# Universities as Drivers of Growth in the U.S.

*A Brief Introduction*

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**Building the 21st Century:**
**U.S. China Cooperation on Science, Technology, and Innovation**
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# Outline

## HISTORY

- Science and Technology Policy before 1945
- Science and Technology Policy after 1945
- The Bayh-Dole Act (1980)

## PRACTICE

- The purposes of U.S. Universities
- The U.S. Innovation System
- The role of Clusters/Commons

## TRENDS

## NEW SYSTEMS FOR INNOVATION?

# HISTORY

# U.S. Science and Technology Policy before 1945

- The Land Grant Act of 1862
  - Established public universities
    - Agriculture
    - “Mechanic Arts” (Engineering)
- Most university research was funded by private industry before 1945.

# U.S. Science Policy since 1945

- It began with a letter from President Roosevelt to Vannevar Bush in 1944.
- Roosevelt asked how the U.S. science community could work in peacetime to secure the nation's economic vitality, health, and security.

# The Bush Report
# ***Science the Endless Frontier***
# Primary Recommendations

- Universities should be the primary national Basic Research Infrastructure.
- Federal dollars do two things:
  - Procure research results
  - Educate the next generation
- Award research grants based on *competitive merit*.
- Establish a National Science Foundation.

# The Bush Report's Economic Development Assumptions

- Linear

  Basic Research --> Applied Research --> Product Development --> Market Products and Services

- *Laisser-faire:*

  Do basic research in universities and leave its commercialization to chance and market forces.

# The Bayh-Dole Act of 1980

- Universities own Intellectual Property (IP) developed with financial support of the U.S. Government.
- Universities can patent and license this Intellectual Property under most circumstances.
- The U.S. Government generally can use this IP without cost.

# PRACTICE

# The Purposes of Universities

- Education
- Research
- Service to Society

***Universities create Opportunity***

# The U.S. Innovation System

- Government, Universities, and Industry working together to

  1. Create new knowledge and technology through RESEARCH;

  2. EDUCATE young men and women to create and understand the new knowledge and technology; and

  3. Move it to the MARKETPLACE as new products, processes and services.

- Decentralized, Very loosely organized, Entrepreneurial

# The Innovation System is an Enormous Success.

- More than 50% of U.S. economic growth during the last 60 years was due to technological innovation.
- Much of the technological innovation came from our research universities.

# University Innovations

(Sole or Dominant Role)

- Computing
- Laser
- Internet
- GPS (fundamentals)
- Numerical Controlled Machines
- WWW (organization)
- Financial Engineering
- Genetic Revolution
- Modern Medicine
- Etc.

# Two Key Ingredients

1. Venture Capital

2. Clusters
    1. Naturally Evolving
    2. Planned

# TRENDS

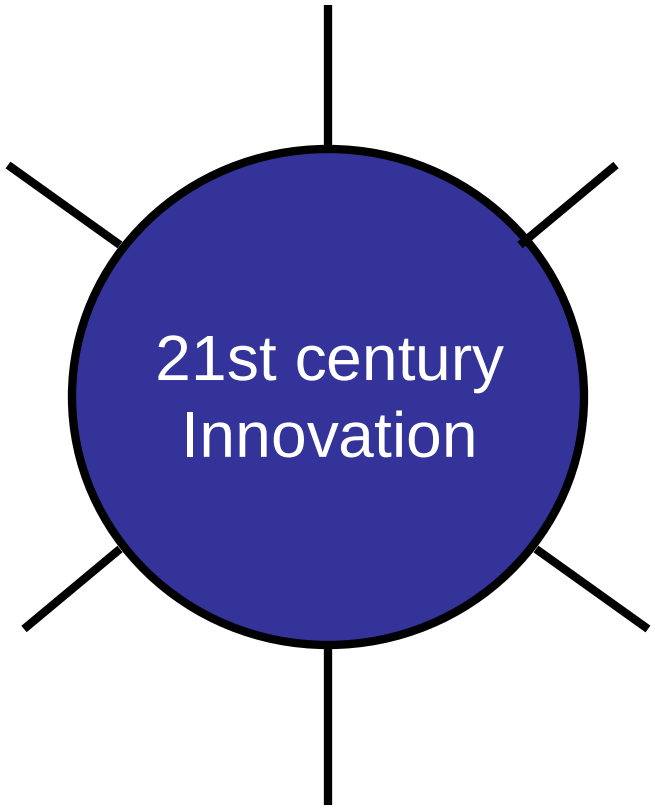
# Trends:
# Corporate Innovation and R&D

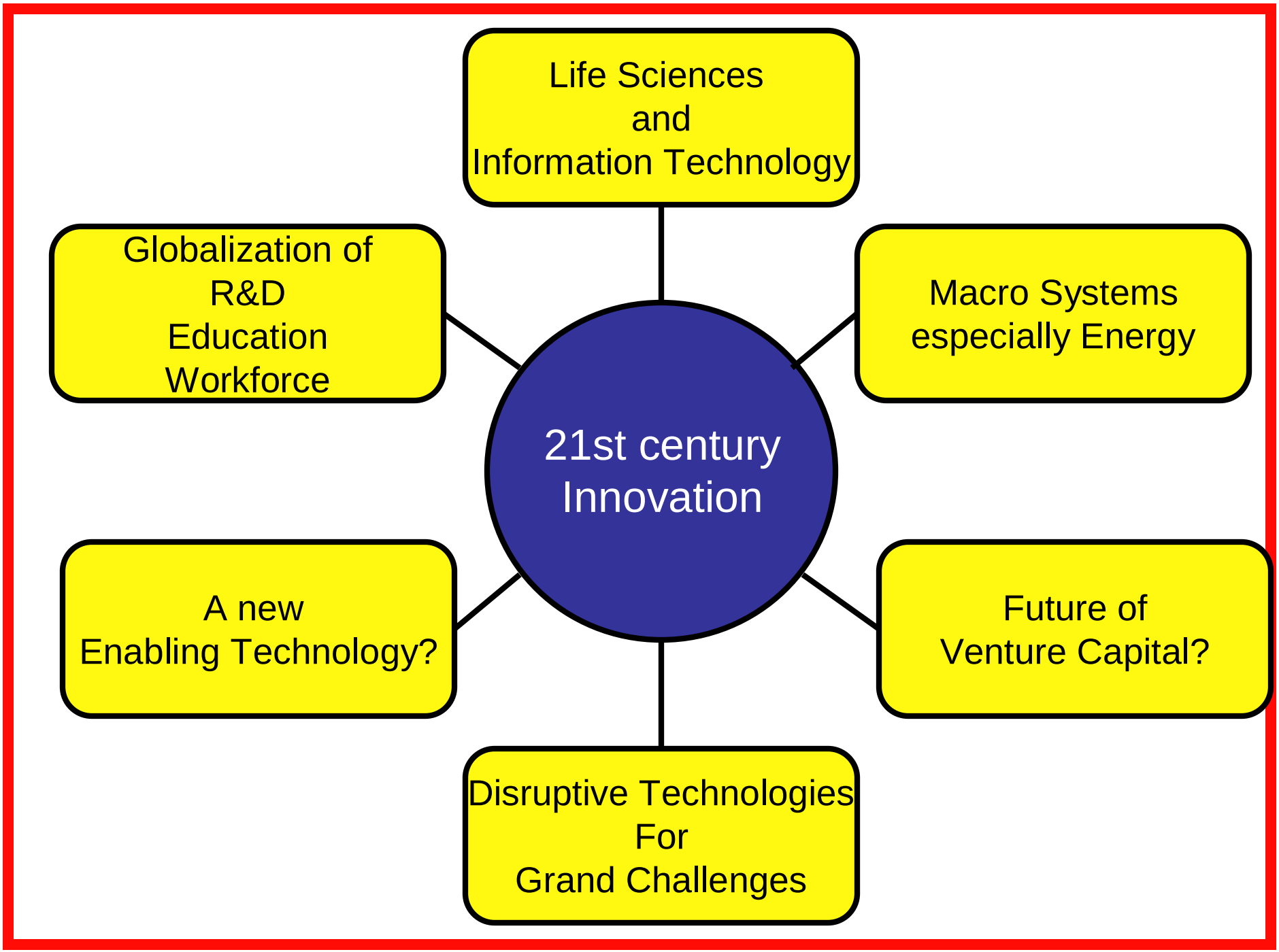
- 1970s: Central Corporate Research Labs
- 1980s: R&D Absorbed and Transformed into Product Development
- 1990s: Purchase High-Tech Startups to acquire Innovation
- 2000s:  Open Innovation
- 2010s:  ???

# Trends:
# University Research

- 1970s:The Engineering Science Revolution
- 1980s: Design, Manufacturing, Computer Science, Joint Management/Engineering
- 1990s: Life Science, Interdisciplinary, More work in “Use Inspired Basic Research”
- 2000s: Accelerating the 1990s trends plus increased Cyberinfrastructure
- 2010s: ???

# New Systems for Innovation?


21st century
Innovation


Life Sciences
and
Information Technology
Globalization of
R&D
Education
Workforce
Macro Systems
especially Energy
21st century
Innovation
A new
Enabling Technology?
Future of
Venture Capital?
Disruptive Technologies
For
Grand Challenges

Thank you.

# Building the 21st Century:

## U.S. - China Cooperation on Science, Technology, and Innovation

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**Washington, DC**

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