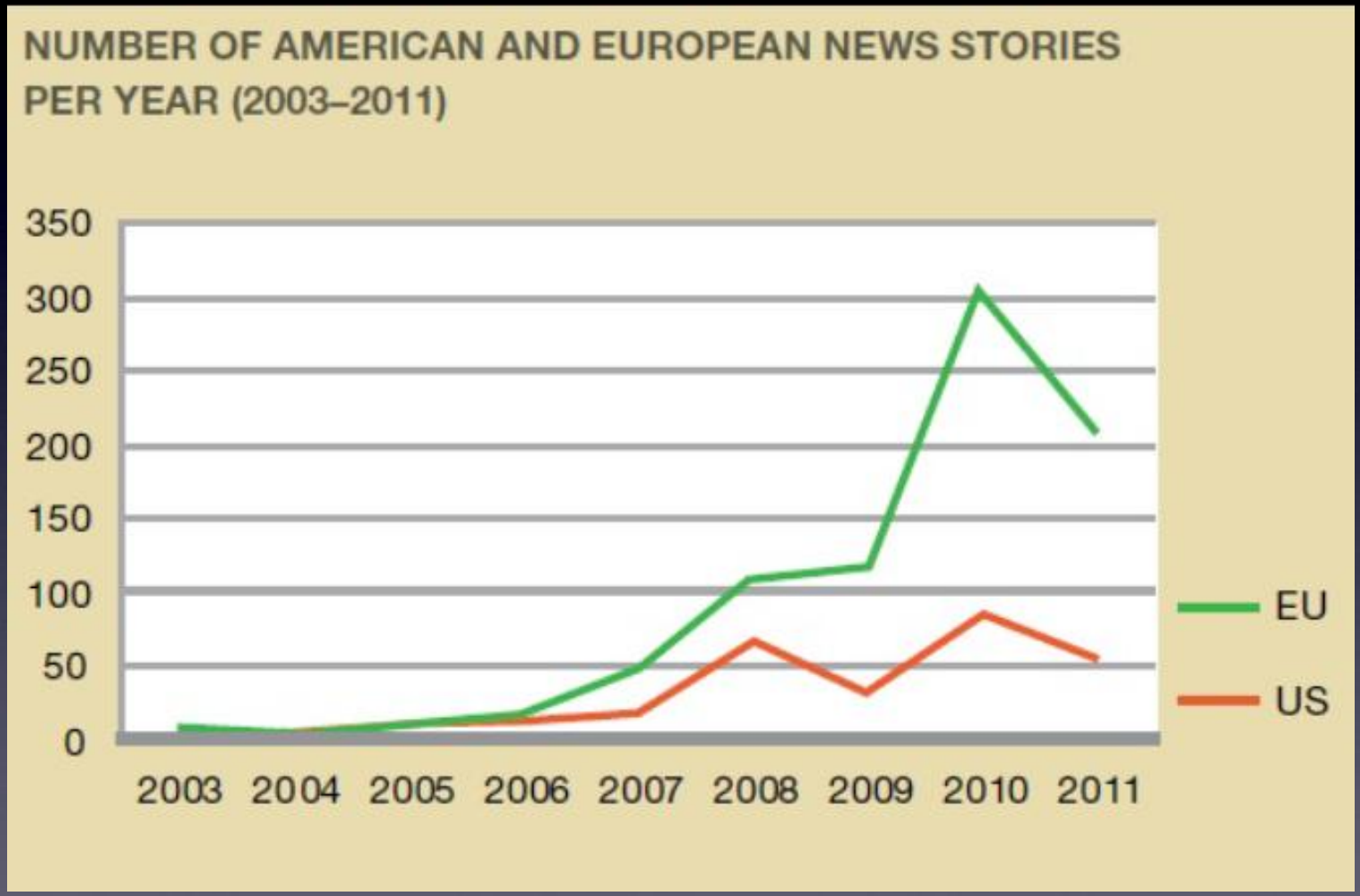
NUMBER OF AMERICAN AND EUROPEAN NEWS STORIES PER YEAR (2003–2011)
350
300
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
EU
US