

The United States National Bioeconomy Blueprint

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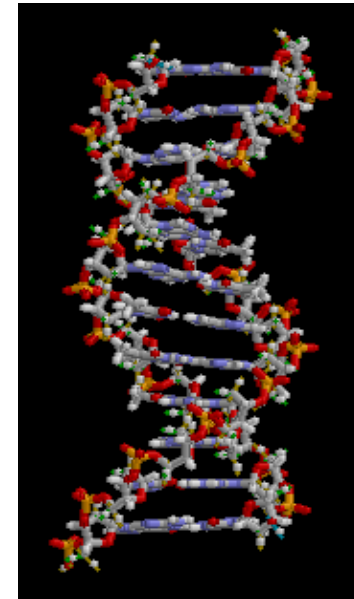
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The U.S. bioeconomy rests on two pillars

BIOMASS

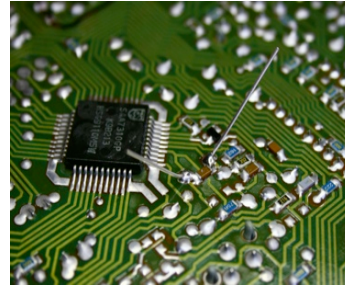


BIOSCIENCES



We are now in an era where biology is technology...

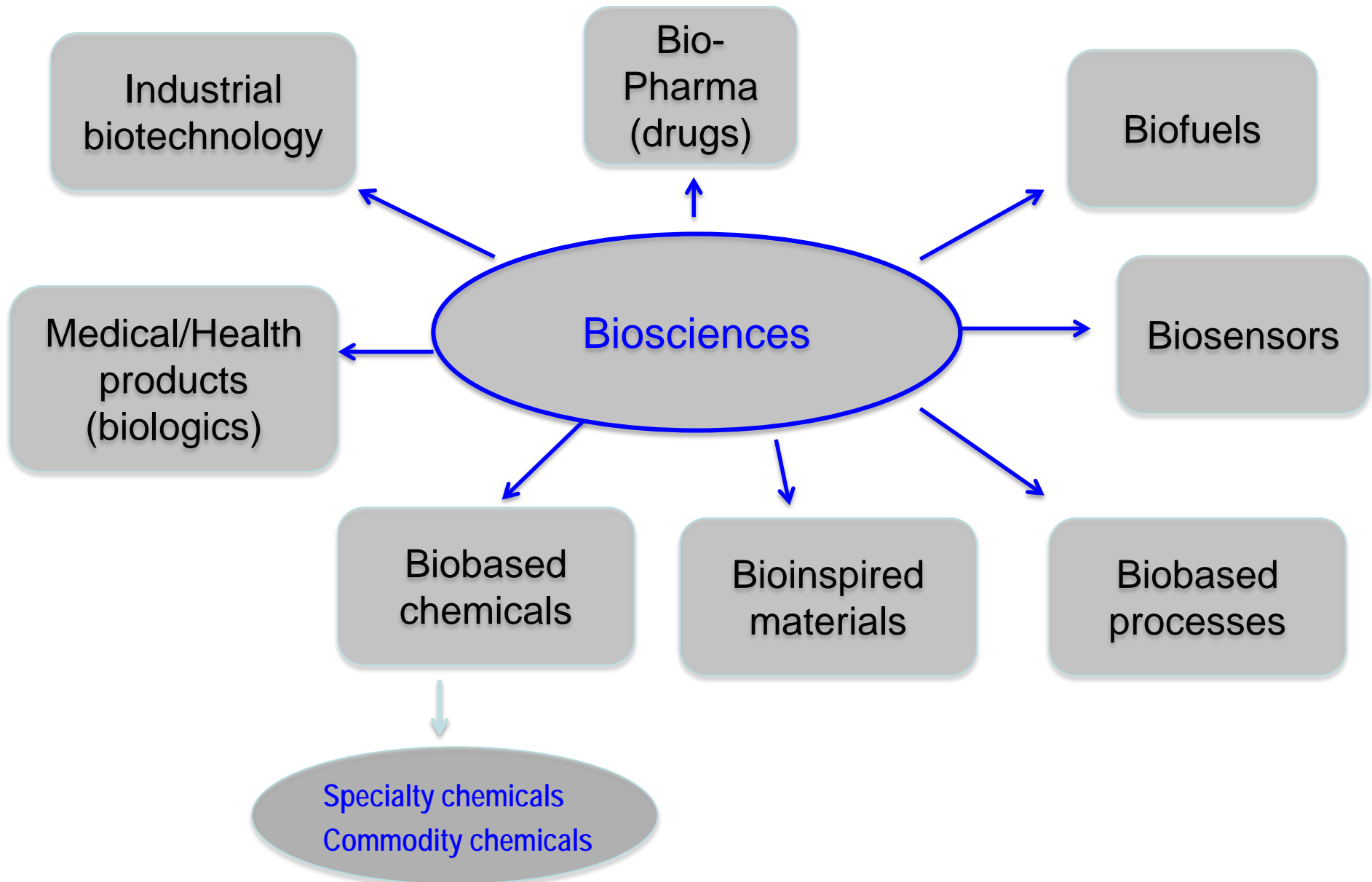
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...with multiple applications

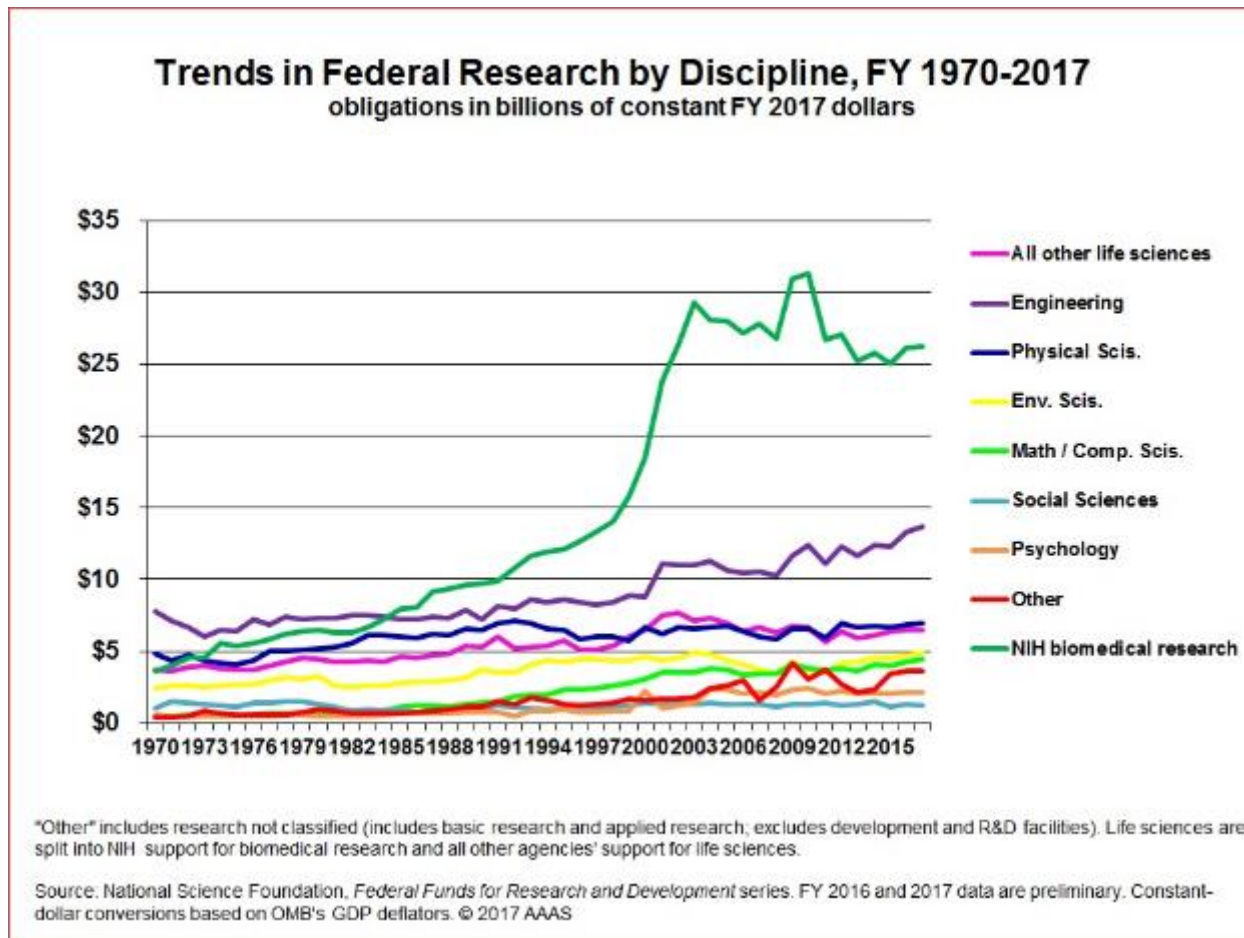


United States Government biosciences effort is large and diverse

More than 20 R&D agencies across 8 Cabinet-level departments and 4 independent agencies

- **Department of Agriculture (USDA)**
 - Agricultural Research Service (ARS)
 - National Institute of Food and Agriculture (NIFA)
 - Forest Service (FS)
 - Animal and Plant Health Inspection Service (APHIS)
- **Department of Commerce (DOC)**
 - National Oceanic and Atmospheric Administration (NOAA)
 - National Marine Fisheries Service (NMFS)
 - National Institute of Standards and Technology (NIST)
- **Department of Defense (DOD)**
 - Air Force Office of Science Research (AFOSR)
 - Defense Advanced Research Projects Agency (DARPA)
 - Defense Threat Reduction Agency (DTRA)
 - Office of Naval Research (ONR)
 - U.S. Army Medical Research and Materiel Command (USAMRMC)
- **Department of Energy (DOE)**
 - Office of Science
 - National Laboratories
 - Office of Energy Efficiency and Renewable Energy (EERE)
 - Advanced Research Projects Agency-Energy (ARPA-E)
- **Department of Homeland Security (DHS)**
- **Department of the Interior (DOI)**
 - Fish and Wildlife Service (FWS)
 - Geological Survey (USGS)
- **Health and Human Services Department (HHS)**
 - Centers for Disease Control and Prevention (CDC)
 - Food and Drug Administration (FDA)
 - National Institutes of Health (NIH)
 - Food and Drug Administration (FDA)
- **Veterans Affairs Department (VA)**
- **Independent Agencies**
 - National Aeronautics and Space Administration (NASA)
 - National Science Foundation (NSF)
 - Environmental Protection Agency (EPA)
 - Director of National Intelligence (DNI)
 - Intelligence Advance Research Projects (IARPA)

U.S. Gov't spends >\$30 billion on biosciences R&D

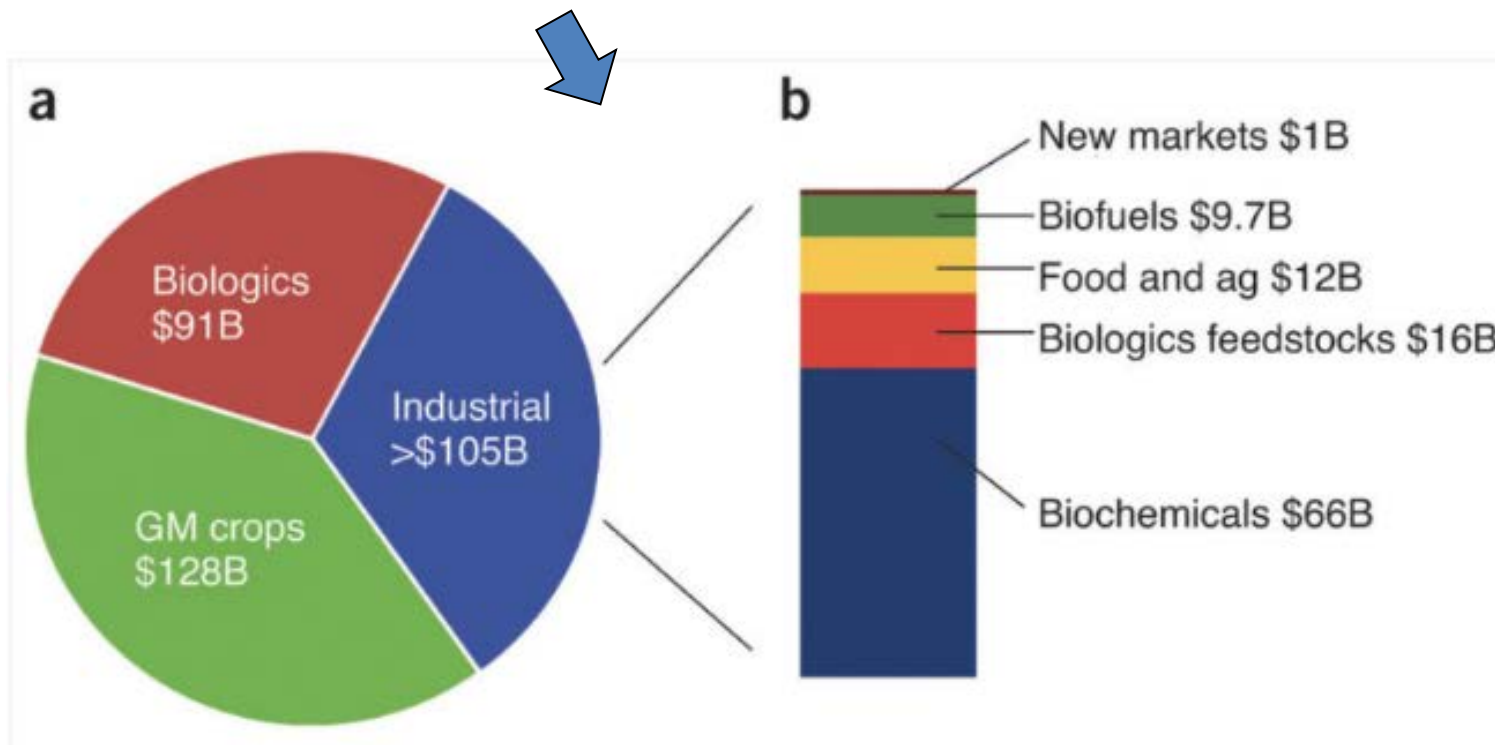


- And, when you include funding from foundations, philanthropists, state governments, private research institutes, and industry that number is much larger.

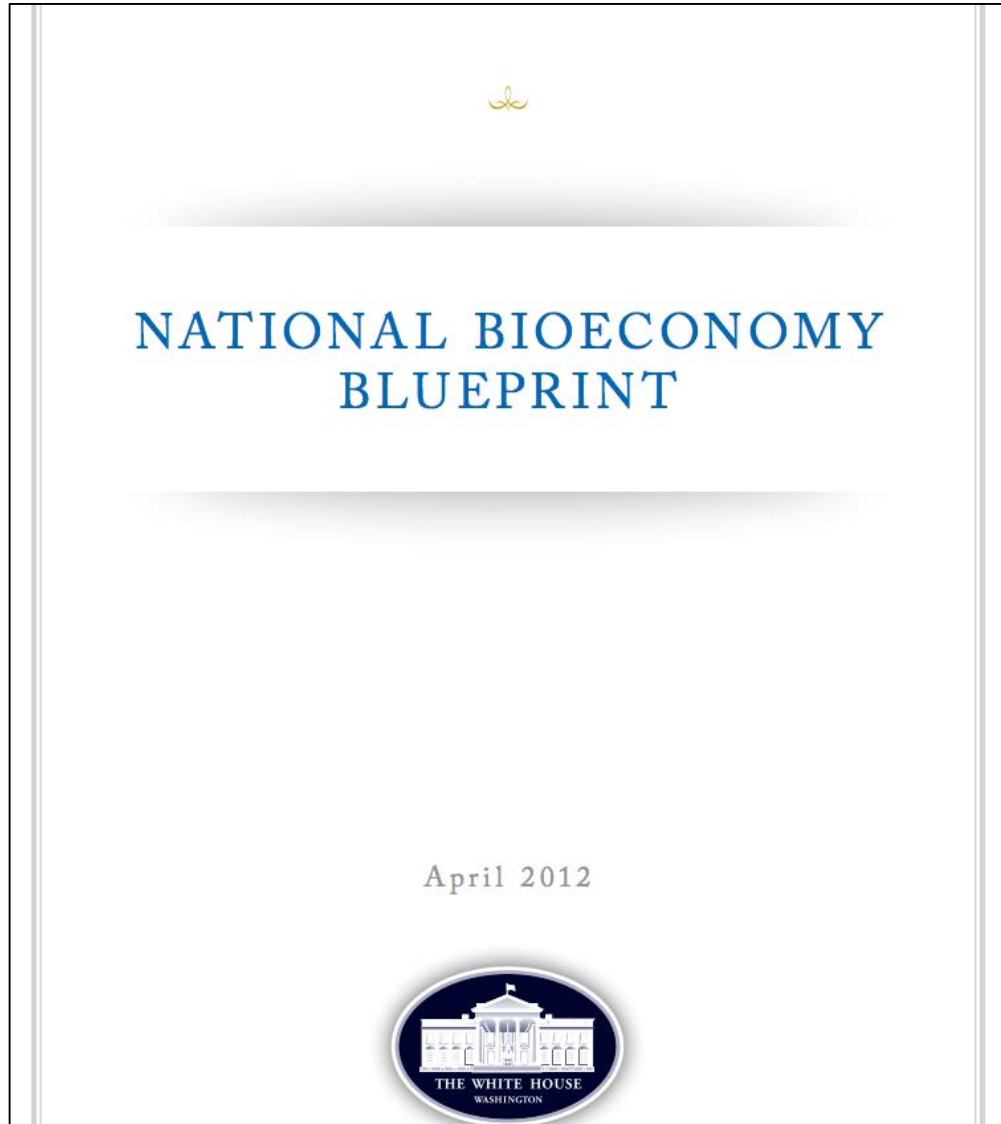
The U.S. bioeconomy is large and diverse

In 2012

- >\$324 Billion in revenues
- = 2% of overall U.S. GDP
- Contributed to more than 5% of U.S. economy's overall growth



Ok, fine, but why develop a national bioeconomy strategy?



- Lay out strategic objectives that will help realize the full potential of the U.S. bioeconomy
- Signal to industry, investors, and researchers a commitment to biological research as a driver of the future bioeconomy
- Underscore the potential of biological research to address national challenges in health, energy, environment, food
- Provide guidance to S&T agencies about where to focus efforts



NATIONAL BIOECONOMY BLUEPRINT

April 2012



Objective 1

Support R&D investments that will provide the foundation for the future U.S. bioeconomy

- Expand and develop essential bioeconomy technologies
- Integrate approaches across disciplines
- Implement improved funding mechanisms

Objective 2

Facilitate the transition of bioinventions from lab to market, focusing on translational and regulatory sciences

- Update SBIR programs
- Accelerate transfer of government-owned inventions*
- Enhance entrepreneurship at universities
- Utilize federal procurement authority to create and grow new bio-markets

Objective 3

- Develop and reform regulations to reduce barriers, increase speed and predictability of regulatory processes, and reduce costs while protecting human and environmental health
- improve regulatory processes and regulations
 - collaborate with stakeholders

Objective 4

Update training programs and align academic institution initiatives with student training for national workforce needs

- Enable employer-educator partnerships
- Re-engineer graduate education programs

Objective 5

Identify and support opportunities for development of public-private partnerships and precompetitive collaborations – where competitors pool resources, knowledge, and expertise to learn from successes and failures

What came AFTER the National Bioeconomy Blueprint?



More than \$6.5 billion in new R&D funding (public and private) for bioeconomy-related activities, including:

- 2013 - BRAIN Initiative (**neurotechnologies**) - \$1.5B public-private funding from 2014-2016 AND \$1.5B over 2017-2026 (21st Century Cures Act)
- 2015 - **Precision Medicine** Initiative – \$1.4B over 2017-2026 (21st Century Cures Act)
- 2016 - **Cancer Moonshot** - \$1.8B over 2017-2026 (21st Century Cures Act)



What came AFTER the National Bioeconomy Blueprint? (continued)



More than \$6.5 billion in R&D funding (public and private) for bioeconomy-related activities, including:

- 2015-2017 – **Modernized the U.S. Biotechnology Regulatory System**
- 2016 - Advanced Regenerative Manufacturing Institute (**multicellular tissues and workforce development**) - \$290M public-private funding
- 2016 - National Institute for Innovation in Manufacturing Biopharmaceuticals (**cell-based therapeutics and workforce development**) - \$90M
- 2017 - DOE Agile Biofoundry (**synthetic biology**) - \$40M to achieve a 50% reduction in time-to-scale up for chemical biomanufacturing

National Strategy for Modernizing the Regulatory System for Biotechnology Products

Product of the Emerging Technologies Interagency Policy Coordination Committee's Biotechnology Working Group



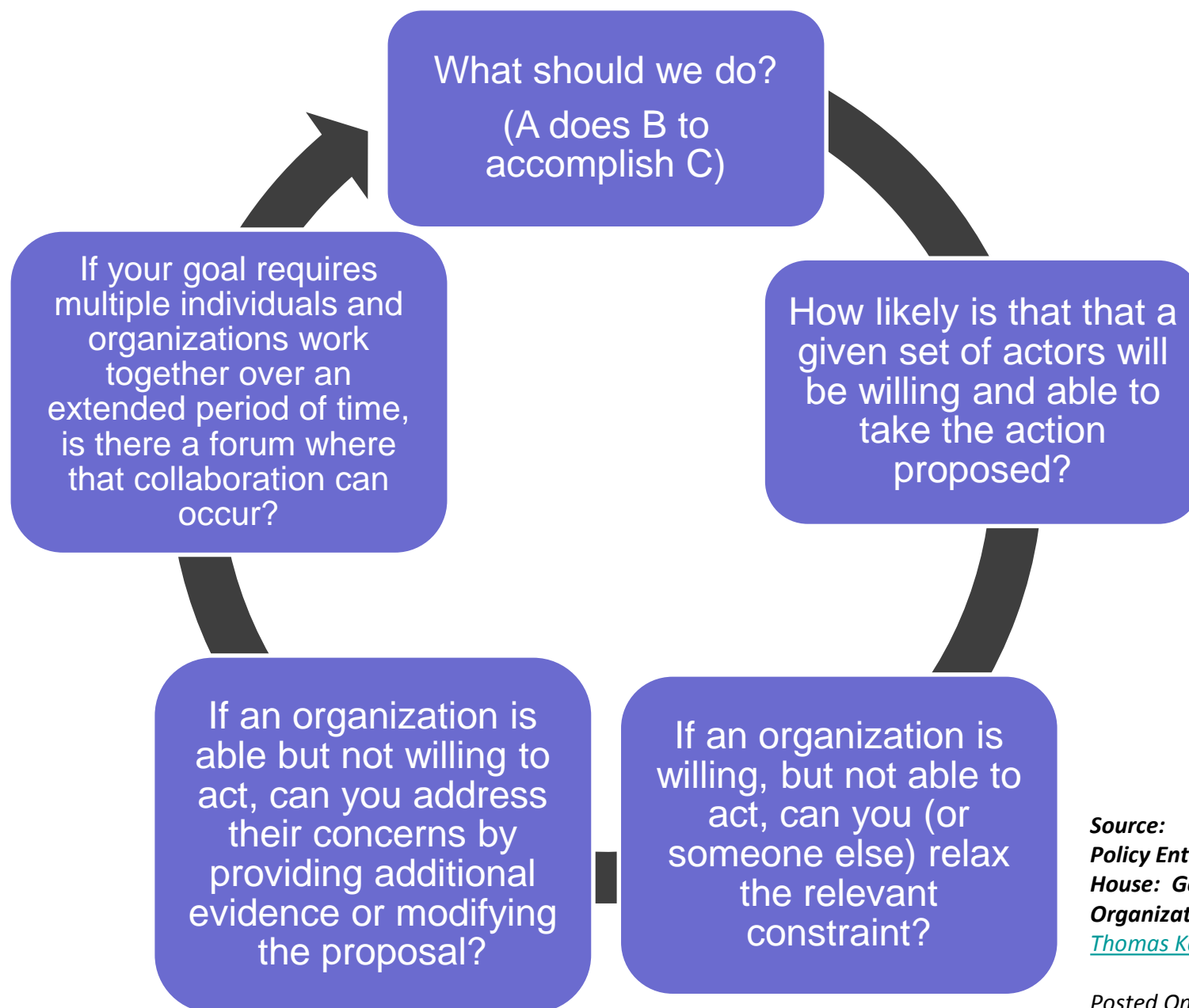
September 2016



So HOW did the United States develop a national bioeconomy strategy?

- Objectives developed and refined
 - National needs/societal challenges (e.g., National Academy of Sciences reports)
 - Administration priorities
 - Agency input
 - Public input
- Research – trends, economics, etc.
- Foundational technologies selected
 - Potential to significantly and broadly change biology and the economy
- Early achievements solicited from agencies
- Clearance through official USG process
- Release the document
- And, continue to work on the priorities!

One useful framework for filling in the details



Source:
Policy Entrepreneurship at the White House: Getting Things Done in Large Organizations
[Thomas Kalil](#)

Posted Online July 11, 2017
doi: [10.1162/innov.a.00253](https://doi.org/10.1162/innov.a.00253)

And, some things that might be possible if we make the right investments

- Advances in biomedical sciences & “big data” & artificial intelligence will drastically improve healthcare
 - But, will be critical to protect privacy and security
- Ensuring sufficient safe, secure, sustainable, affordable food, water, and energy for all, while reducing GHGs
- Fashioning materials from abundant elements to substitute for current uses of scarce ones
- Understanding the brain and curing its ailments
- Controlling infectious and vector-borne diseases
- Defeating cancer
- Facilitating graceful aging
- Cellular therapeutics
 - Beyond small molecules and biologics
- Personalized organs and tissues on demand

Credit to Dr. John Holdren, Former Director of White House OSTP, for assembling most of this list

Thank you!

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