



# Pacific Rim Summit on Industrial Biotechnology and Bioenergy

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NANCY J KELLEY  
+ ASSOCIATES



# Year-Long Sustainability Survey

# 110

Our Process with the Synthetic Biology Community:



Created and led 9 working groups with a total of **100** members



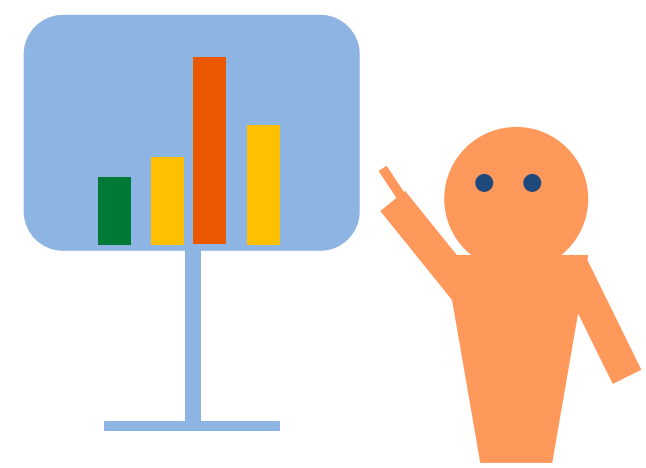
Performed a full review of the literature:

# 500

reports and documents

Published several articles and comprehensive industry surveys

interviews with companies, scientists, and community members across the globe



Multiple presentations at synbio community events

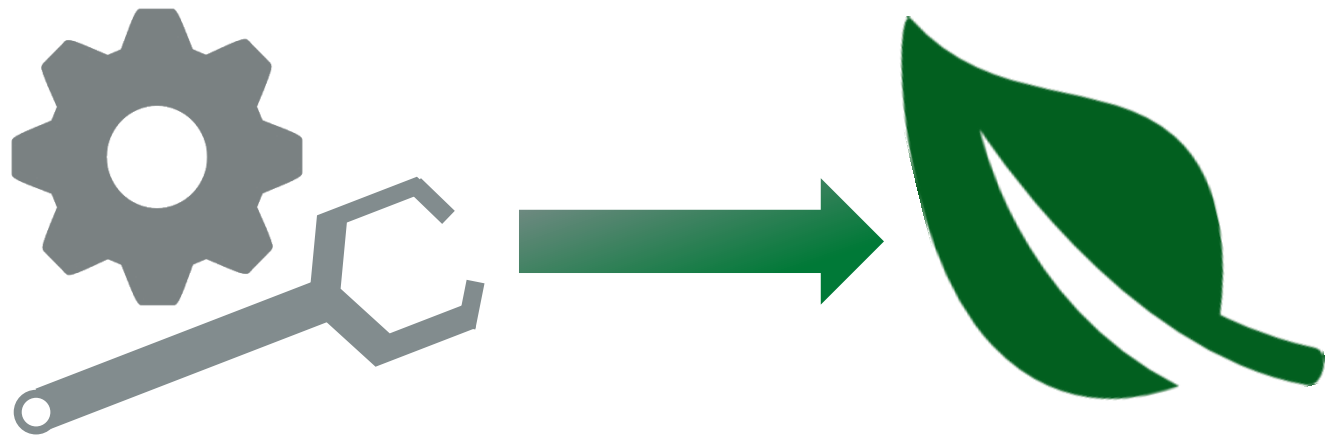
Brainstorming sessions with over

# 300

community members

# Synthetic Biology: The Next Big Thing

## What is it?



## Next Wave of Biotechnology

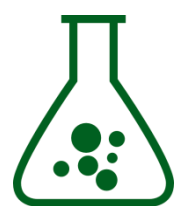
Synbio combines an engineering approach to (1) design new biological parts, devices, and systems at a molecular level or (2) re-design existing biological systems for useful purposes

Synbio is set to change the world in many profound ways.

# Synbio Impact



**Energy:** algae based biofuels



**Chemicals:** synthetically derived with few environmental implications



**Healthcare:** faster response to pandemics



**Agriculture:** Higher yielding foods

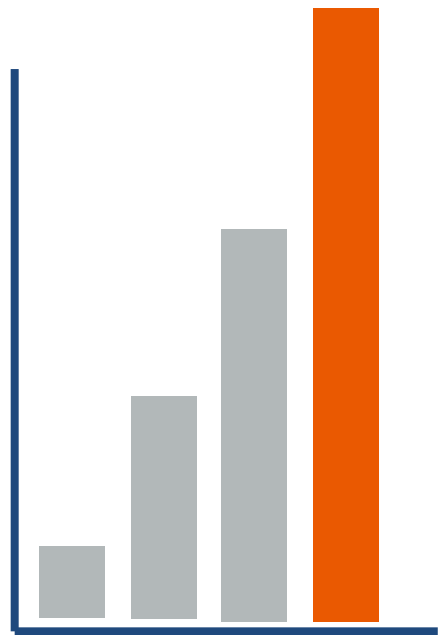


**Bioremediation:** biodispersants against oil pollution

Broad Impact Makes Synbio a Critical Component to Future Competitive Advantage



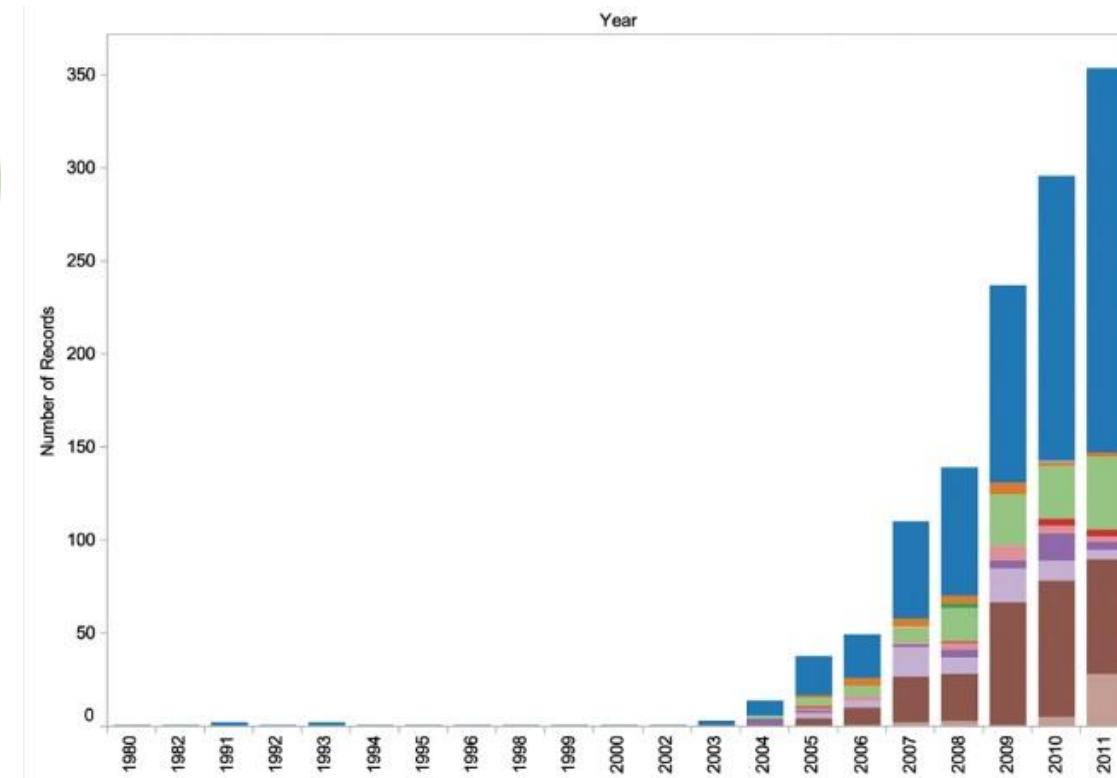
# A Burgeoning Field



\$1.6 billion in 2011

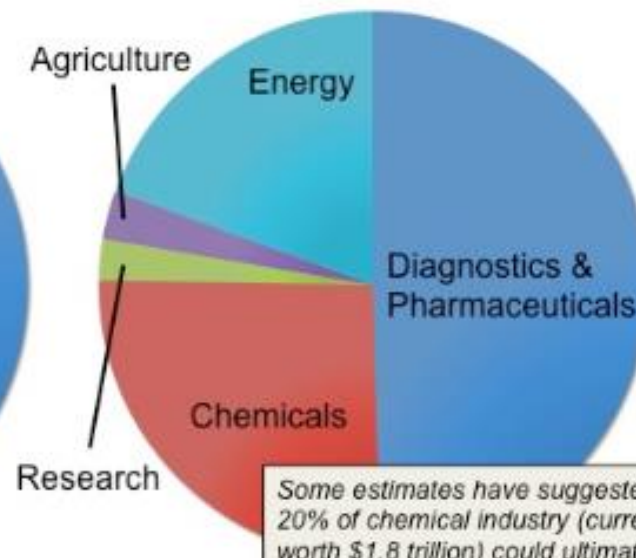
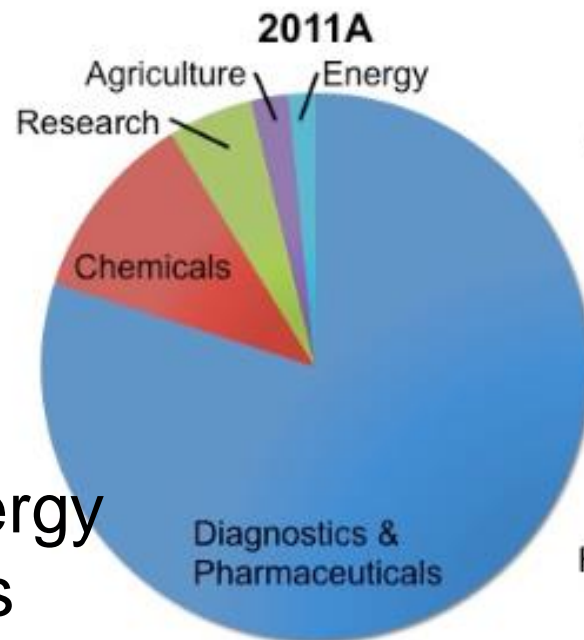
45% CAGR

\$11 billion in 2016  
2016E



Oldham, P., Hall, S. & Burton, G. Synthetic biology: mapping the scientific landscape. PLoS One 7, e34368 (2012).

\$500m - \$1 billion  
govt. investment



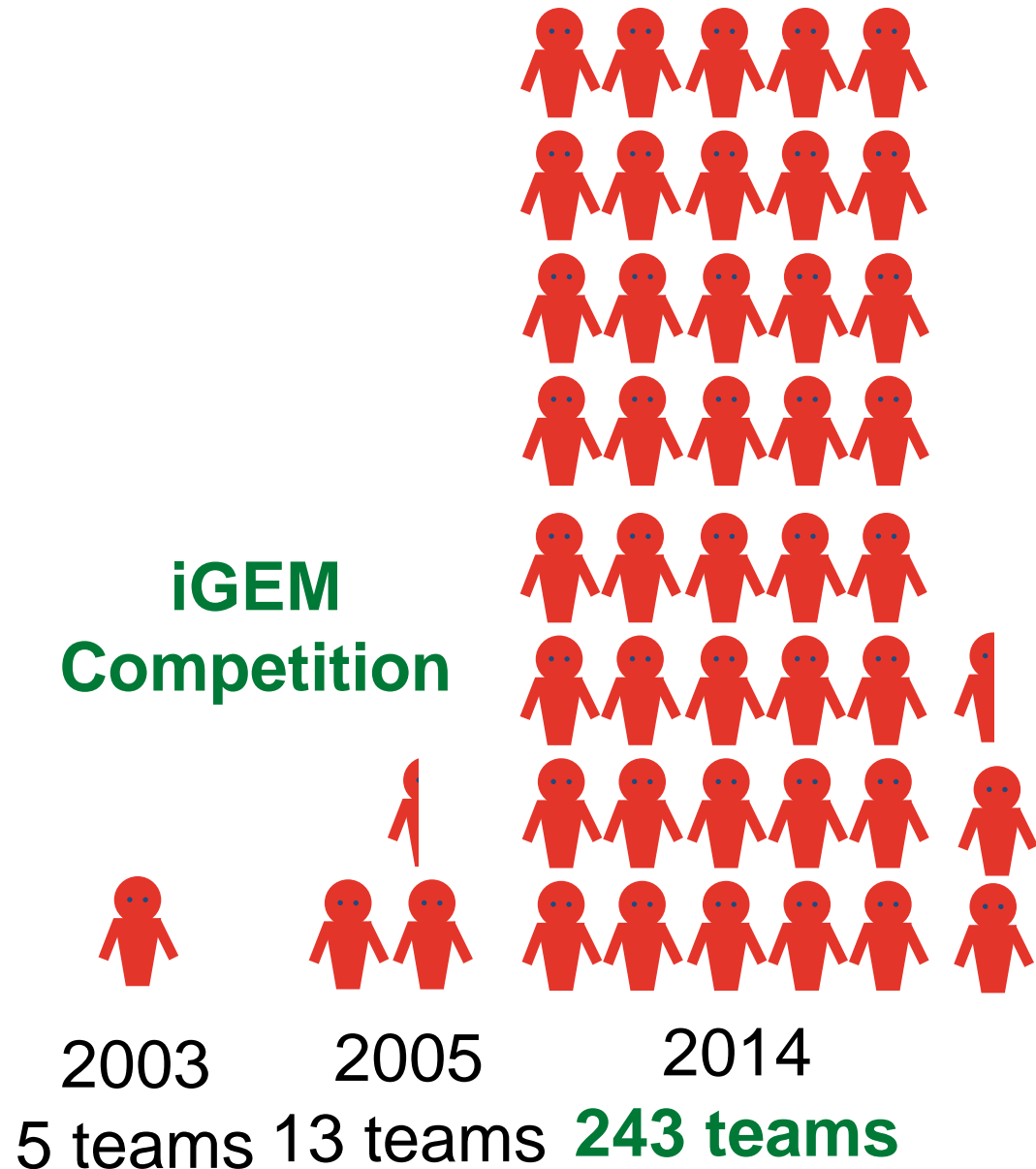
Some estimates have suggested 20% of chemical industry (currently worth \$1.8 trillion) could ultimately be dependent upon synbio.

Shift towards Energy  
and Chemicals

Academic Articles  
mentioning "Synbio"

# A Burgeoning Field

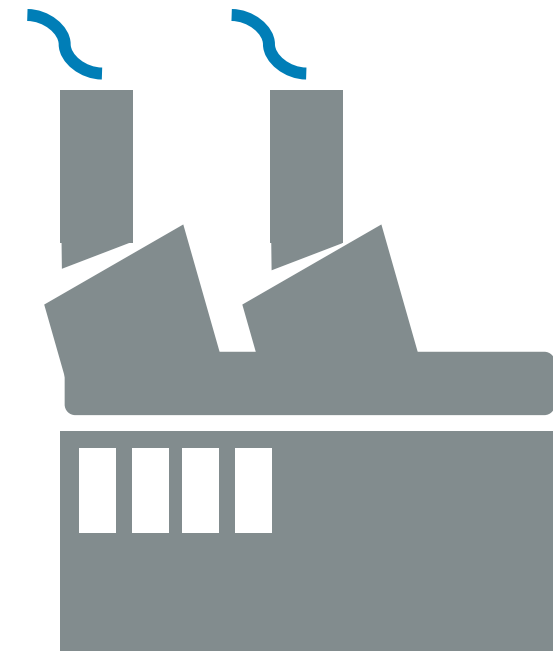
## iGEM Competition



33 **new academic courses** developed

+

**New centers** being developed: Wyss, MIT, Berkeley, etc.



2009: **61** companies  
 2013: **192** companies

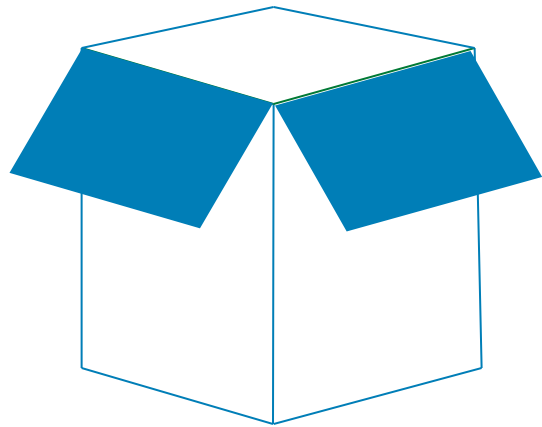


# New Ways of Working

- Collegial Culture: Focus on Collaboration
- Virtual Global Laboratories
- Fully Automated Laboratories
- Crowd Sourcing:
  - Funding
  - Labor
  - Problem Solving
- DIY Movement

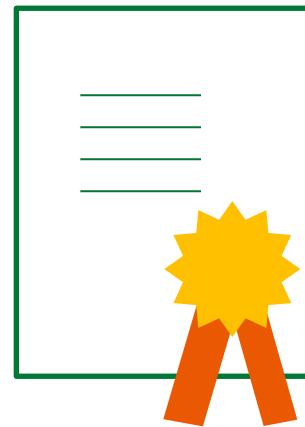
# Synbio IP

## Two Distinct IP Cultures in Synbio:



### **Open Source Advocates**

*Direct response to  
academic collegiality*



### **Patent Protector Advocates**

*Necessary to hedge start-up  
risk, commercial incentive*

Which mechanism is  
better at driving  
innovation?

Some advocate a  
**‘diverse ecology’** where  
parts are standards and  
open source,  
combinations patentable





# Regulatory Patchwork

No governing body for synbio: patchwork of agencies around end products

Numerous Social & Ethical Issues Being Considered:

Commercial monopolies on patenting life

Environmental Contamination

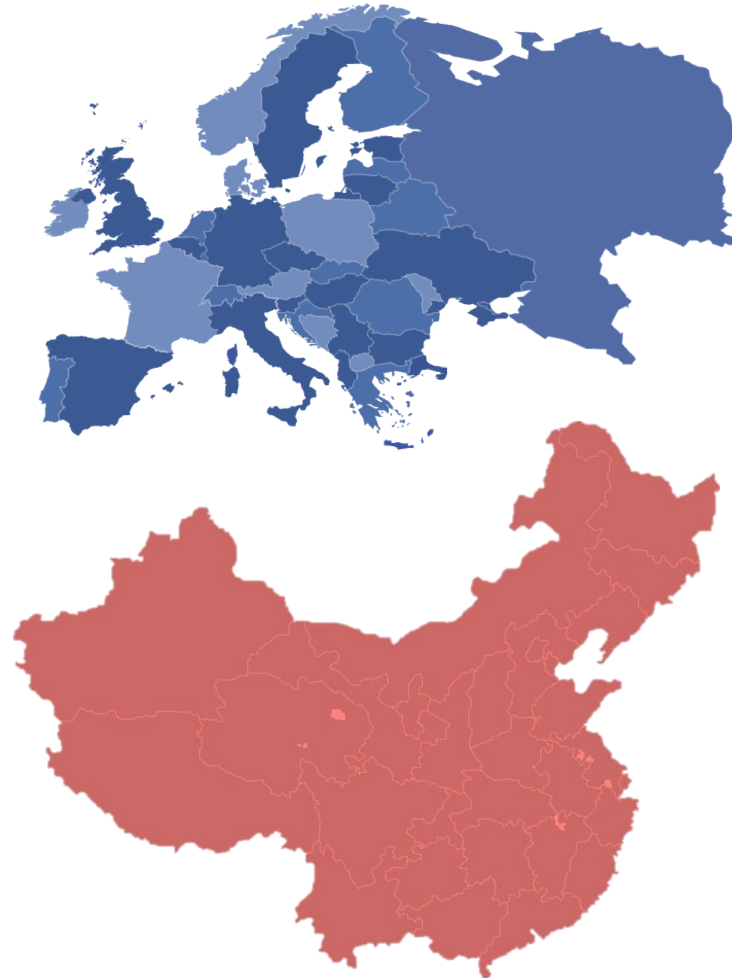
Bioweapons and Warfare

Globalization of practices that threatened indigenous ways of life

Unethical Manipulation

# Global Competition

China, UK, Europe  
have coordinated  
agendas and  
funding structures;  
US does not



Difference is primarily by who is **driving** the industry: in the US, synbio is driven by academia through govt. grants, Europe is driven by government with focus on foundational development and commercial successes



# Global Treaties, Agreements

Several important documents:

- Convention on Biological Diversity
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity
- Nagoya Protocol
- The Biological Weapons Convention
- Austria Group Guidelines



The Australia Group



# What Roadblocks Exist

**Roadmaps and Research  
Agendas**

**Funding for Fundamental  
Research**

**Accessible Infrastructure for  
Those Outside of Academia**

**Spaces for Design, Testing, Scale-Up  
and Commercial Manufacture**

**Public Awareness and  
Acceptance**

**Education, Workforce, and  
Leadership Development**

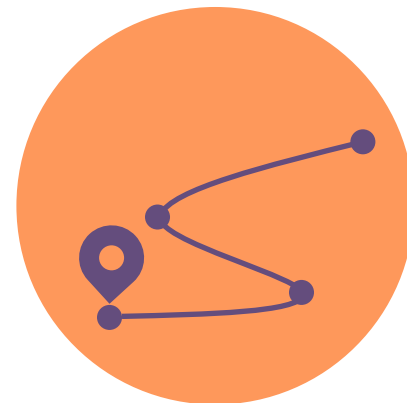
**Informed and Malleable  
Regulatory Process**

**International Collaboration**

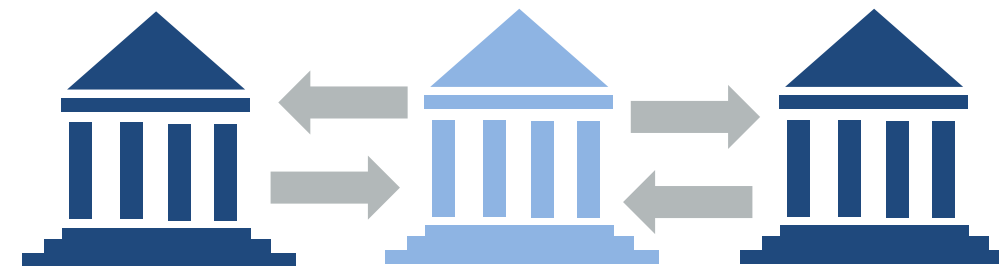
# What the Community Needs



State-of-the-Art Labs Focused on Fundamental and Translational Research (Accessible to entrepreneurs, industry members, regulators, policy-makers)



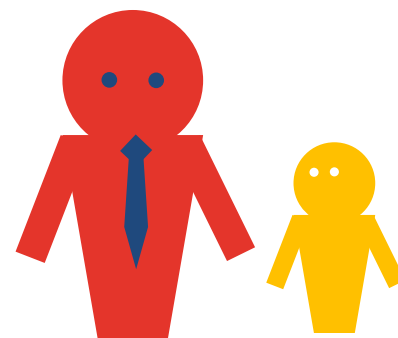
Defining and implementing strategic roadmaps



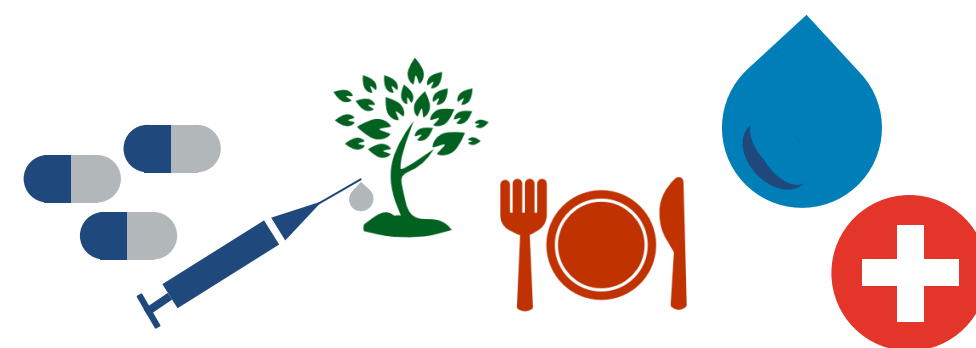
Coordinated synbio activities within existing institutions and creating better funding and regulatory mechanisms among govt. bodies



Establishing common infrastructure (registries, repositories, biofabs, software tools) and standards



Continuing engagement at post-grad, undergrad, and high school



International research efforts focused on solving global challenges



# Synbio NewOrg

Build What the Community Needs, Drawing Resources & Support From:



Public/Government



Private Sector



Philanthropic  
Organizations



Academic  
Institutions

Engage in collaborative research across these sectors and across the globe.



# Thank You!

## Contact Information:

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See Our Comprehensive Survey

<http://bit.ly/1yJg5fw>



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See Our Sustainability Plan

<http://bit.ly/1w6SQe8>