

***LINC 2010 Conference***

**Open Education for an  
Open World**

Charles M. Vest  
President, National Academy of Engineering  
President *Emeritus*, MIT

**Cambridge, Massachusetts  
May 25, 2010**

M  
LINC  
T

Richard Larsen,  
Founder

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LINC  
T

*Consortium*

Richard Larsen,  
Founder

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LINC  
T

*Consortium*

Richard Larsen,  
Founder

*Hero*

Four Great Thoughts that  
shaped my views on Education

*An uncommon education for the common man*

James Burrell Angell  
President University of Michigan  
1871-1909

*New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life.*

President Franklin D. Roosevelt to Vannevar Bush  
November 17, 1944

*If ability, and not the circumstance of family fortune, determines who shall receive higher education, then we shall be assured of constantly improving quality at every level of scientific activity.*

Vannevar Bush to President Harry S. Truman  
July 5, 1945



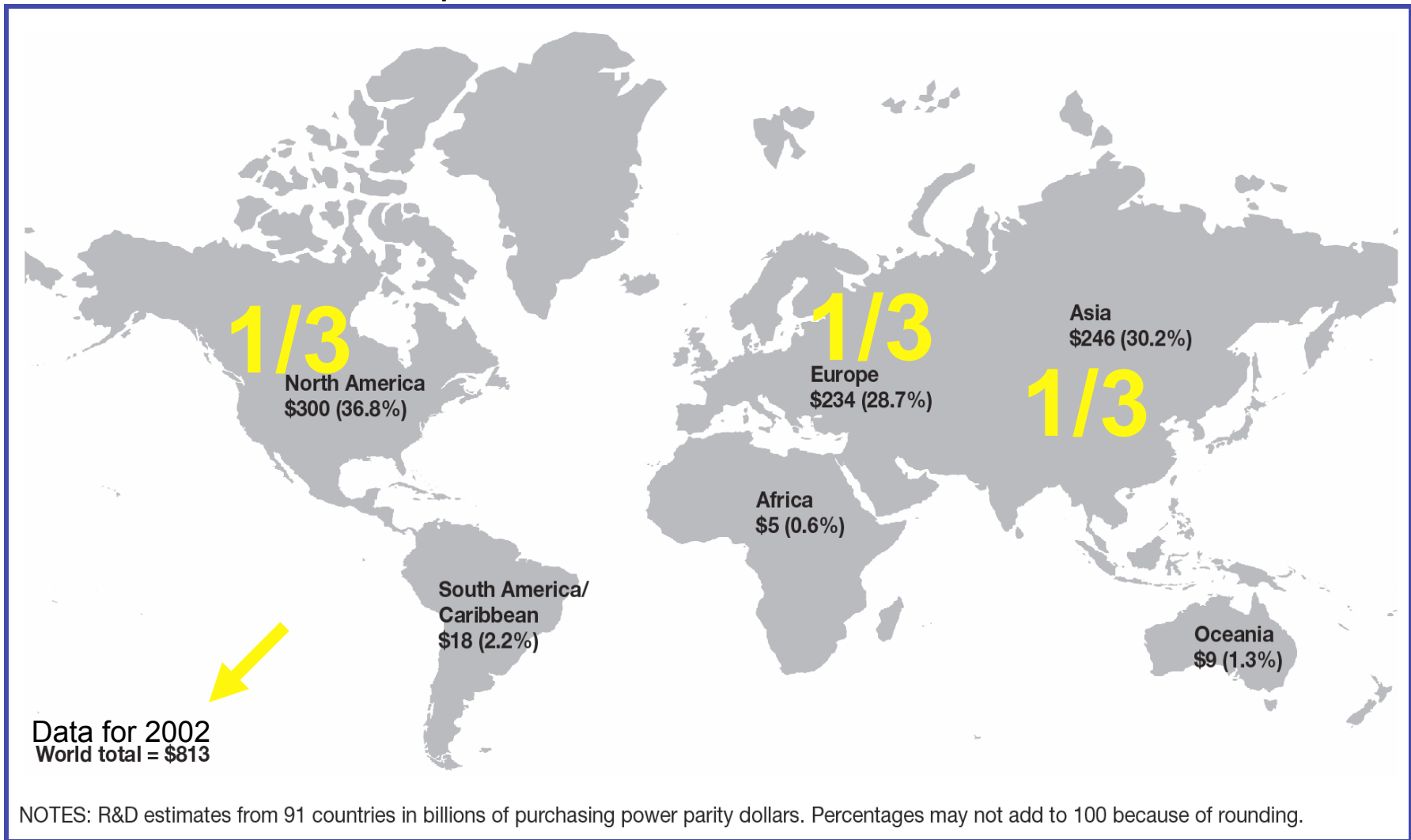
*May we now use every ability we have to communicate to build a society in which mutual respect, understanding and peace occur at all scales, between people, and between nations.*

Sir Tim Berners-Lee  
Japan Prize Lecture  
2002

# A Changing World

# Global R&D Investments

R&D Expenditures and Share of World Total

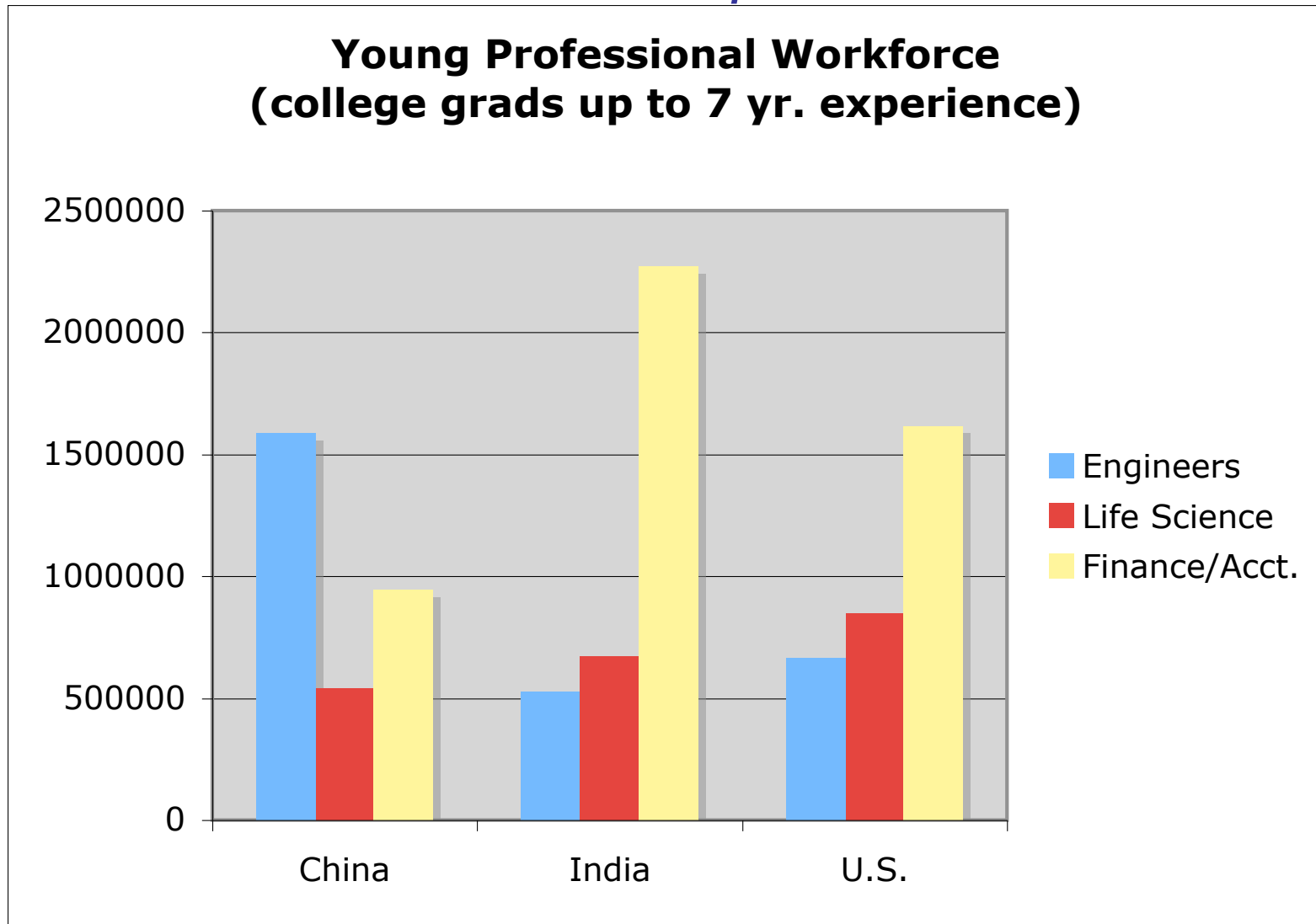


Source: *Science and Engineering Indicators*, NSF 2008

# New Players

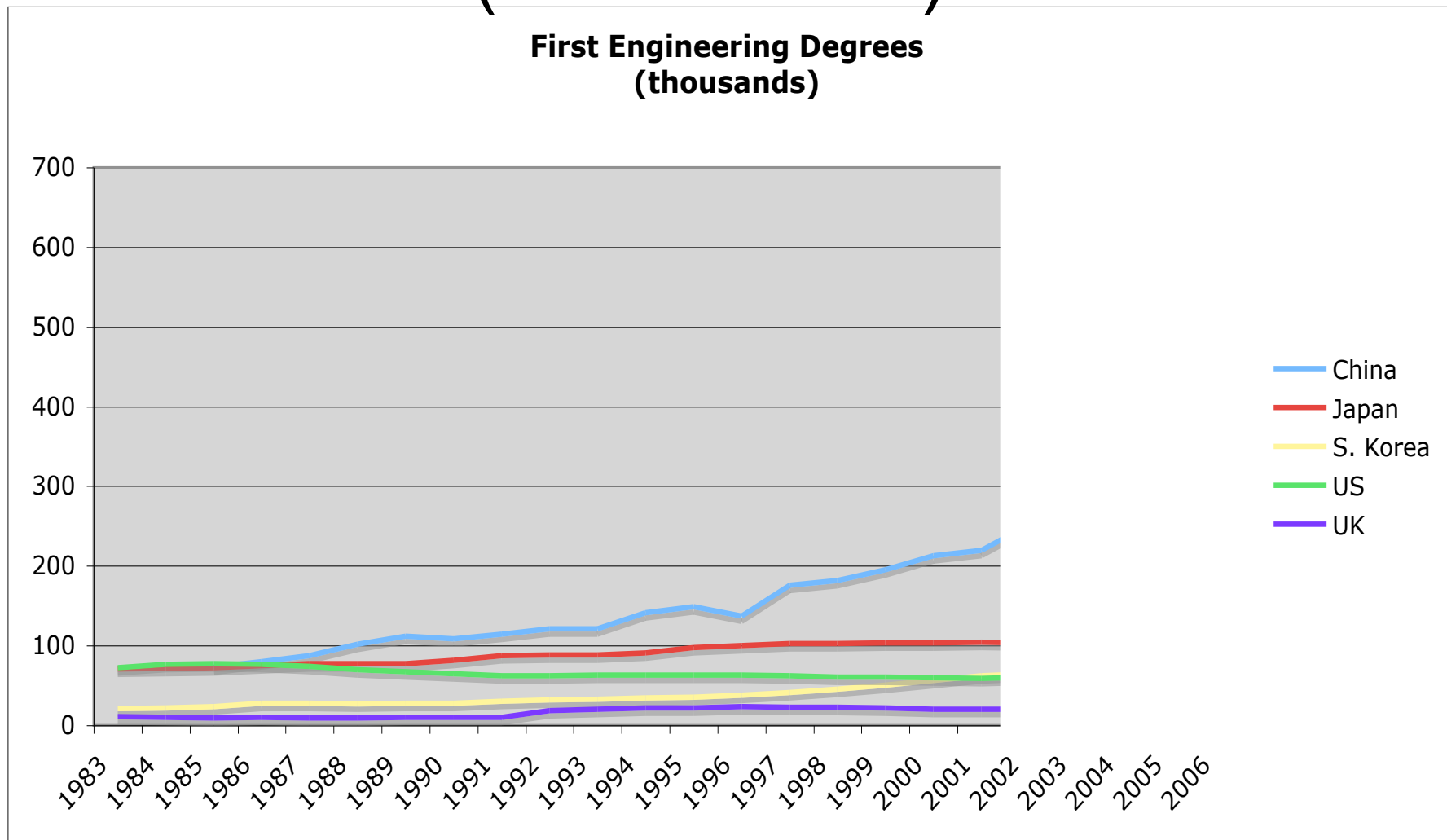
*Where the Expertise is*

**Young Professional Workforce  
(college grads up to 7 yr. experience)**



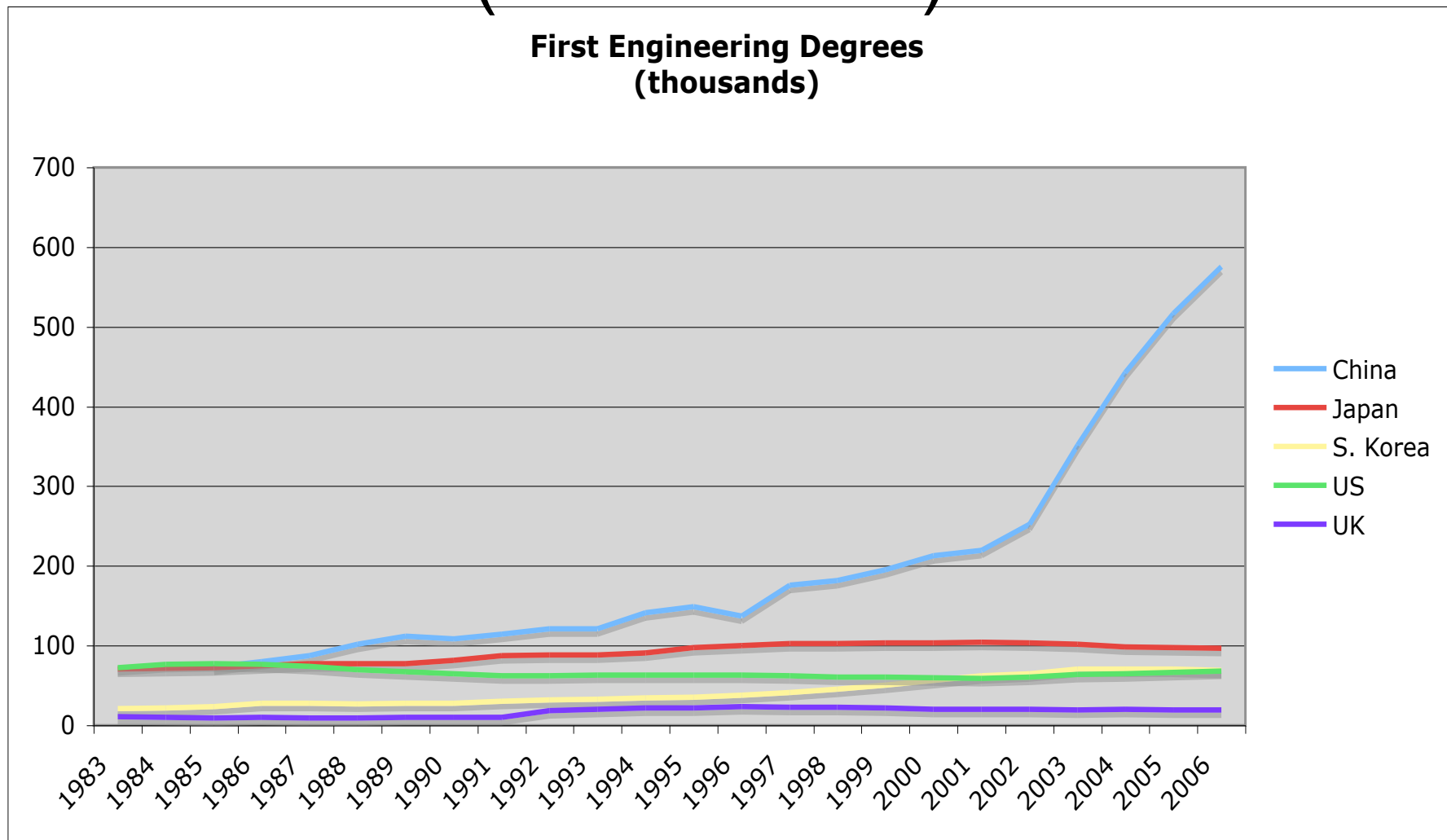
Source: Competitiveness Index 2007, Council on Competitiveness, Washington, DC

# First Engineering Degrees (China Rises)



Source: NSF Science and Engineering Indicators 2010

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Source: NSF Science and Engineering Indicators 2010

R&D Investment  
and  
Scientific, Engineering, and Business Talent  
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**People everywhere are smart and capable.**



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People everywhere are smart and capable.

**Are research universities globalizing?**

# Globalization of Research Universities

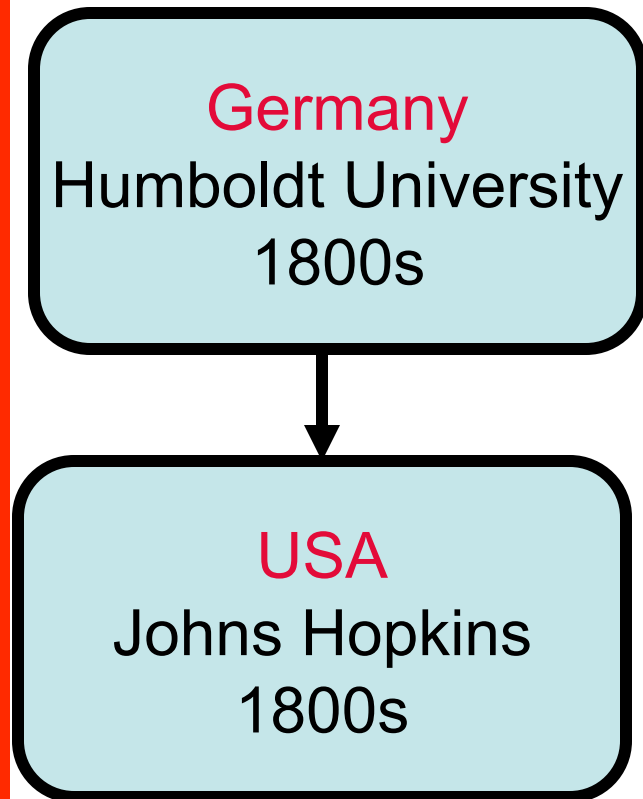
## Phase I: Diffusion

# Research University Globalization Phase I

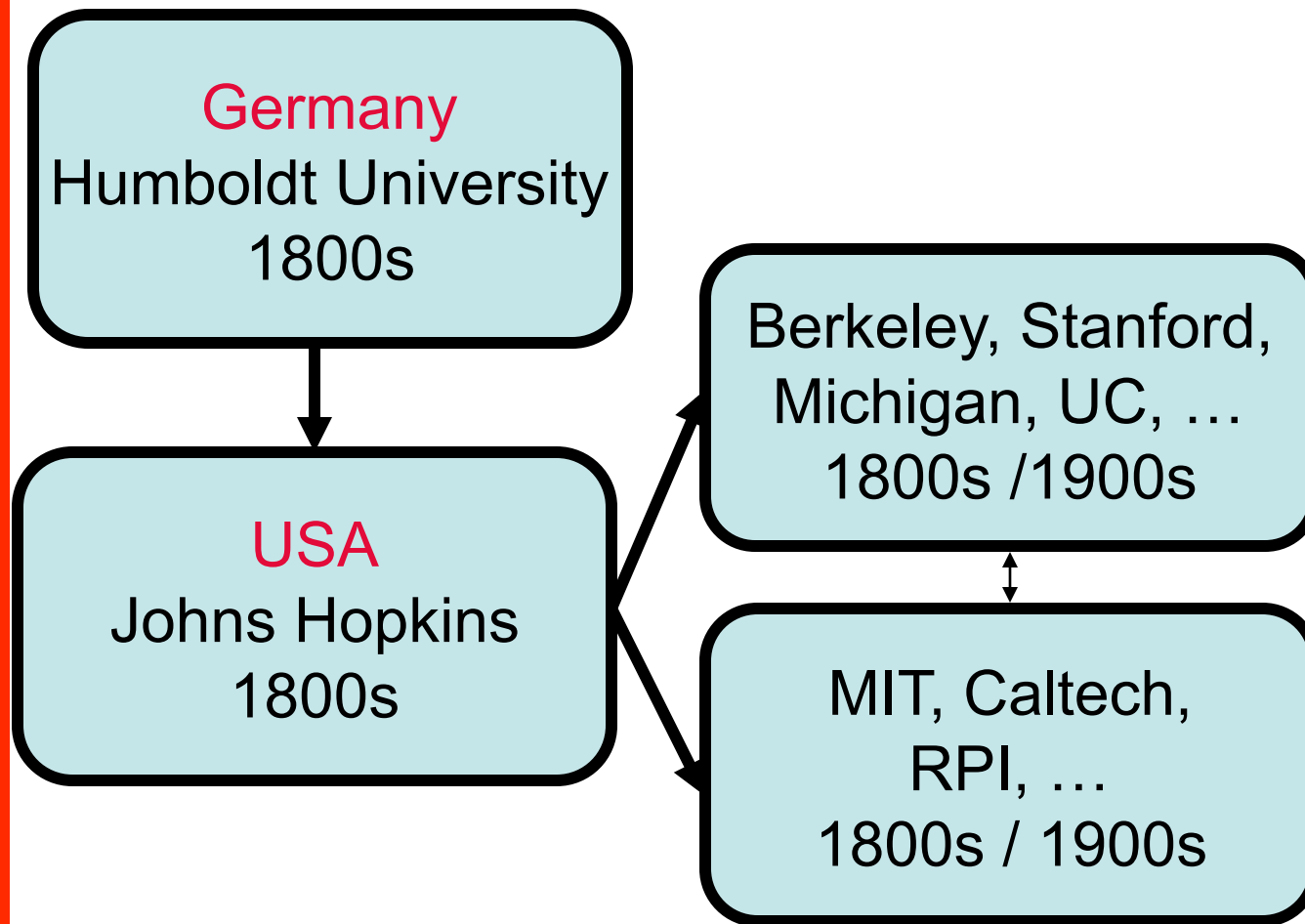
Germany

Humboldt University  
1800s

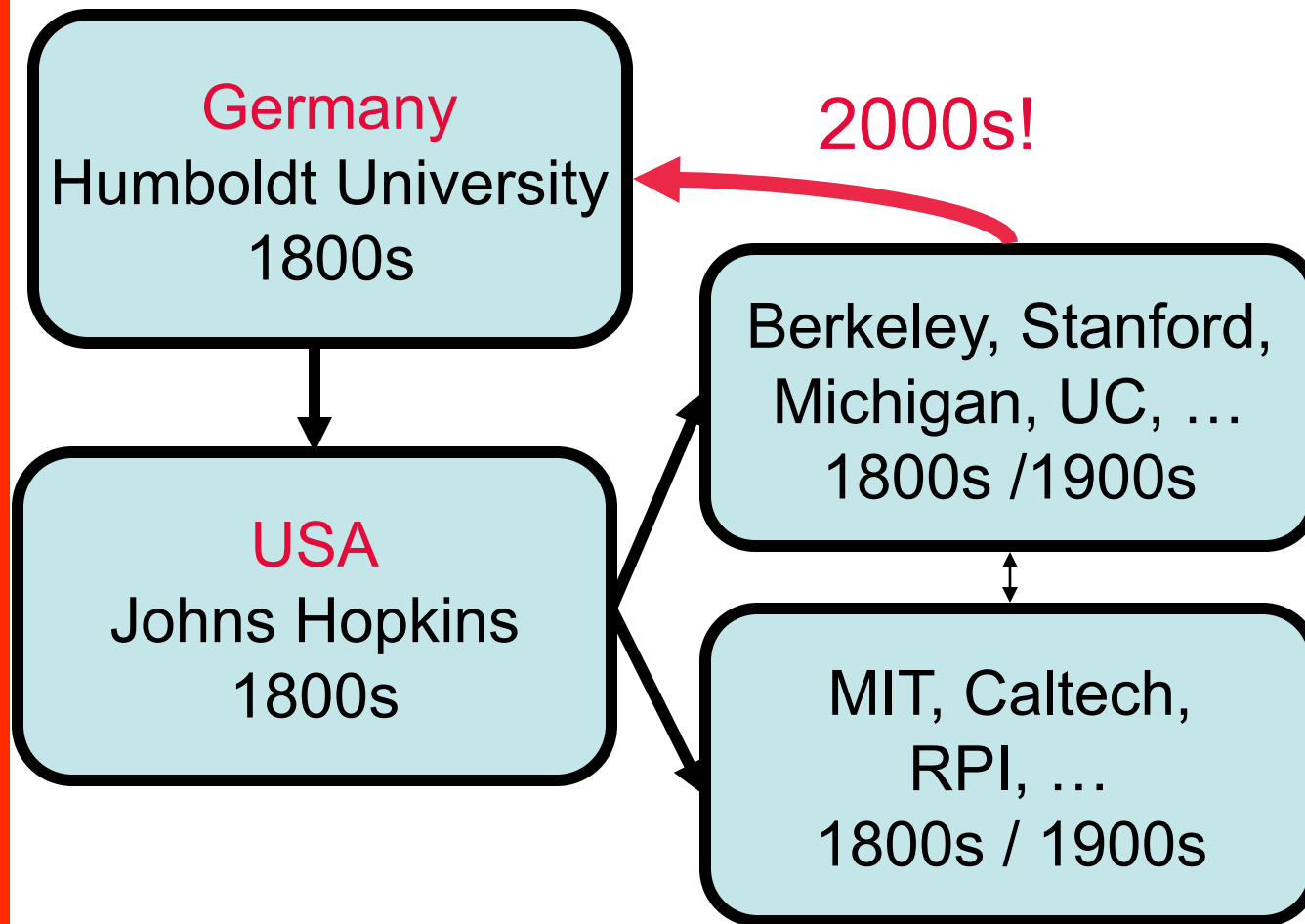
# Research University Globalization Phase I



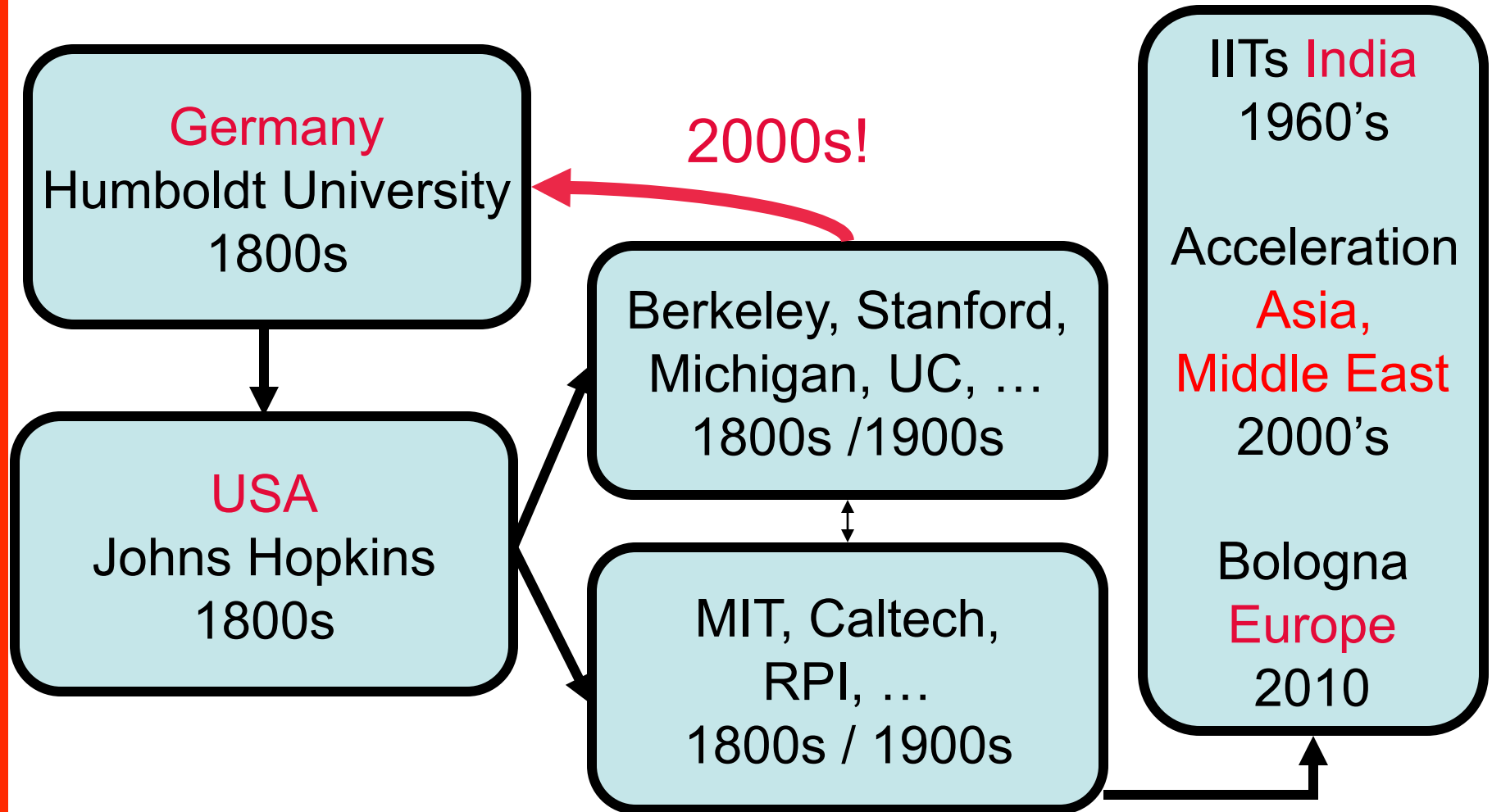
# Research University Globalization Phase I



# Research University Globalization Phase I



# Research University Globalization Phase I



Which University will be  
the Global University of the 21st century?



Which University will be  
the Global University of the 21st century?

**Wrong Question**

# Globalization of Research Universities

Phase II: Cooperation  
& Openness

# Research University Globalization Phase II

- Physical Presence in Other Countries
  - Campuses
  - Laboratories

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  - Laboratories
- Strategic Alliances Between Universities

# Research University Globalization Phase II

- Physical Presence in Other Countries
  - Campuses
  - Laboratories
- Strategic Alliances Between Universities
- Virtual Presence in Other Countries
  - Distance Education
    - Synchronous
    - Asynchronous
  - Open Content: The Emerging Meta-University
    - Teaching Materials
    - Scholarly Archives
    - Telepresent Laboratories

# Research University Globalization Phase II

- Physical Presence in Other Countries
  - Campuses
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  - **Open Content: The Emerging Meta-University**
    - **Teaching Materials**
    - **Scholarly Archives**
    - **Telepresent Laboratories**

At MIT I became passionate about sharing knowledge.

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**Because the Role of Universities  
is to Create Opportunity.**



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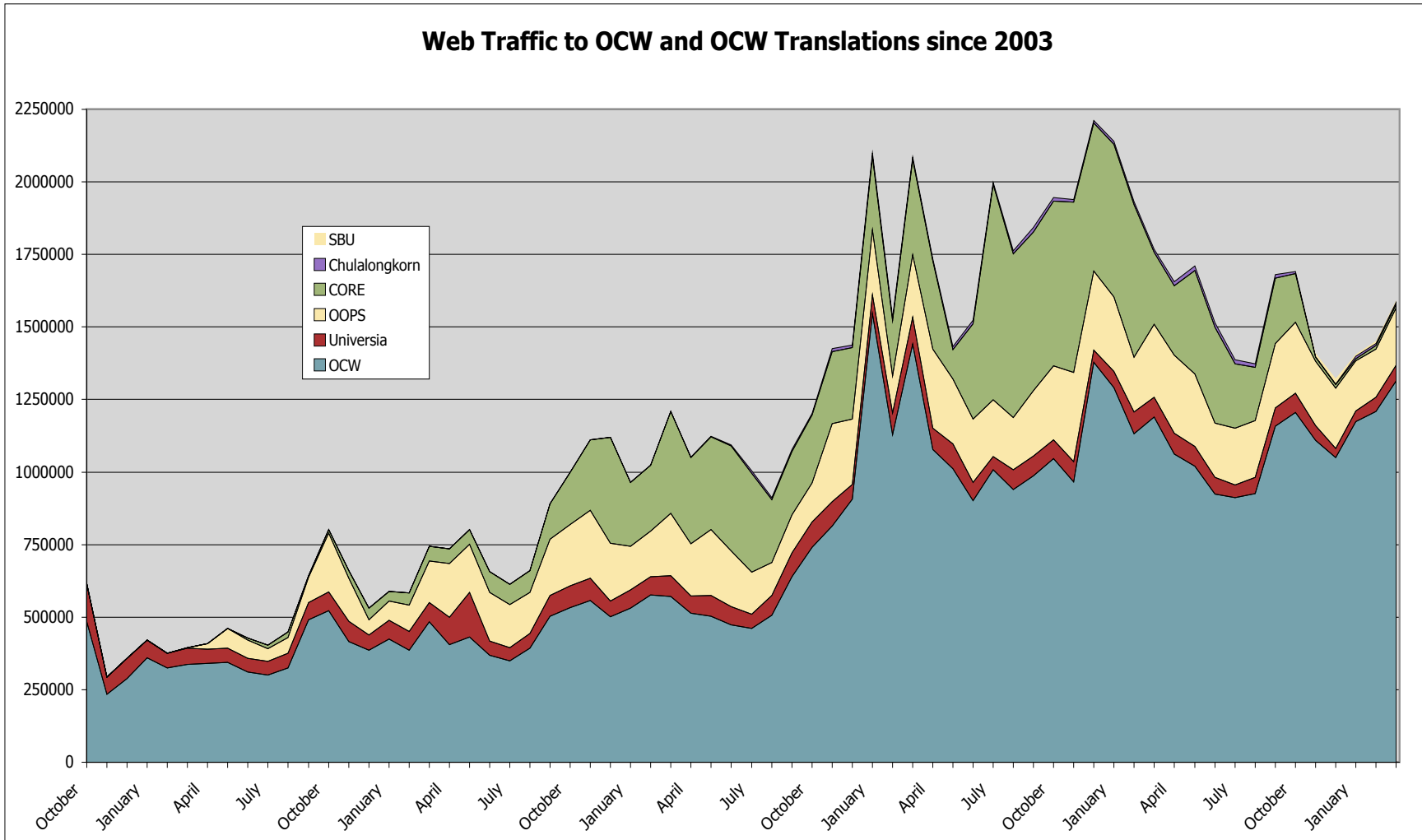
And People Everywhere  
need Opportunity.



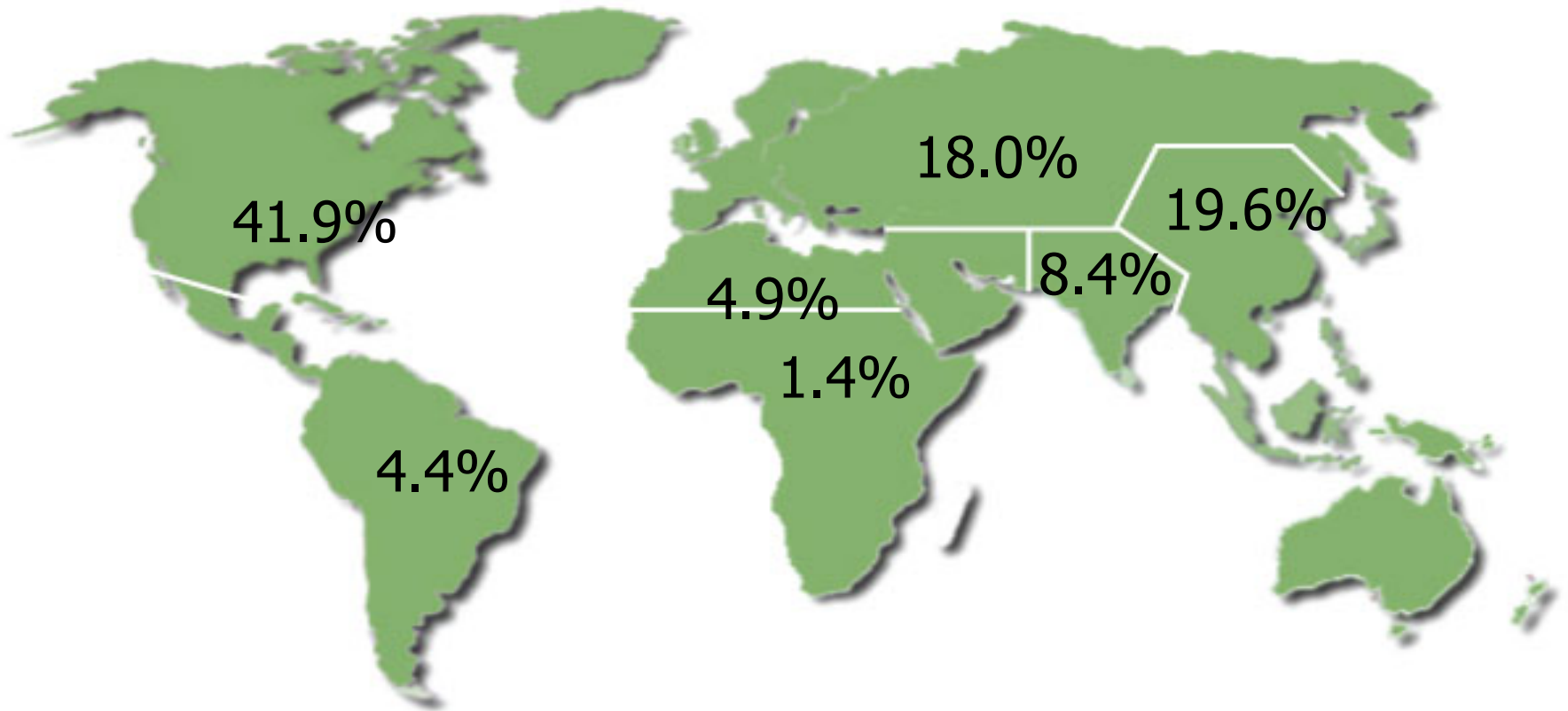
We put the teaching materials for 2000 courses  
on the Web

for anyone to use,  
anywhere,  
anytime,  
free of charge.

I learned that many people sought this knowledge.



# From all over the world



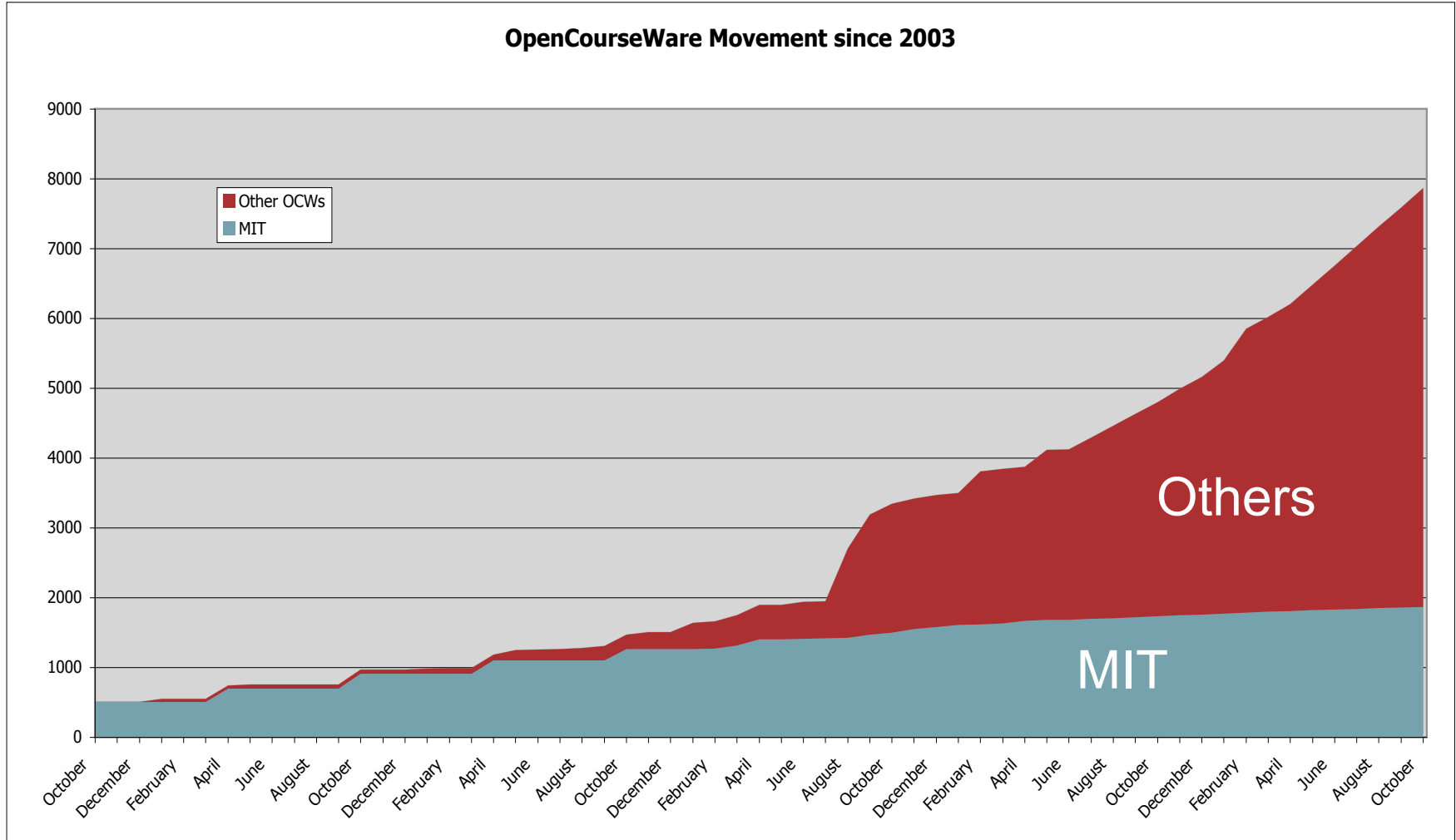
**% web hits since 10/1/03**

And that they appreciated the knowledge:

*MIT OCW is the "8th Wonder of the World!" My Sincere Heartfelt Thanks to all of you out there who have been involved in the making of this project. Keep up the excellent work!*

-- e-mail from Latvia Sept. 2002

# Others think it is a good idea.



There are many other examples of  
freely or inexpensively available

Libraries,

Scholarly Materials,

On-Line Education  
and even

Web-accessible Laboratories.

In my view, this is all about  
**openness** as well as about  
sharing resources.



# Openness in Higher Education ...

- is the true spirit of education, democratization, and empowerment.
- underpins innovation, cooperation, and competition worldwide.
- enables sharing and accessing expensive and intellectually-intensive materials.
- speaks of institutional and national values.

# Open Flow of Scientific Information is essential.

- Science thrives through unfettered communication.
- Science has an international culture.
- Science requires criticism, testing, and repetition.

# And Now, ... Open Flow of Educational Resources

- Not new, but ...
- The Internet and Web introduce unprecedented
  - **Scope**
  - **Reach**
  - **Speed**
  - **Interaction**

I think something very  
fundamental is happening ...

# The Meta University

## *A Personal View*

What we are observing is the early emergence of a *Meta University* -- a transcendent, accessible, empowering, dynamic, communally-constructed framework of open materials and platforms on which much of higher education worldwide can be constructed or enhanced.

# The Meta University

- Will enable -- not replace -- residential campuses
- Will bring cost efficiencies to institutions through shared development;
- Will be adaptable -- not prescriptive;
- Will serve both teachers and learners;
- Will speed the propagation of high-quality education and scholarship;
- Will build capacity for economic development;
- Will build bridges across cultures and political boundaries; and
- Will be particularly important to the developing world.

Then came another  
Great Thought

*With today's computer and telecommunications technologies, every young person can have a quality education regardless of his or her place of birth.*

MIT Professor Richard Larson



**LINC**

Learning International Networks Consortium

and

**BLOSSOMS**

Blended Learning Open Source  
Science or Math Studies

**LINC**

Bringing

Consortia and Partnership with Nations

Expanding to Secondary Education



**BLOSSOMS**  
BLENDED LEARNING OPEN SOURCE SCIENCE OR MATH STUDIES



An Initiative of MIT LINC



## Bringing

# Partnership with Jordan, Pakistan, and Lebanon

## Human/Technology interaction for learning

## Learning Videos by volunteers

Let me relate this to the Grand Challenges  
project of the U.S. National Academy of  
Engineering (NAE)

# GRAND CHALLENGES FOR ENGINEERING

MAKE SOLAR ENERGY ECONOMICAL PROVIDE ENERGY FROM  
FUSION DEVELOP CARBON SEQUESTRATION METHODS MANAGE  
THE NITROGEN CYCLE PROVIDE ACCESS TO CLEAN WATER RESTORE  
AND IMPROVE URBAN INFRASTRUCTURE ADVANCE HEALTH  
INFORMATICS ENGINEER BETTER MEDICINES REVERSE-ENGINEER  
THE BRAIN PREVENT NUCLEAR TERROR SECURE CYBERSPACE  
ENHANCE VIRTUAL REALITY ADVANCE PERSONALIZED  
LEARNING ENGINEER THE TOOLS OF SCIENTIFIC DISCOVERY

NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

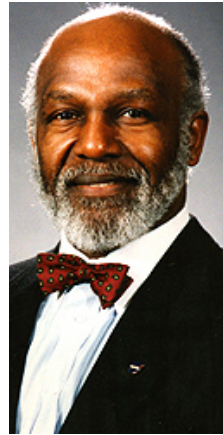
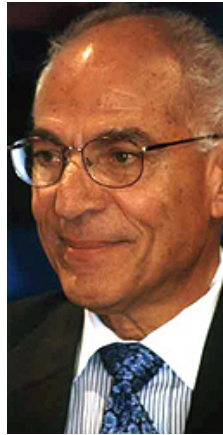
**INSPIRE**

**CHALLENGE**

**EDUCATE**

# Grand Challenges Committee

- Bill Perry, chair
- Sir Alec Broers
- Farouk El-Baz
- Wes Harris
- Bernadine Healy
- Daniel Hillis
- Calestous Juma
- Dean Kamen
- Ray Kurzweil
- Bob Langer
- Jaime Lerner
- Bindu Lohani
- Jane Lubchenco
- Mario Molina
- Larry Page
- Rob Socolow
- Craig Venter
- Jackie Ying



# Engineering Grand Challenges



Make Solar Energy Economical



Provide Energy From Fusion



Develop Carbon Sequestration Methods



Manage the Nitrogen Cycle



Provide Access to Clean Water



Restore and Improve Urban Infrastructure



Advance Healthcare Informatics



Engineer Better Medicines



Reverse Engineer the Brain



Prevent Nuclear Terror



Secure Cyberspace



Enhance Virtual Reality



Advance Personalized Learning



Engineer the Tools of Scientific Discovery





# Engineering Grand Challenges

[www.engineeringchallenges.org](http://www.engineeringchallenges.org)

Energy  
Environment  
Global Warming  
Sustainability

Reducing Vulnerability to  
Human and Natural Threats

Improve Medicine and  
Healthcare Delivery

Expand and Enhance  
Human Capability  
And Joy

# GRAND CHALLENGES FOR ENGINEERING

MAKE SOLAR ENERGY ECONOMICAL    PROVIDE ENERGY FROM  
FUSION    DEVELOP CARBON SEQUESTRATION METHODS    MANAGE  
THE NITROGEN CYCLE    PROVIDE ACCESS TO CLEAN WATER    RESTORE  
AND IMPROVE URBAN INFRASTRUCTURE    ADVANCE HEALTH  
INFORMATICS    ENGINEER BETTER MEDICINES    REVERSE-ENGINEER  
THE BRAIN    PREVENT NUCLEAR TERROR    SECURE CYBERSPACE  
ENHANCE VIRTUAL REALITY    ADVANCE PERSONALIZED  
LEARNING    ENGINEER THE TOOLS OF SCIENTIFIC DISCOVERY

NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

**INSPIRE**

**CHALLENGE**

**EDUCATE**

# GRAND CHALLENGES FOR ENGINEERING

**WHY?**

MAKE SOLAR ENERGY AFFORDABLE PROVIDE ENERGY FROM  
FUSION DEVELOP CLEANER EXPLORATION METHODS MANAGE  
THE NITROGEN CYCLE PROVIDE ACCESS TO CLEAN WATER RESTORE  
AND IMPROVE URBAN INFRASTRUCTURE ADVANCE HEALTH  
INFORMATICS ENGINEER BETTER MEDICINES REVERSE-ENGINEER  
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NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

**INSPIRE**

**CHALLENGE**

**EDUCATE**



**BECAUSE**

**Exciting Futures**

**Global Survival**

Exciting Futures

*For Our Children*

Exciting Futures

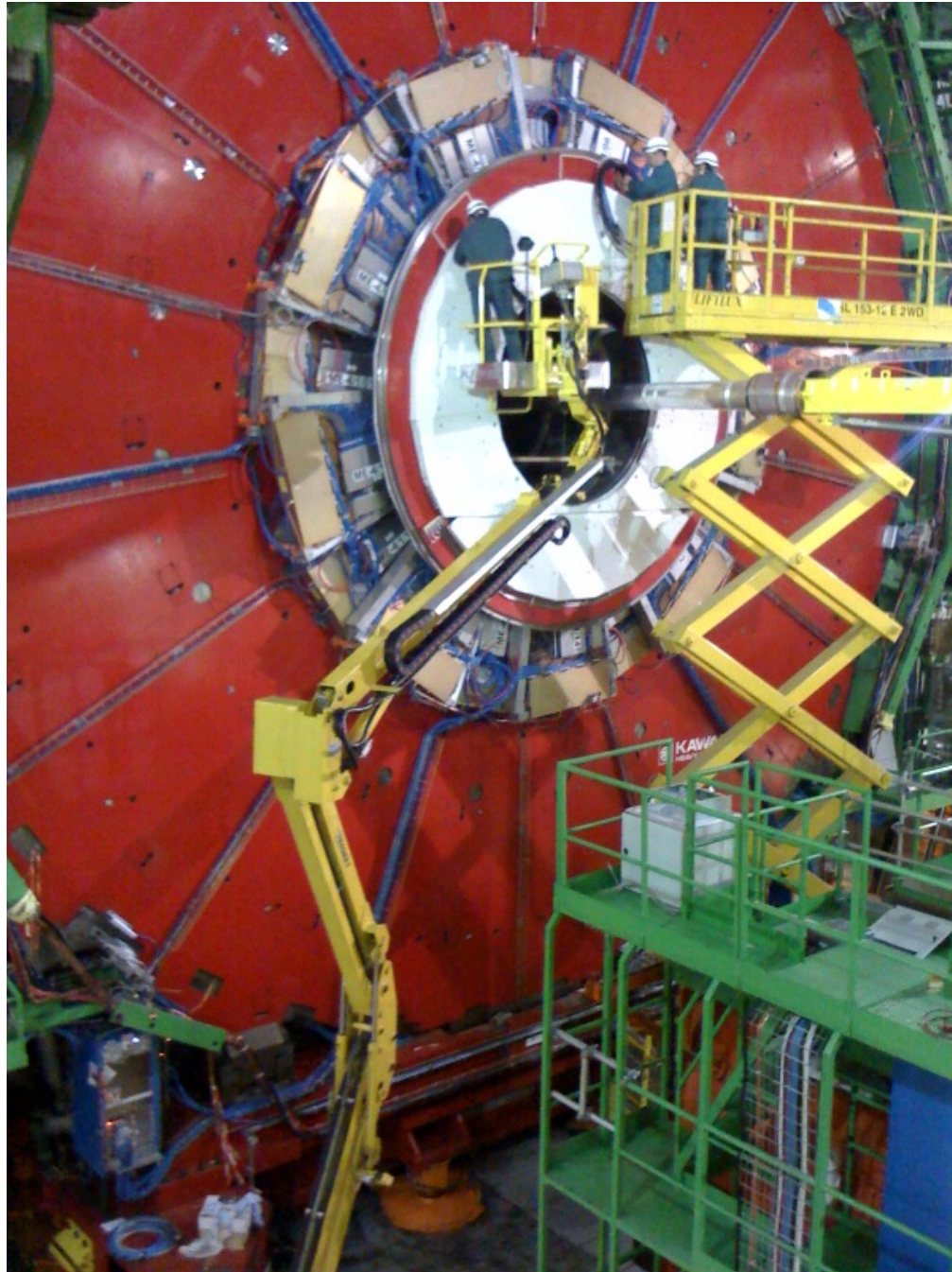
*Through Education and Innovation*

This is the most exciting era  
in Engineering and Science  
in Human History.

# Creating the Tools of Scientific Discovery







# Reengineering the Brain



# Making Solar Energy Economical



# Global Survival

*The Challenges are Profound.*

Global Survival

*and so are the opportunities.*



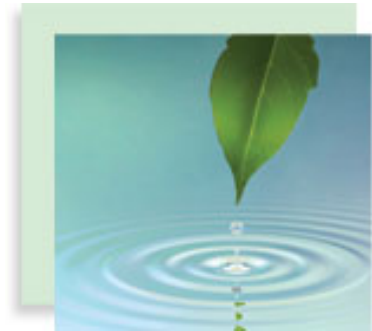
Energy  
Environment  
Global Warming  
Sustainability

Improve Medicine and  
Healthcare Delivery

## Global Health

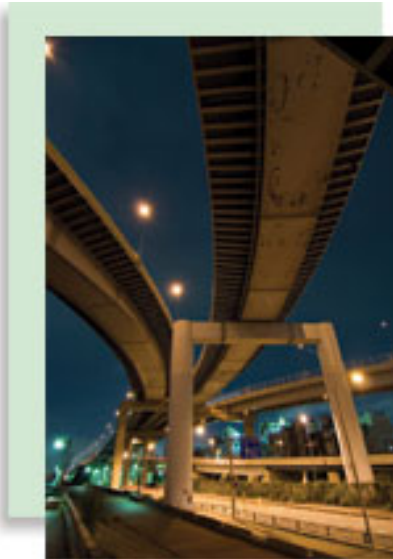


## Clean Water



Energy  
Environment  
Global Warming  
Sustainability

## Urban Sustainability



Improve Medicine and  
Healthcare Delivery

**Carbon,  
Energy,  
and Climate**



Reducing Vulnerability to  
Human and Natural Threats

Expand and Enhance  
Human Capability  
And Joy

## Secure Cyberspace



Reducing Vulnerability to  
Human and Natural Threats

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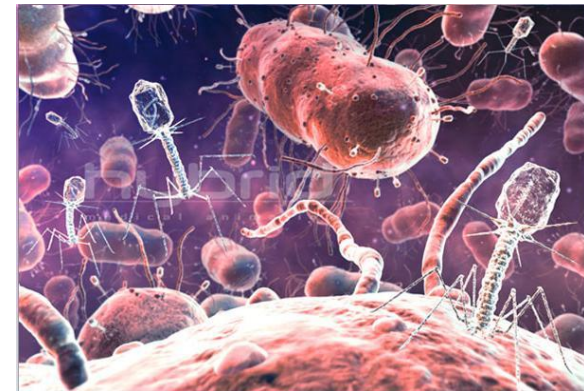
## Restore and Improve Urban Infrastructure



## Advance Personalized Learning



## Enhance Virtual Reality



I am an Optimist.

I am an Optimist.

If we can Learn together,  
we can meet Grand Challenges  
together.

**LEARNING**



**PROBLEM SOLVING**

**LEARNING**

**PEOPLE**

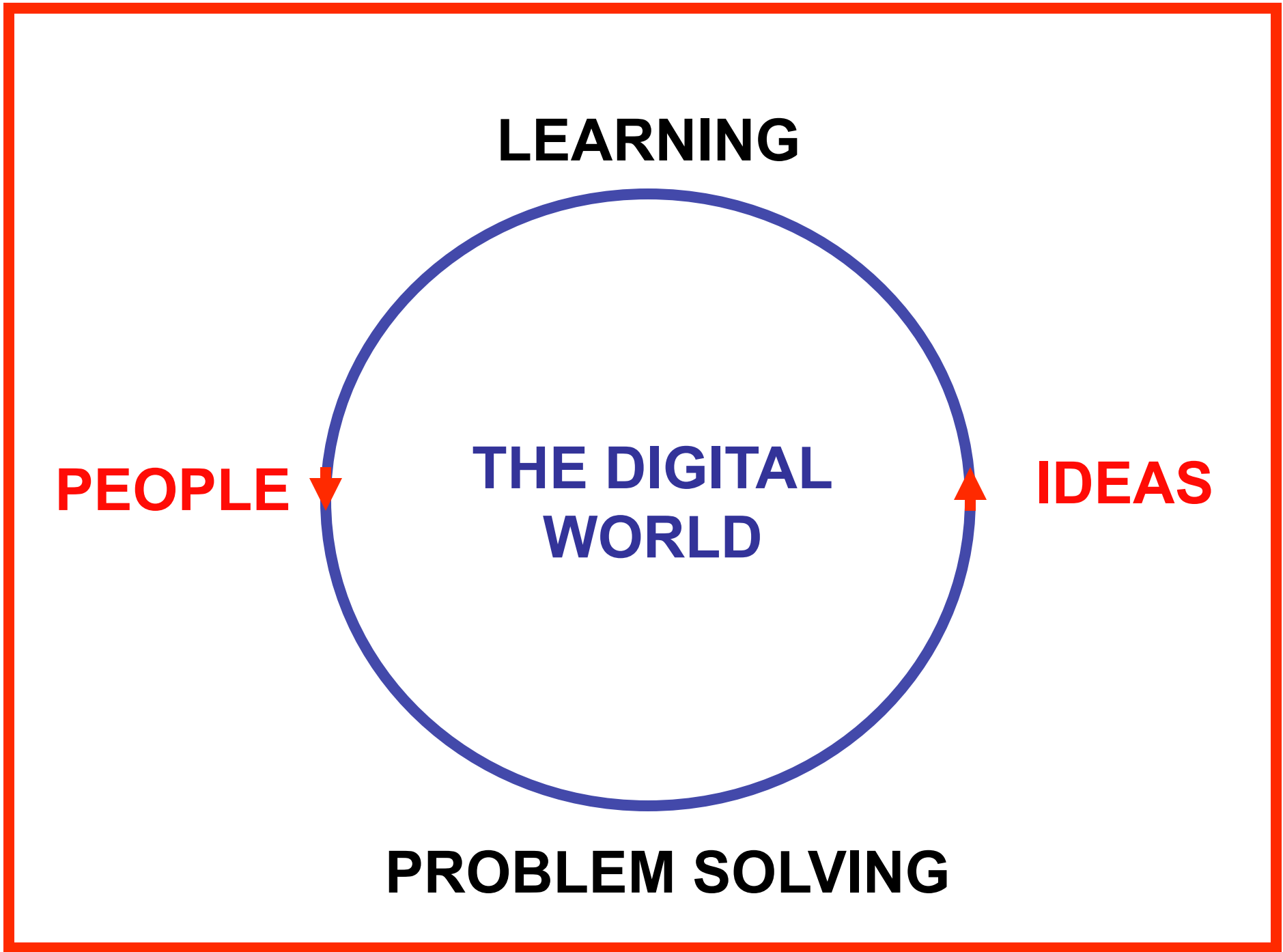


**THE DIGITAL  
WORLD**

**IDEAS**



**PROBLEM SOLVING**





I am an Optimist.

Because this is my view  
Of the Future ...

**Then**

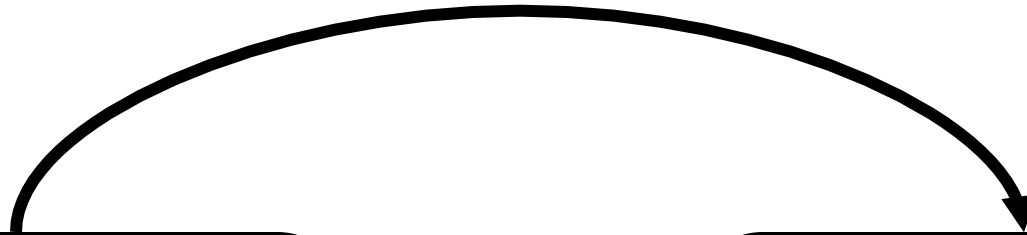
**Brain  
Drain**

**Then**

**Brain  
Drain**

**Now**

**Brain  
Circulation**



**Then**

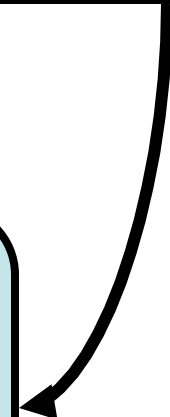
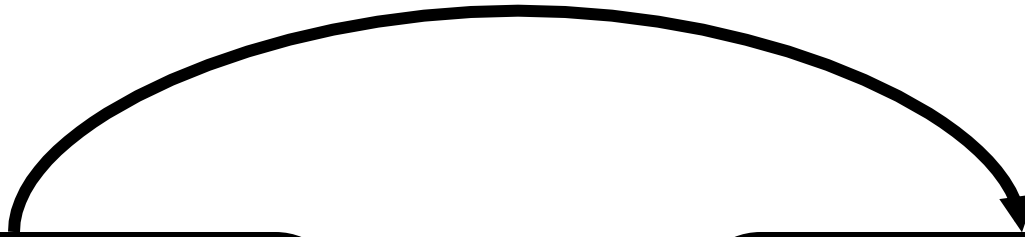
**Brain  
Drain**

**Now**

**Brain  
Circulation**

**Next**

**Brain  
Integration**



**Then**

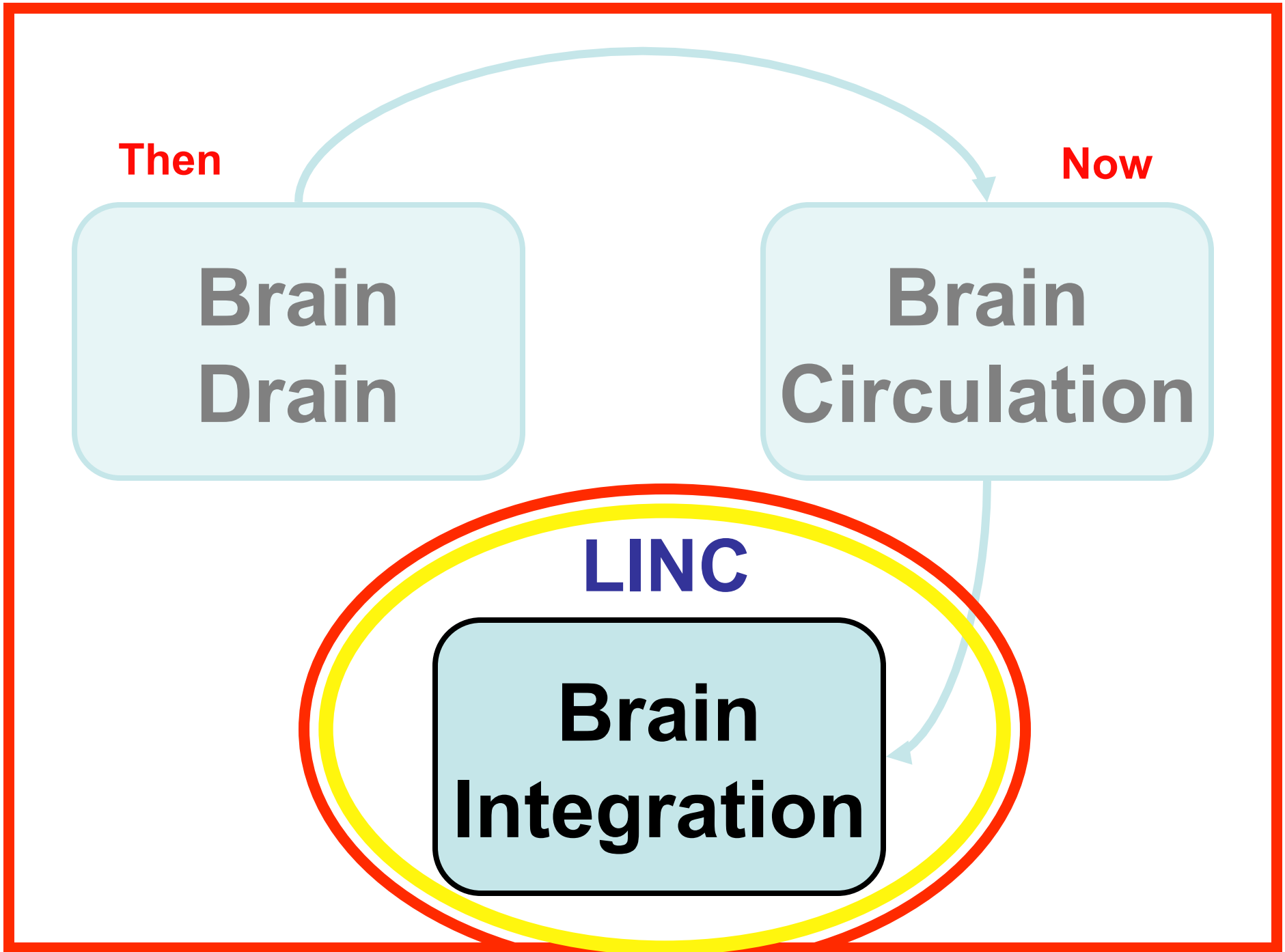
**Brain  
Drain**

**Now**

**Brain  
Circulation**

**LINC**

**Brain  
Integration**



# LINCed To Learn



**LINCed**  
To Learn



**LINCed**  
To meet Grand Challenges

**Thank you.**