



***Network for Computational Nanotechnology-
Collaborative Learning and Information Sharing
for Global Challenges***

HUBzero Workshop

Indianapolis, IN

April 12-14, 2010

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Program Director

Electrical, Communications, and Cyber-Systems (ECCS) Division

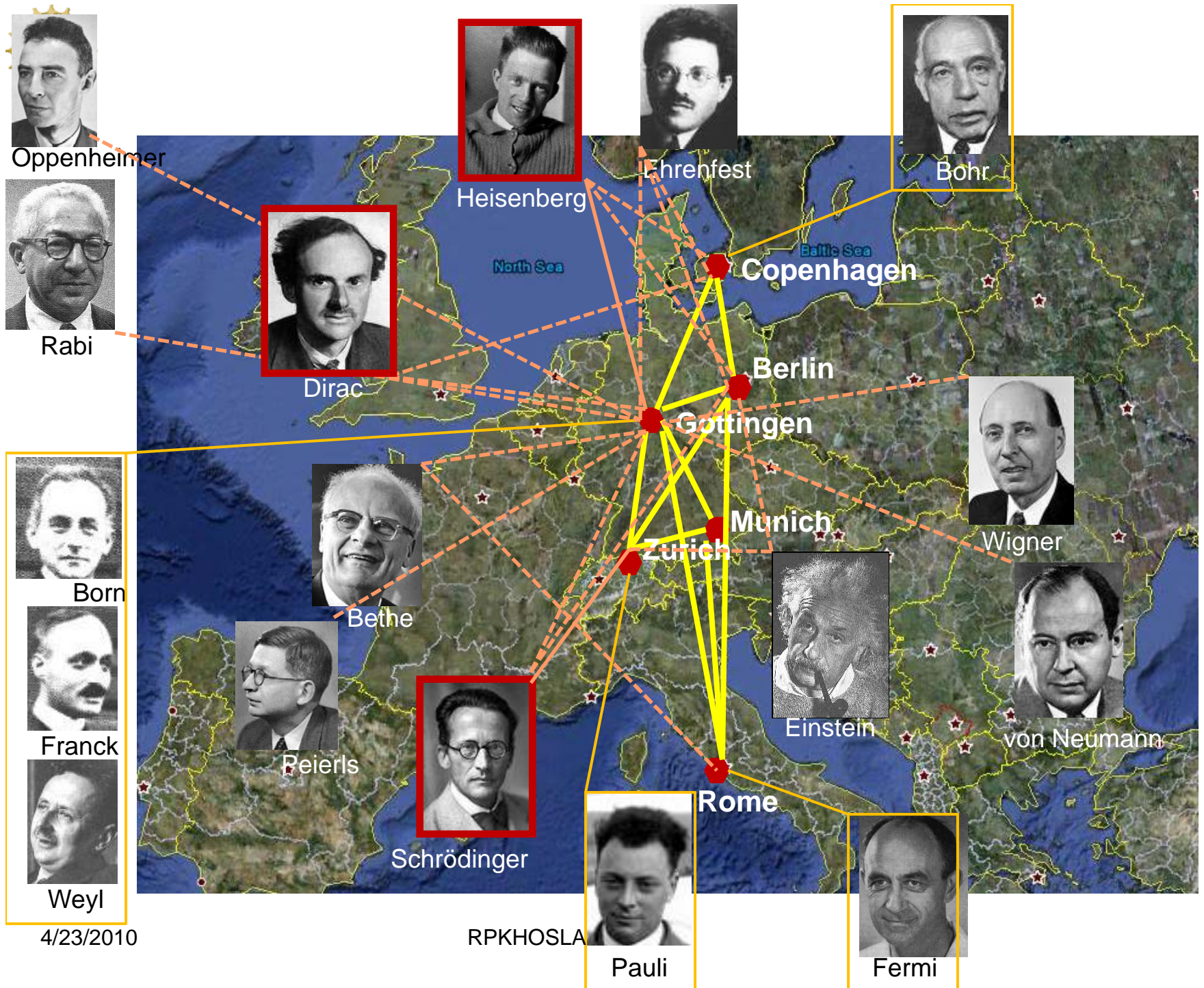
National Science Foundation

rkhosla@nsf.gov



Presentation Outline

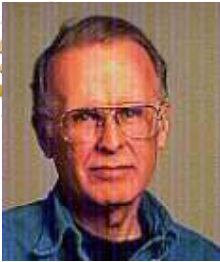
- **Historical Perspective**
- **Network for Computational Nanotechnology (NCN)**
- **NCN supports NSF and NNI Goals**
- **HUBzero**
- **Conclusion**



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John Backus

Chemistry (Virginia) & Mathematics (Columbia)
SSEC (IBM)
Fortran (IBM)
Algol (IBM)
Fellow (IBM)
Computing Language

Computing

Intel 4004 Microprocessor 1971



"Ted" Hoff

EE (RPI) EE (Stanford)
IC Designer (Intel)
Computer on a chip 1968



RISC

Reduced Instruction set
Computer

John Cocke

Mech. Engr. & Math (Duke)
Harvest (IBM)
Reduced Instruction Set (IBM)



IBM 360

Gene Amdahl

Engineering Physics (SDakota State U)
Physics (Wisconsin)
Design Engineer (IBM) Stretch/7030/360
Amdahl Corp.
Trilogy Systems, ...

Gerrit Blaauw

EE (Lafayette College)
Physics (Harvard)
Design Engineer (IBM) Stretch/8000/360
Professor (Twente)



Federico Faggin

Physics (U. Padua)
MOS Process (Fairchild)
Automated Logic Design (Intel)
Test Systems & Applications (Intel)



Marc Auslander

Math (Princeton)
Formac (IBM)
PL.8 (IBM)



Fred Brooks

Physics (Duke) & Engineering Physics (Harvard)
Design Engineer (IBM) Stretch/7030/360
Computer Organization (IBM)
Processor Engineer (IBM)
Professor (UNC)

4/23/2010



Stanley Mazor

Mathematics (SFSU)
Programmer (Fairchild)
Digital Designer (Digital)
4004 Code Software (Intel)



Greg Chaitin

Math (City College)
Algorithmic Theory (IBM)



Charles Bennett

Chemistry (Brandeis)
Physics (Harvard)
Molecular Dynamics
(Argonne)
Information Physics (IBM)



Personalization: Communications and Computing



Information accessible to everybody everywhere



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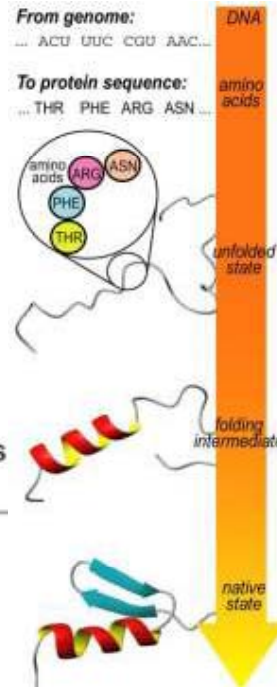
Sharing and Openness

Sharing Knowledge

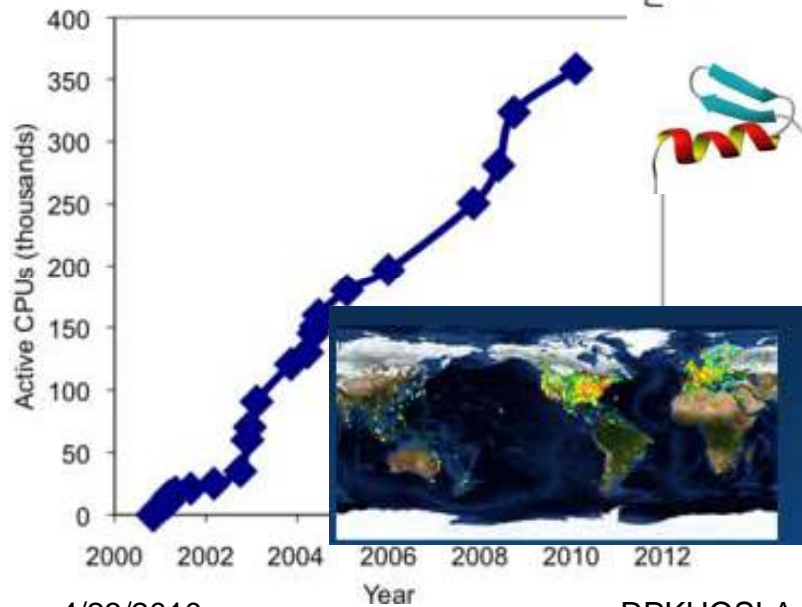
Performing complex calculations: protein folding

<http://folding.stanford.edu>
folding@home

internet

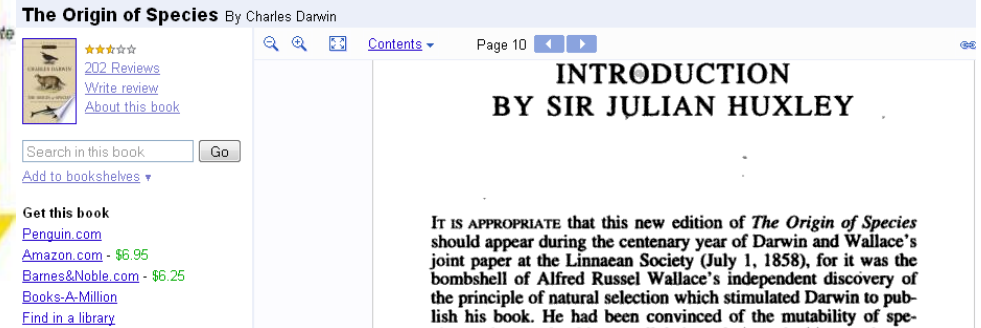
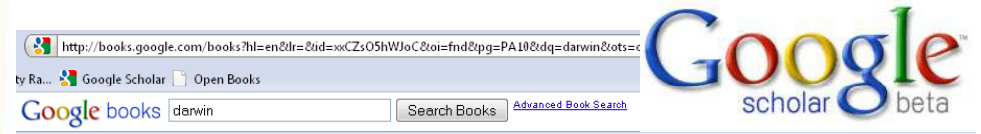
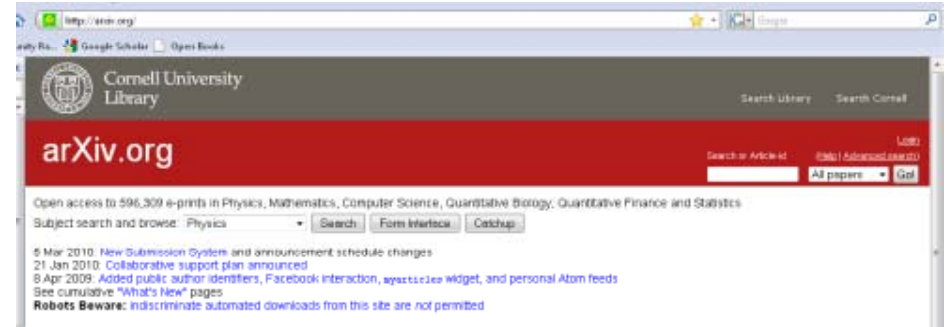


Number of Active Folding@Home CPUs



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Network for Computational Nanotechnology (NCN)

- Nanoscale Modeling and Simulation Solicitation (NSF 00-36) resulted in seven awards (2000)
- “Molecular Nanoelectronics: Simulation from Molecules to Circuits,” NSF award to Purdue University under the leadership of Prof. Mark Lundstrom (2000). Purdue University Network Computing Hubs (PUNCH)
- Expansion of the Purdue’s web-based “Nanosimulation” Capability Workshop (2001)
- NCN-A Multidisciplinary, Multi-university Core Team designed to encourage the broader participation of communities in research and education (2002)
- nanoHUB (2004)/HUBzero (2007)



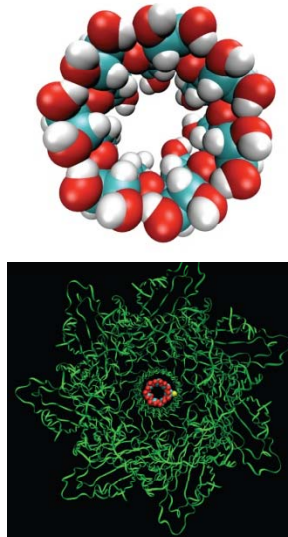
Network for Computational Nanotechnology (NCN) Infrastructure



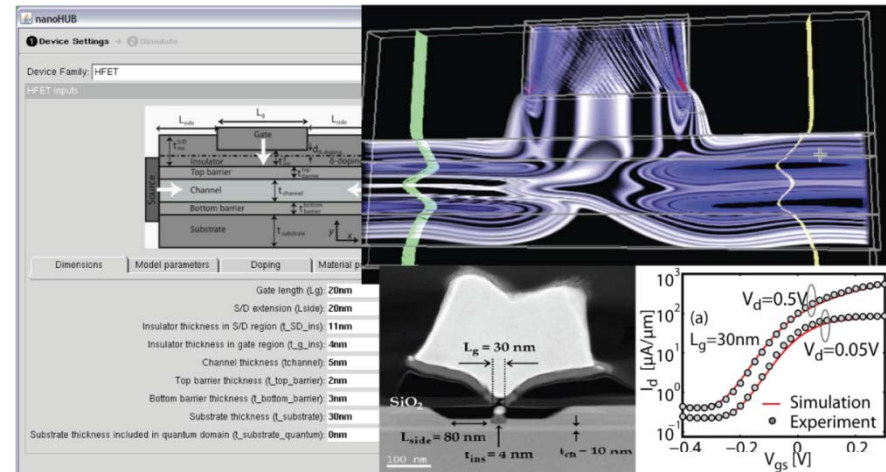


Collaborative Discovery

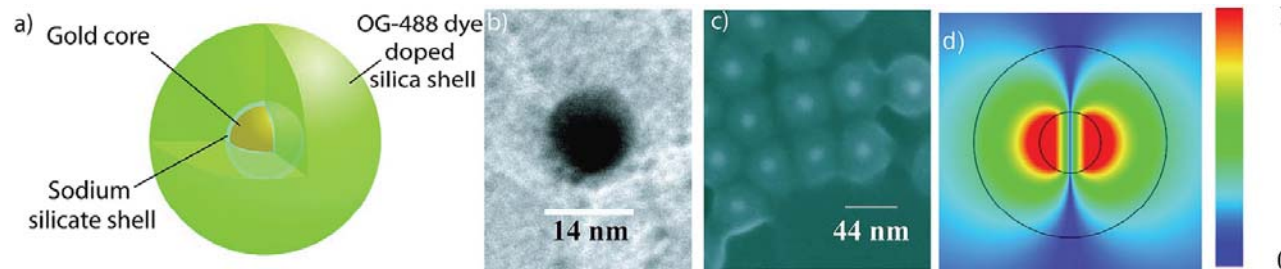
3D Particle Ion Channel Simulator



Modeling Electron Transport in High-Mobility Transistors



Spacer-based Nanolaser



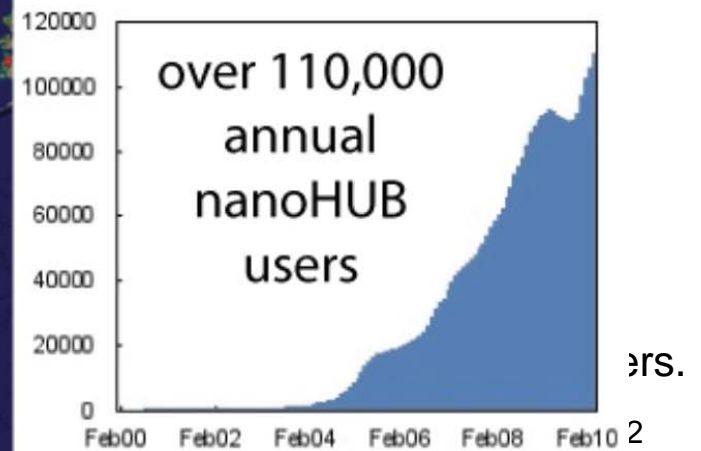
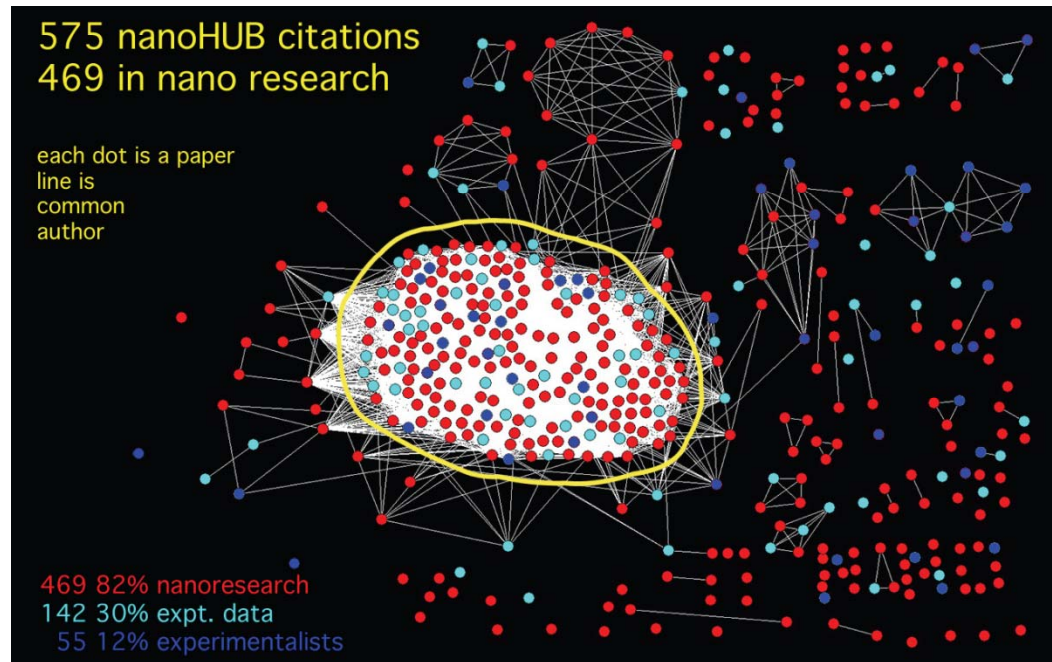


Education & Diversity





nanoHUB Global-Impact





NCN Supports NSF Goals

- ***Discovery***
 - *Advancing the Frontiers of Knowledge*
- ***Learning***
 - *Science & Engineering Workforce and Scientific Literacy*
- ***Research Infrastructure***
 - *Advanced Instrumentation and Facilities*
- ***Stewardship***
- *Supporting Excellence in Science and Engineering Research with their Integration into Education.*



NCN supports NNI Goals

- *Advance a world-class research and development program*
- *Foster technology transfer for commercial and public benefit*
- *Develop and sustain educational resources, a skilled workforce, and the supporting research infrastructure and tools*
- *Support responsible development of nanotechnology*



IndianaCTSI | GLOBALHUB | thermalHUB

PHARMAHUB | MANUFACTURINGHUB | cceHUB cancercareengineering

CAT CENTER FOR ASSISTIVE TECHNOLOGY
CONNECTING ASSISTIVE TECHNOLOGY CONSUMERS, PROFESSIONALS, INNOVATORS, AND PROVIDERS | METSHUB | C3Bio

driNET DROUGHT RESEARCH INITIATIVE NETWORK | CLEARHUB Collaboratory for Engineering Education Research | NEEShub George E. Brown, Jr. Network for Earthquake Engineering Simulation

TEMHUB | SMARTENERGY-HUB Indiana Advanced Electric Vehicle Training & Edu | Open Parks Grid The Knowledge Pipeline fo

hpc | eiHUB

Regenstrief Center Healthcare Delivery Hub | Center for Biological and Environmental Nanotechnology | Volcano Hub SUNY Buffalo



Conclusion

- Throughout history, sharing information and solving challenges in a *collaborative fashion* have led to major discoveries in science, engineering and technology.
- Many current and future societal challenges will necessitate even a larger collaborative effort , which requires network infrastructure such as the *NCN and the HUBzero*. There are many opportunities to extend the HUBzero concept to new areas such as security, health care, environment, energy, and transportation.
- NCN is an outstanding example of a *Cyberinfrastructure* in support of the NSF vision- ‘ to Advance the discovery, innovation and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering.’



Thank You!