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## We will begin momentarily at 2pm ET

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## Have Questions?

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**"Why am I muted?"**
Don't worry. Everyone is muted except the presenter and host. Thank you and enjoy the show.

Type them into questions box!

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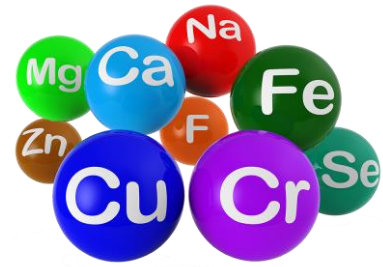
## Have you discovered the missing element?

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**Thursday, July 9, 2015**

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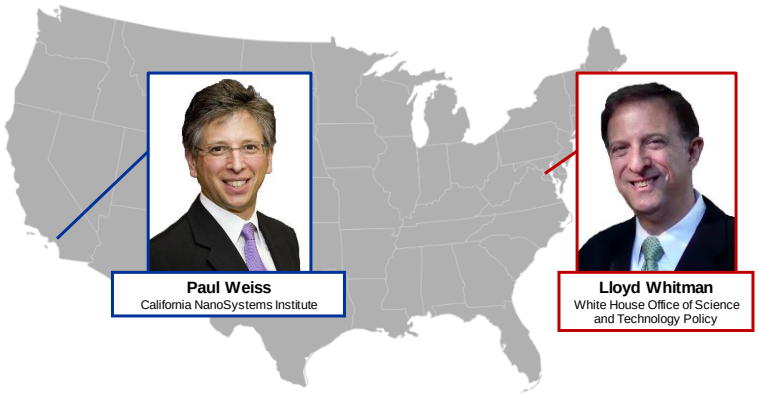
*"Nanotechnology-Inspired Grand Challenges"*

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## A Special Message from Diane Grob Schmidt

***2015 ACS President***



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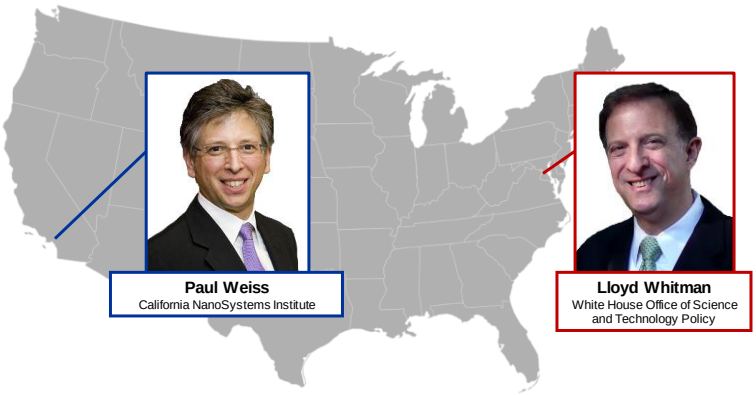


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# A Call for Nanotechnology-Inspired Grand Challenges

https://federalregister.gov/a/2015-14914

Lloyd Whitman
Assistant Director for Nanotechnology
White House Office of Science and Technology Policy

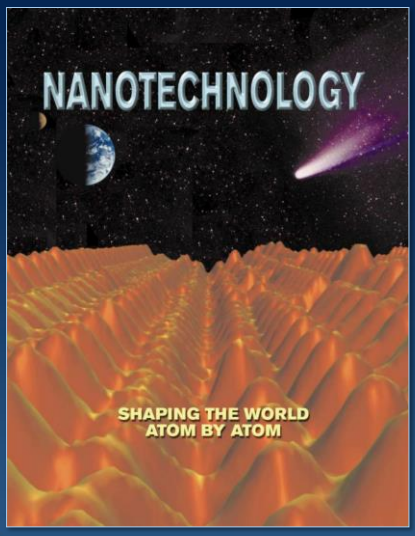
*ACS Webinar, July 7, 2015*

## National Nanotechnology Initiative (NNI)

20 Federal Departments and Independent Agencies
*11 with nanotech budgets*

2015 budget: $1.5 billion
*$22 billion since 2001*

www.nano.gov

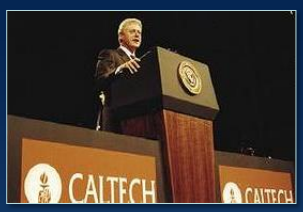



NNI Brochure, 2000

# 15 Years of Presidential Nanotechnology

"Just imagine materials with 10 times the strength of steel and only a fraction of the weight… it was a real thrill for me to meet Dr. Moore, …even I knew what Moore's Law was."

*President Clinton at CalTech, January 21, 2000*




Discussing nanomanufacturing at Boise State, the President invoked Moore's law, and later remarked "Some of your faculty and students are working with next-generation materials like graphene, which is a material that's thinner than paper and stronger than steel."

*President Obama at Boise State, January 21, 2015*

news.boisestate.edu

# Fifth Assessment of NNI by PCAST

NNI has delivered significant S&T progress

*Healthy research should continue*

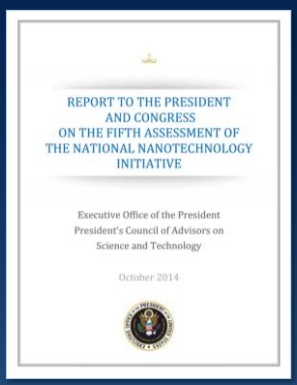
International competition has increased

*U.S. now behind in infrastructure, workforce*

"NNI 2.0" should focus on nano-systems and commercialization

Agencies should facilitate commercialization through Grand Challenges

Need formal system of metrics to track progress



REPORT TO THE PRESIDENT
AND CONGRESS
ON THE FIFTH ASSESSMENT OF
THE NATIONAL NANOTECHNOLOGY
INITIATIVE

Executive Office of the President
President's Council of Advisors on
Science and Technology

October 2014

## Innovating Through Grand Challenges

Ambitious but achievable goals that harness science, technology, and innovation to solve important national or global problems and have the potential to capture the public's imagination.

DOE SunShot Grand Challenge

*Make solar energy cost competitive with coal by 2020*

DOE EV Everywhere Grand Challenge

*Make electric vehicles that are as affordable as today's gasoline-powered vehicles by 2022*

NASA's Asteroid Grand Challenge

*Find all asteroid threats to human populations and know what to do about them*

## Characteristics of a Grand Challenge

Measurable end-point

Advances in fundamental scientific knowledge

Clear intermediate milestones

Drives the need for collaboration

Catalyzes the transition of technologies

Too big to be undertaken by one or even a few organizations

Exciting enough to motivate decision makers

Captures the imagination of the public

# Nanotechnology-Inspired Grand Challenges for the Next Decade

Ambitious but achievable goal that harnesses nanoscience, nanotechnology, and innovation…

Not every important challenge will be solved using nanotech

*Aim is to identify those where benefits of nano likely to play an important role in solving the problem*

Six examples developed by agencies, NNCO, & OSTP

# Example Nano-Inspired Grand Challenges

By 2025, achieve the following:

*Increase the five-year survival rates by 50% for the most difficult to treat cancers*

*Create devices no bigger than a grain of rice that can sense, compute, and communicate without wires or maintenance for 10 years, enabling an "internet of things" revolution*

*Create computer chips that are 100x faster yet consume less power*

*Manufacture atomically-precise materials with fifty times the strength of aluminum at half the weight and the same cost*

*Reduce the cost of turning sea water into drinkable water by a factor of four*

*Determine the environmental, health, and safety characteristics of a nanomaterial in a month*

# Information Requested

Your ideas for grand challenges

How to improve any of the examples offered

For each grand challenge discussed, answer some key questions

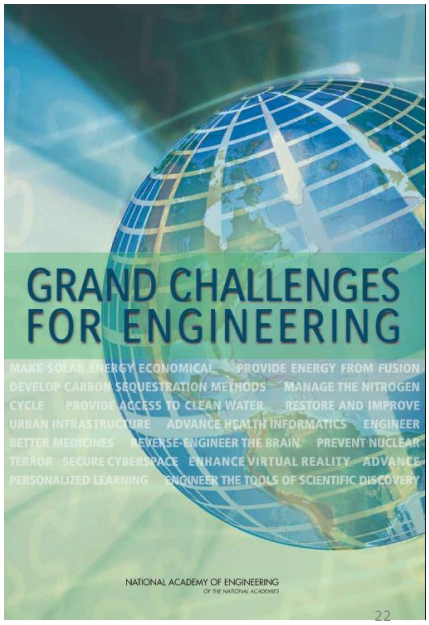
**Responses accepted through 11:59 pm Eastern Time on July 16, 2015**

Email preferred: NNIChallenges@nnco.nano.gov

Depending upon responses, may select a few to announce this fall, possibly in partnership with other organizations

## Grand Challenges

**National Academy of Engineering**
**www.engineeringchallenges.org**



# BRAIN Initiative:
## Understanding Functioning & Malfunctioning Neural Circuits in the Brain

**Approaches:**
- Dynamic voltage mapping
- Dynamic chemical mapping
- Physical connectome
- Computer simulations

**Human brain:**
- ~100 non-orthogonal chemical neurotransmitters
- ~85 billion neurons
- ~100 trillion synapses


Nanotools for Neuroscience and Brain Activity Mapping

A. Paul Alivisatos,[†] Anne M. Andrews,[‡,§] Edward S. Boyden,[⊥] Miyoung Chun,[∥] George M. Church,[#] Karl Deisseroth,[∇,□] John P. Donoghue,[■] Scott E. Fraser,[○] Jennifer Lippincott-Schwartz,[●] Loren L. Looger,[△] Sotiris Masmanidis,[‡,▲,*] Paul L. McEuen,[▽] Arto V. Nurmikko,[▼] Hongkun Park,[◇] Darcy S. Peterka,[●] Clay Reid,[††] Michael L. Roukes,[‡‡,§§] Axel Scherer,[‡‡,⊥⊥,*] Mark Schnitzer,[∇,∥∥] Terrence J. Sejnowski,[▲▲] Kenneth L. Shepard,[##] Doris Tsao,[∇,¶] Gina Turrigiano,[□□] Paul S. Weiss,[‡,■■,*] Chris Xu,[○○] Rafael Yuste,[●●●,*] and Xiaowei Zhuang[△△]

[†]Department of Chemistry, University of California, Berkeley, California 94720, United States and Lawrence Berkeley Laboratory, Berkeley, California 94720-1460, [‡]California NanoSystems Institute and [§]Department of Psychiatry, and Semel Institute for Neuroscience & Human Behavior, Department of Chemistry & Biochemistry, University of California, Los Angeles, Los Angeles, California 90095, [⊥]Media Laboratory, Department of Biological Engineering, Brain and Cognitive

NANO FOCUS

**Alivisatos *et al.*, *ACS Nano* 7, 1850 (2013)**

**www.whitehouse.gov/share/brain-initiative**
***cf*. European Union Human Brain Project, www.humanbrainproject.eu**

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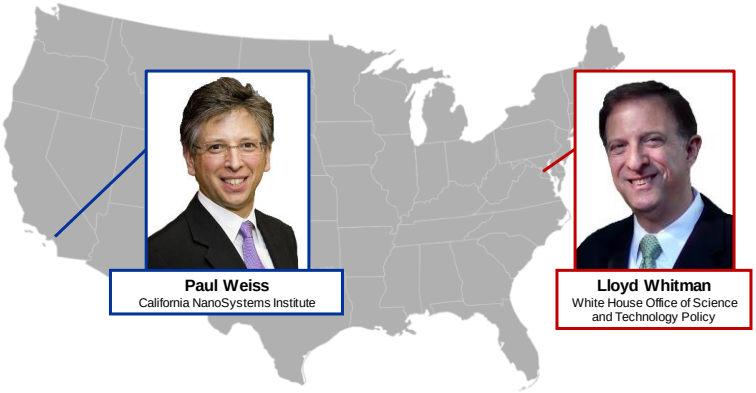


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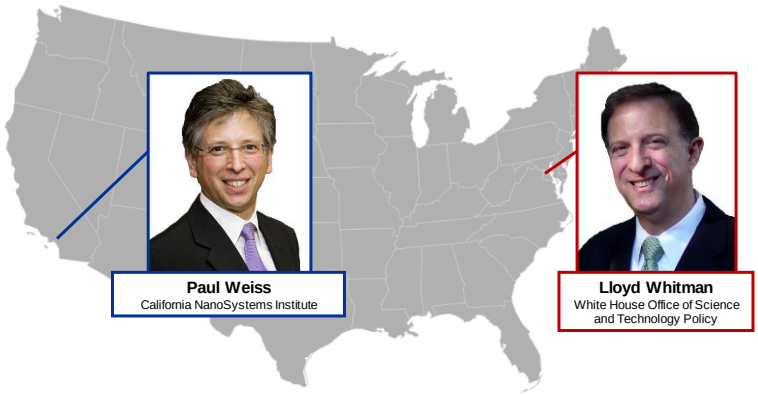


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