

WORKSHOP ON THE RESEARCH AGENDA IN THE SOCIETAL ASPECTS OF SYNTHETIC BIOLOGY

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WHY SYNTHETIC BIOLOGY?

Synthetic Biology demarcated as emerging technology because:

- Diverse and dynamic nature
- Rapid growth
- Uncertainty but high stakes of its outcomes
- Different values operative in its assessment

“POLITICS OF NOVELTY”

“...the decision about the novelty of nanotechnology, or synthetic biology, or geoengineering, can be settled by neither the nature nor essence of those technologies, nor by the definition nor reference to the concept of novelty itself. Rather it needs to be settled – if indeed it can be settled – by a political process that references context and the particular aspects of the novelty at stake – its purposes” (Guston 2013).

THE WORKSHOP: 4-6 NOVEMBER 2014

PIs: Guston (ASU), Brian (ASU), Murray (Caltech)

115 people...

- US and EU
- Societal and S&E
- SynBio and Other ET
- Across career status
- Across sectors
- Across intellectual approaches



OPENING PLENARY

"WORKING TOGETHER AS A COMMUNITY TO DETERMINE WHAT RESPONSIBLE INNOVATION IS IN SYNTHETIC BIOLOGY." Dave Gusten

CLAIRE MARIS
KINGS COLLEGE

- We are being prevented from doing our work due to **SPECULATIVE ETHICS**
- Values are imbedded in technology.
- Values might Feed Us and Heal Us... and there are other paths

A CLAIM

- ***SB** makes it easier to engineer biology anyone anywhere
- Much of the work **ASSUMES**

THIS IS KEY !!

- We need to **OPEN UP THIS WORK**

"SYN-BIO PHOBIA"

- biased on deep rooted misunderstanding of how the public understands science

"PUBLIC CONTRAVERSITY"

- public debate where people CAN disagree

- We are expected to do the work of firefighters → deal with Fear
- Problematic = **Funded work**
 - It's Not easy... infrastructure, tools, prioritization, etc.

★ Social science workers SHOULD be doing social science.

- ↓ RISK ↑ PROMISES
- ↓ PERCEPTION ↑ UNDERSTANDING
- ↓ AMATEURS ↑ PROFESSIONALS

what KIND(S) of understanding do people bring to their thinking about SB?

what about RESEARCH about what they desire?

- No it's about understanding what **SB** means TO THEM.

KARMELLA HAYNES
@DRKHAYNES

- How should **I** be engaging? (challenge yourself)
- How to use my TIME most effectively??
- Women in Philanthropy looking for a big pile of cash...
- Think about why this matters to someone, not me:
- **COMMUNICATE a BROAD idea to a broad audience!!**
- Can you make TOO SIMPLE of an analogy?
- How to balance communicating to OUTSIDE people?
- Things do hide slowly.

1. How should I be engaging? (challenge yourself)

- Trip to the Capital, **LOOKING** for Support
- The RISK = losing Confidence in the technology.
- Don't talk about safety... unless you can WITH CONFIDENCE
- You can do this by Partnering with **SCIENTISTS + REGULATORS**

2. Accepting people's value of my work

- We can't very nuanced questions
- How do I advocate for my work and find the balance public feedback interests?
- Make a **BALANCED** conversation

RESEARCH AGENDAS of the SOCIETAL ASPECTS of SYNTHETIC BIOLOGY

Nov 4-6 2014
Tempe AZ

THERE'S A REALLY DIVERSE SET OF PEOPLE, a wide slice, IN THIS ROOM. Richard Murray

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DINNER PLENARY

ERIK FISHER - AGU

- * Sociotechnical integration
- considers and ADDRESS the societal impact on their work
- anywhere there is LEARNING where social/science occurs
- Small scale bottom up OPPORTUNITIES
- long term CAPACITY BUILDING
- strengthening COLLABORATION between Social Sciences + Society



3 DESIGN PRINCIPLES

1. Imbeddedness
2. Sustained
3. Open Ended

- DEVELOP COLLABORATE
- Think longer term

1. Scale Up
2. Incorporate Linkages
3. Create Communities of Integration Scholars

Ideally to create FEEDBACK loop

JAYDEE HANSON - CTR. FOR FOOD SAFETY

What kind of SB can have meaning for you?

SB: Xtreme Genetic Engineering

RISK ASSESSMENT MISSES ALOT

Precautionary Principle

Need to have ALL ALTERNATIVES ASSESSMENTS REGULATIONS

Full Research Agenda

We are super ALOT because the rest of policies are not in place.

We are REALLY good at USING the tools we have

Teaches you about what PEOPLE PERCEIVE = RISK

challenging

the TESTING cycle is dramatically shorter

A challenge: Which QUESTIONS CAN'T we ask? Fundamental to democratic society.

our current Food Safety rules WON'T WORK

VIRGINIA URSIN - MONCANTO

Focusing on what RESONATES for ME

FOOD LIFECYCLES

CONNECTIVITY

SB is an emergent technology

Consider the DEPLOYMENT of the product ... this makes it NO DIFFERENT

A lack of CONNECTIVITY will jeopardize the outcomes

Need Food Security GLOBALLY

Policy Community Enter the Continuum!

Foundational Science unincorporated by downstream theories

ED YOU - FBI

Need to take a step back

The Baking Bad Model

CAUTION: NOW there's NO protection Anyone can know your genetics

To see the BROADER PERSPECTIVE re: SECURITY

Today there's a security stand down

IGEM - The students ARE looking at DUEL USE OF SECURITY

Need to have a BROADER DISCUSSION !!

How to INTEGRATE security awareness from the gitgo?

WHAT KIND of WORK do WE WANT?

Perspectives from a variety of disciplines

JEFF MORRIS - EPA

SUBSTANCE: something other than food regulatory science information

Should we care? worry about their release without KNOWING, it's difficult to release the responsibility

What ROLE does GOVT play in GOVERNANCE?

leads to ALL SORTS of Questions

IF the public is going to be involved then they must KNOW the implications

push our Proponents incl. Commercial ones DISCLOSE

STEVE LADERMAN - AGILENT Technologies

We ARE interested in SB And we believe inter-disciplinary events = IMPORTANT

Investing because we believe SB will be adopted by all of our customer segments

It will be able to HELP US IMPROVE

We ARE part of Society.

Hazards and risks are probable. How to protect society?

This is NOT EASY... and we are enthusiastic by what IS possible?

What Scenarios relate to people, societal goals

The interdisciplinary pursuit provides

JIM THOMAS - ETC GROUP

FOUR PROPOSALS to throw out!!

1. Scholarship from the bottom. "Tron King" from below. Spending more time in the field. Listening to Experiences. Looking at Land grants.
2. Not embedded. "Get out of bed!" Funding does not require getting into bed for SB
3. Avoid solutions. Custom. Policy makers LIKE SOLUTIONS
4. ADDRESS the REVOLUTION!

LARRY BELL - MUSEUM OF SCIENCE - BOSTON

Public Engagement Science Project on SB

Raise capacity, hold events that stimulate interest, increase value

Identify people/museums - PULL them TOGETHER ...

Make a kit ... spread it out to 200 groups

Can we DO this work w/ less advanced work?

EXPDS !!

Public Interactive Activities w/ Public

FORUMS !!

Dialog and Gripping with Questions

All kinds of Groups - Interested - This is PRACTITIONER work!

How else can we INFLUENCE the science community?

How can we INFLUENCE this work?

There is an INDUSTRY that calls itself SB that's real, that's happening.

Questions and Comments from The Group

WEDNESDAY PLENARIES: US

WHAT KIND OF WORK ARE WE DOING NOW?

JENNIFER KUZMA North Carolina State

- WE NEED ways to INTEGRATE or at least MANAGE the domains
- What SHOULD we DO?
 - meet regularly, increase synergy, reduce duplication
 - ABOUT Risk Analysis and Governance
 - Identify ISSUES CAPTURE VISIONS
 - workshops
 - Interviews =
 - workshops
 - Markets - CHOOSE the Right People To Create a DIVERSE group.
- UNPACKING SB ROLE OF THE SIMPLER TOOLS
- Analyses - POLICY/ACADEMICALLY inspired testing and reports
- EXPERTS TALKED UNCERTAINTY Not to predict To offer insights
- NEEDED HERE Listening to Practitioners Need Getting our work out
- A Values mapping tool ... the I-D vision Created by IIGM team
- Reflect Evaluate, Compare
- More LOOKING for YOUR INPUT!!
- This was TOP DOWN

KEN OYE MIT

- Many people HERE CAN ADD to what I'll talk about
- HOW? I know I didn't know everything We put together groups
- DUAL PURPOSE PARTNERSHIP
 - Generating - Gathering
 - Critical to UNDERSTANDING
 - This is crucial Enhanced by WORKING ON the project
- SECURITY and SAFETY
 - The thresholds ARE coming down.
 - So we looked at diffusion
 - No one was looking at ALL the projects They slunked up the world ... and found ... 5000
 - There were major misses
 - IIGM was screening
 - LEARNED ALOT!! What are you not doing IF used not been participating ACTIVELY
- ENVIRONMENT
 - A miracle happened! Everyone agreed on the need for PUBLIC FUNDING
 - There's a lot of fear
 - There's a need for RESPONSIVE INNOVATION
 - This is important
- POLITICAL ECONOMY
 - Tech-Industrial Policy
 - Considerations could include rules re:
 - IP, PRIVACY
 - ENVIRONMENTAL
 - SECURITY
 - Also need to consider

DIETRAM SCHEFFLE University of Wisconsin-Madison

- TO DO, where the PUBLIC STAYS on SB
- Identify + Integrate CUES HERE
- Academic research for SB starts popping up
- Searches only issues that will REQUIRE MORE WORK on our part
- TRUSTING US THEM TRUST
- When performance is low, TRUST MATTERS
- we need to BUILD trust, with an outlook in Science
- DEFERENCE TO SCIENTIFIC AUTHORITY
- we also committed we UNDERSTAND the facts we believe Science is a UNIQUE way of KNOWING And That Science is good For the Public Good
- TERNS that we'll know how does that impact
- we need to FRAME terminology
- allows us to make decision w/o knowledge
- Implications for US HOW WE TALK about it
- There IS a HISTORY of talking like this
- Lock out the literature out there on WHAT SUMMERS CAN + CANNOT

GREG KAEBNICK The Hastings Center

- Identify new parts and aggressively non-profit
- Our projects
 - Want to develop a framework based in on questions re: intrinsic moral boundaries (w/ SB)
 - The idea of engineering
 - Concern of human encroachment on nature
 - IS IMPORTANT - To engage at these ways of thinking Separate
 - IS DEEPLY HELD LEGITIMATE - but it's NOT COMPELLING
 - What REALLY MATTERS - The construction of the world as we know it
- 2. A report that King about "The Next Step" under lying "Conceptual/moral questions" - the degree to which a moral society ...
- How to make PUBLIC ENGAGEMENT a more meaningful part of the right papers
- How to direct new technology? - To go wherever want it to go
- THE PHILOSOPHY OF RISK
 - THE MODELS
 - How it's weighted?
 - Identify values at stake
 - Do they align w/ President's priorities?

PHIL SHAPIRA University of Manchester

- Trying to develop new METHODS - analyzing trends
- OUR take on YOUR work - Social Science contributes to SB and nanotechnology
- PUBLISHING
- WHAT CAN WE LEARN FROM ALL THE THEORY THAT'S BEING DONE?
- SB BUILDS out from work on Genomes - from a different tradition
- IT'S ALREADY begun ...
 - Not starting with blank sheet of paper
 - It's got traction
 - BROADEN our collaboratives (Asia, developing countries)
 - Capabilities ... Understanding or Embedded Evaluation from the start
- SB is a General Purpose Platform - Cuts across domains

LUIS CAMPOS University of New Mexico

- SHINY SPOT cluster of ideas?
- What can I do here?
 - Listening observing
 - Listening to inspirational stories
 - Noticing - what goes unsaid
 - Pay attention to context, ideas, and more
 - social science Researcher should DO the work of social science
 - what IF - what IF - what IF - what IF
 - History is interpretation of the past
 - WE NEED to have a SHARED RESEARCH agenda for the WORLD of science
 - don't need pre-negotiated historical to find surprising interesting

PHIL SHAPIRA University of Manchester

- Core part of the COMPARISON - closer to a bio-engineering way of thinking
- Nano + SB = Different Vision, Knowledge, Public Engagement, Integration
- very little OVERLAP in settings
- do we DEVELOP new tools?

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WEDNESDAY PLENARIES: EU

JANE CALVERT University of Edinburgh

- Involved in the Edinburgh Network and The Yeast Project and a SB research center - All funded by the Scientific Research Council
- Also involved in IGEN - encouraging CONNECTIVITY and their evangelism
- And SB 5.0 - on an incredibly problematic panel
- And SB 6.0 - on the planning team, incorporated ethics
- With the SB Road map - also problematic

"I'm very interested particularly in the relationship between **BIOLOGICAL** and **ENGINEERING**"

What WE DO?

we partner with museums, science centers, corporations

A VERY INCLUSIVE APPROACH - we are appreciated for !!

THRU OUR We will bring in External Experts FORUMS

At the moment - Creating infrastructure - Creating agendas - POLICY PARTICIPATION - RESEARCH

on the BENEFITS of public discourse

Really Grateful for YOUR comments and Suggestions

Looking to create **NEW SPACES** - where people can come together - where social sciences can realize

Really Grateful for YOUR comments and Suggestions

where people can come together

where social sciences can realize

FYI: Jane needs to be **AUTONOMOUSLY** Funded.

My relationships are different, in part because of THEIR Sympathy to MY approach - Scientists often bring assumptions

CHRISTOPHER COENEN KIT Karlsruhe Institute of Technology

An organization + mutual action plan

- we had workshops, public discourse, created papers with public and university etc
- *UNIQUE to us - larger amount of public dialog

PUBLIC DIALOG and **CONVERSATIONS w/ STAKEHOLDERS**

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ANA DELGADO

- Looking at how to apply a **DIY** approach
- The project investigates scientific tools and practices are becoming digital

There's NO research !!

How can **RESPONSIBILITY + INTEGRATION** be applied to scientific enterprise?

How to share? 1st work package

- Storytelling
- Different methods of distribution
- Focuses on ethics + open source

Design practices: 2nd work pkg

- Open software
- New programs

Governance Inclusive: 3rd work pkg

- Focusing on innovation and
- Colleague engagement

META-analysis - 4th work package

What is the political economy of SHARING what does it mean?

WHAT KIND OF WORK

MARGARET ENGELHARD European Academy Gmü

outside university/industry to do the research

PERMITTE Sound Discussions about BioTech

GROUPS form for 3 Years - many disciplines

discussing SB as a whole - accurate and - courses conflict

DIFFERENTIATING THE DISCUSSION

lock for the POINTS that are NEW

CONTINUITY Argument

- it has MANY ROLES
- the context is important - to integrate it into research and in political discussions

THE FRAMING OF SB

- the field is EVEN MORE DIVERSE
- by the scientific background of participant
- it's NOT clear
- doesn't reflect the situation

EXAMPLES

- quality-wise
- quantity-wise
- for humanity
- for lives

Focus on PARTICULARITY

- Rules of familiarity - what you know then you judge the similarity
- It can become more complicated

As a DIFFERENT DEPTH of SB introduces a NEW societal context

- It's all a NEW KIND of Cultural Change

There's an ON-GOING Assessment in Germany re: SB

- The idea originally came from other countries - before we start...

WHAT KIND OF WORK ARE WE DOING NOW?

MORGAN MEYER Ago Paris Tech

DIY BIOLOGY

- There's a STRONG LINK with IGEN
- SPACES SOCIALLY, TECHNOLOGY, EQUIPMENT AND ECONOMICALLY
- Regular regular manufacture - much easier

OPENING UP BIOLOGY

STILL STRONG BOUNDARIES

What about Health Policy etc?

The conversation continues

What happens if it falls into the wrong hands?

ERONKIST? SURETY?

It's just about **DIY Yourself**

- to have the capability to enable one to be an active producer of knowledge
- Someone who actively ENGAGES
- a connected individual
- others university

creative work grounds

- with objects
- with institutions

IN THE WORKS =

- code of ethics
- Created in US, in EU
- practical procedures guidelines developed
- relationship w/ FBI
- code in US
- unclear in Europe

cost of setting up decades

Grants

Kickstarters

Job creation - on the rise

Will there be a PEACEFUL COEXISTENCE betw. Market Logic s?

DIRK STEMERDING Rathenau

MOVING FROM RISK TO INNOVATION

GOVERNANCE

our main focus - IMPLICATIONS

- Urging MORE ENGAGEMENT from SOCIETY

PROJECTS and ILLUSTRATE

1. A close collaboration with IGEN community - SB Futures

- For anti-biotics resistance

2. Working with a Belgium soap maker - Eco-boost - its oil use (from palm-oil)

- a problem created by Smbi - not be well received
- does this create a "more sustainable" product
- Amore to BIO BASED Economy - we will need the TOOLS of SB

3. GM

WHAT are we? placing possible futures in a talking about?

- Systematic - organized way
- Beginning by thinking about the Present

Next Steps: workshops to discuss the PLAUSSIBILITIES and flesh out an agenda

Issues in Parliament today

- Intimate Technology in the Netherlands
- It's slow and cautious in Germany
- want to have the discussion but...

Today when governing funding in Germany

- Projects are provided - conversations are approached

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Research Agenda in the Societal Aspects of Synthetic Biology - Nov 2017

AN HOUR WITH ASU PRESIDENT CROW



SESSIONS



Anticipation & Futures
Bioeconomy
Biosafety & Biosecurity
Governance
Informal Science
Education
Research & Innovation
Systems Analysis
Responsible Innovation
DIY/Makers
Ethics
Integration & Reflexivity
Public Opinion & Values
Risk & Sustainability

REPORT BACK FROM BREAK-OUT GROUPS: WHAT KIND OF WORK DO WE WANT TO DO?

ANTICIPATION

- How to EVALUATE? social not just technical
- EMPOWER EXPERTS to produce the future
- Participation AND Anticipation
- lots of DIFFERENT interests + angles
- WHO do we BELIEVE? left uninvolved
- How to BELIEVE? how to account for PRIVACY and SECURITY
- How to BELIEVE? how to account for PRIVACY and SECURITY

BIOECONOMY

Restored AND learned ADT

- What is INCLUDED?
- HOW is it EMERGING?
- FUNDING STRUCTURES
- VALUES - where is the coming from?
- ONGOING RESEARCH
- RESEARCH QUESTIONS =
- History of the term
- Empirical work
- Life cycle analysis of new products
- Comparative work on imaginative futures
- The Bioeconomy in contrast to other forms of economic growth
- Scale
- Need welcome EXPERTS help to flesh out these questions

BIO SAFETY

A RANGE OF CONCERNS

- The focus so far: Production vs Effects
- STUDIES - what's needed? At what stage? What level, scale, timeframe
- STRUCTURE - sufficient data needed for the pathway
- VALUES to assign to quantification
- CAUTION re: Broadening the agenda?
- CULTURE EDUCATION
- lots of questions about
- What about INVASIVE SPECIES?
- What are the conditions of RESP?

GOVERNANCE

Research - gap analysis / looking for other than computing

- How does it relate to risks?
- Where is the POWER?
- The Ecology of G. the eukaryotes
- What is the RATIO of change? can we change that?
- What Qs are asked?
- European vs US - both requesting changes to consider
- Combining in the non-EU
- Governance applies ACROSS ALL portions
- What does it mean for our personal lives? ENGAGEMENT

FUTURES

JGE has substantial research from DECADES of work, focused on UNDERSTANDING science

Now moving to ENGAGING with SCIENCE

- How to MEASURE the impact of environment / economies?
- What is SB? is it anything?
- How to ATTRACT scientists to talk with the public?
- How to ATTRACT scientists to talk with the public?

RESEARCH and INNOVATION SYSTEMS ANALYSIS

- WHAT is it? - Who is doing this? - when and where? - what implications?
- HOW to Define - Look at current papers - SEARCH TERMS - TOO simplistic - TOO complicated - Plasma and Veret - Funding and Researchers don't collate in France
- Data & Tools - leads to Education opportunities - What is out there?
- Good Designs - Good social science design!!

BIOSECURITY

an incident in a bio lab that is a security

ROB can occur on many different levels

Examine its implications

Define the BROADER field

- WHERE does it present?
- Scientists as a RESOURCE
- How is RESPONSIBLE defined?
- How can INNOVATION
- Articulate SOCIAL DESIGN CRITERIA
- Define the field - Establish center for it

ETHICS

Whatever the practices are, and the examples

There's NO monopoly - Some flexibility!

- Could SB be a sub-field of other work?
- Responsibility and Authority - Can it be diluted?
- Broader Social Justice - Is there space?
- Education and Outreach - Come to our conference and help us understand ethics of our work

PUBLIC OPINION

Got to ask "WHAT?" - need to be fine grained questions - cause the public doesn't know SB.

WHY? ask the public... - marketing - you actually want to KNOW

- Lots of Books and publications
- Lots of quantitative data available
- The public is NOT stupid... train them.
- Interested in serious conversations - And surprised how far this conversation's gone without defining / definitions

INFORMAL SCIENCE

Now moving to ENGAGING with SCIENCE

- How to ATTRACT scientists to talk with the public?
- How to ATTRACT scientists to talk with the public?

EDUCATION

leads to Education opportunities

What is out there?

RESPONSIBLE INNOVATION

Define the field - Establish center for it

INTEGRATION

bringing together a landscape of diverse perspectives

They are RESOURCES

in the field - concepts, once explained - little disagreement

- HOW MUCH
- WHO has the POWER
- What CAN be Learned in Context of Research
- How Reflective are...
- What is the ROLE of Evidence?
- How can we LEARN...
- Barriers - a form of awareness - opens to action

VALUES and RISK and SUSTAINABILITY

Risk should always be considered MORE BROADLY

Sustainability is more normative

TOGETHER OR SEPARATE

How? - what level? - individual or nation wide? - how long, you don't know the effects (months to years)

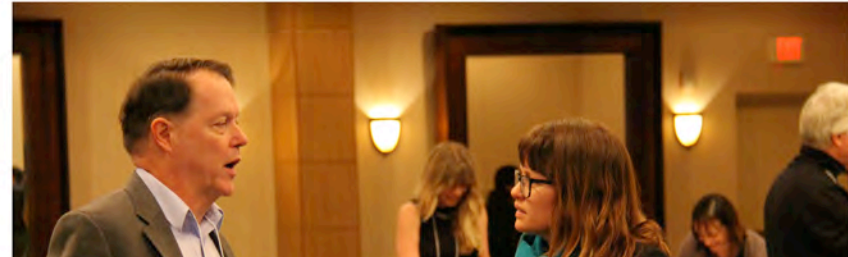
What is SAFE? What is really NOT SAFE?

Comp nms / NGOs wanted RISK assessments for VERY DIFFERENT reasons = Uses

N II



THURSDAY PLENARY



BIOECONOMY

Comparative and international research will be critical for making US policy in an era of the globalization of bioeconomies and of global biological systems. Participants grappled with what gets included and what gets ignored, the mechanisms by which a bioeconomy emerges and flourishes, and what gets lost/distribution of outcomes in that transition.

- **Significant lack of information and very few sources of data**
- **Research interests: history of the term, life cycle analyses of new products, comparative work on imaginative futures, and the bioeconomy in contrast to other forms of economic growth**

RESPONSIBLE INNOVATION

Effort to try to establish more clearly articulated societal design criteria, expand the solution space, and make choices more explicit and transparent

- How can innovation systems internalize RI processes as distinct from regulatory oversight?
- What are the conditions that would make responsible development in syn bio possible? What processes and institutions do we need?
- Systematic consideration of alternative pathways for achieving stated goals of synthetic biology research. For a given “promise”, what are other social/technical means of delivering on it?

GOVERNANCE

Governance is not just about regulations, but the interactions among different sources of power in society. Therefore, there is a need for creativity, flexibility and new analytic and policy frameworks.

- Can governance issues be generalized across emerging technologies?
- Participants requested assistance from federal agencies for creating formal pathways for research to reach policymaking bodies. Strengthening (or creating, in some cases) a more efficient feedback loop between social scientists, policymakers and scientists is a critical need.
- Coordinated and systematic mappings of international/transnational policies and governance structures as they emerge to produce comparative analyses of policies.

STYLE

The most important concern was finding the right balance of integrative and independent social science research.

- **Embeddedness model keeps social science grounded and real**
- **The technical and social sides do not dictate what the other does; differences are complementary and open up research possibilities through awareness and humility**
 - Specific mechanisms, such as mechanism in review process to decline funding for a poorly integrated and embedded project, may help promote appropriate degree of independence

SCALE

Absent a large national synthetic biology program, do we need or want a large ‘societal aspects of synthetic biology program?’

- **Important opportunity to step away from the “ethical, legal and social implications” (ELSI) model in which the social side is funded only through the technical side.**
 - ELSI model minimizes scope and credibility of social science and humanities work by making it contingent on scientific funding
- **Large scale and independent funding critical for success of cooperative and collaborative research agendas**

RECOMMENDATION 1

Federal agencies sponsoring synthetic biology should pay special attention to societal research on synthetic biology, even in the absence of a national initiative.

RECOMMENDATION 2

Federal support for synthetic biology should ideally pursue a co-constructed synthetic biology that would develop a truly integrated research program and be a model of responsible innovation.

RECOMMENDATION 3

Federal support for societal research on synthetic biology should include large-, medium-, and small-scale activities in order to achieve appropriate combinations of independence and interdisciplinary coordination.

RECOMMENDATION 4

A funding model that relies solely on co-funding societal research with science and engineering research should not be pursued; nevertheless, co-funding should still be an important instrument and proposals from both societal and S&E investigators should be evaluated in part by how well they integrate knowledge across disciplines.

RECOMMENDATION 5

Federal support for synthetic biology should be sensitive to the power differentials between S&E researchers and societal researchers in designing funding models and articulating expectations.

RECOMMENDATION 6

Federal support for synthetic biology should be prepared to fund societal research in a number of fields and design programs to take advantage of potential synergies across them.

RECOMMENDATION 7

Federal support for synthetic biology should consider and develop ways of connecting societal research with informal science education about synthetic biology, among other areas.

RESOURCES:

CNS.ASU.EDU/SYNBIO

Workshop agenda

Workshop posters

Workshop reflections

Workshop reports

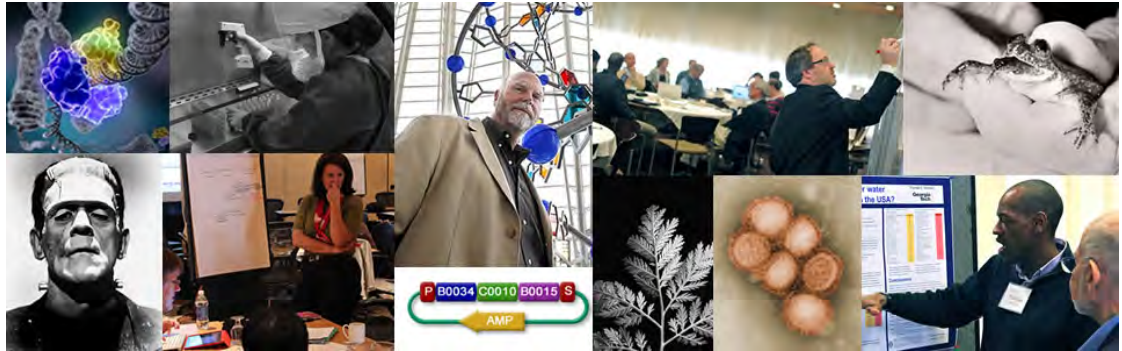
(workshop/eval)

Interviews (coming soon)

Background papers

Bibliography

Glossary



RESEARCH AGENDAS of
the SOCIETAL ASPECTS of
SYNTHETIC BIOLOGY

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Tempe AZ

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~115 Workshop attendees

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