

# *Welcome to the 1<sup>st</sup> Annual NNCI Conference*

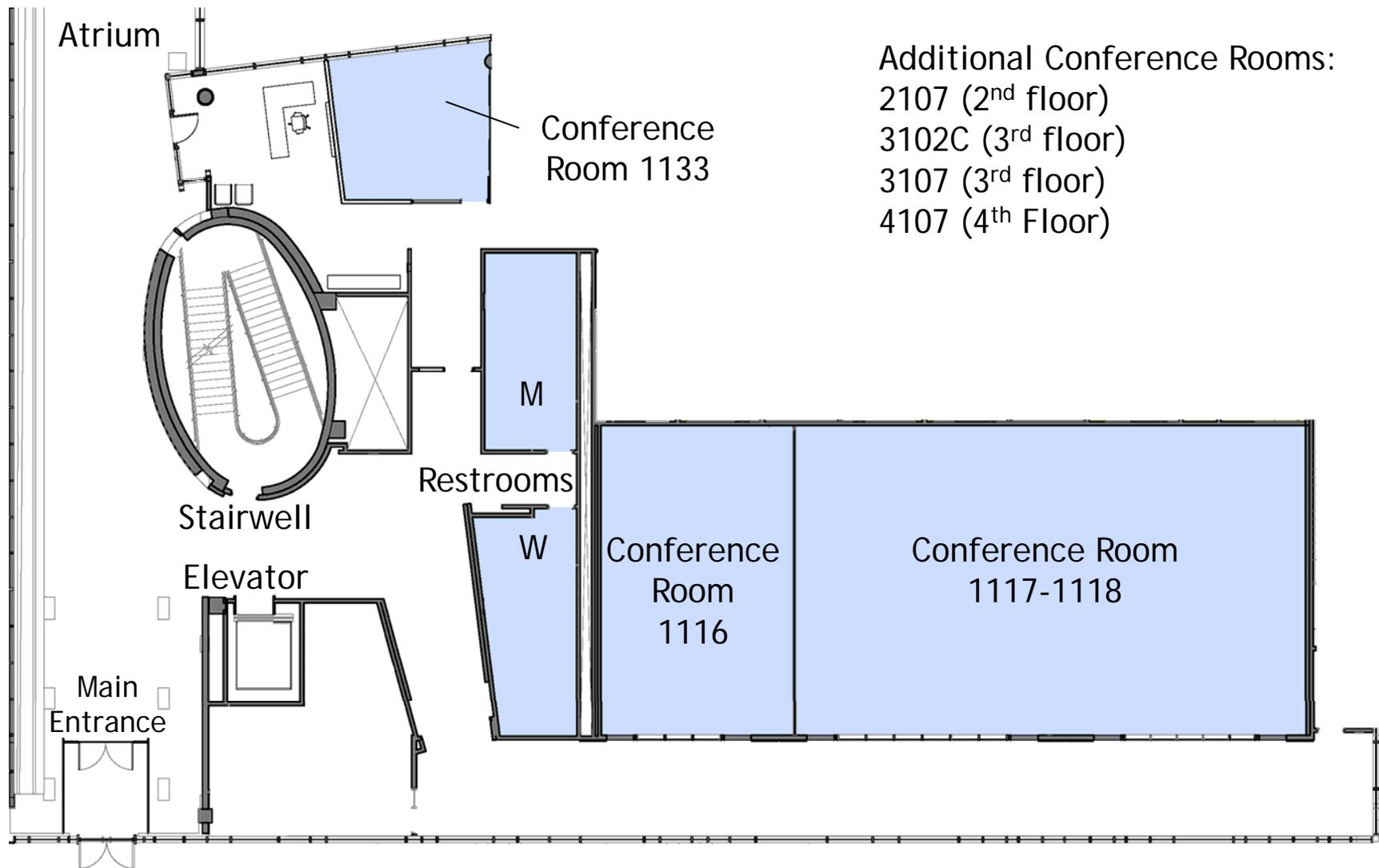
MARCUS NANOTECHNOLOGY BUILDING



National Nanotechnology  
Coordinated Infrastructure



# Room Locations



# Welcome to the NNCI Advisory Board



Tina Bahadori  
EPA



Dion Dionysiou  
U Cincinnati



Reggie Farrow  
NJIT



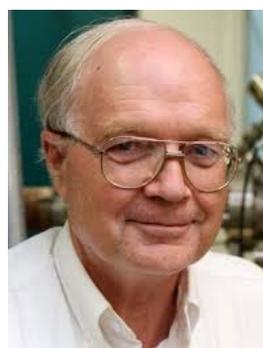
Andrew Greenberg  
U Wisconsin



Angelique Johnson  
Entrepreneur



Joe Magno  
NC COIN



Richard Osgood  
Columbia U



Kurt Petersen  
Entrepreneur



Andreas Roelofs  
Argonne NL



Ken Wise  
U Michigan

# NNCI Conference Program at a Glance

## Wednesday, January 18

8:00-8:30	<i>Continental Breakfast</i>
8:30-8:35	Welcome (Steve Cross, GT EVPR)
8:35-9:15	NNCI Overview
9:15-10:15	Site Reports Group 1: SHyNE, CNS, NNI, RTNN, SDNI, MONT
10:15-10:35	<i>Break</i>
10:35-11:20	Invited Speaker: Magnus Egerstedt, Georgia Tech
11:20-12:05	NNCI Program Reports Education & Outreach, SEI, Computation
12:05-1:30	<i>Lunch</i>

# NNCI Conference Program at a Glance

## Wednesday, January 18 (continued)

1:30-2:20	Site Reports Group 2: MINIC, NanoEarth, CNF, SENIC, NNF
2:20-3:05	Invited Speaker: Jeffrey Morse, U Mass-Amherst
3:05-3:25	<i>Break</i>
3:25-4:25	Breakout Sessions 1
4:25-5:10	Reports of Breakout Groups
5:10-6:00	Facilities Tour
6:00-7:30	<i>Reception &amp; Dinner</i>
7:30-9:00	Advisory Board Meeting NNCI Site Directors Meeting with CO

# NNCI Conference Program at a Glance

## Thursday, January 19

8:00-8:30	<i>Continental Breakfast</i>
8:30-9:20	Site Reports Group 3: TNF, MANTH, nano@stanford, KY MMNIN, NCI-SW
9:20-10:05	Invited Speaker: Ravi Bellamkonda, Duke U
10:05-10:25	<i>Break</i>
10:25-11:25	Breakout Session 2
11:25-11:35	<i>Boxed Lunch Pick-Up</i>
11:35-12:20	Reports of Breakout Groups
12:20-1:20	Advisory Board Report & Discussion
1:20	<i>Adjourn</i>

# Invited Speakers



## **Dr. Magnus Egerstedt**

Executive Director, Institute for Robotics & Intelligent Machines  
Professor, School of Electrical and Computer Engineering  
Georgia Institute of Technology

**Control and Coordination of Increasingly Larger Teams of Smaller Robots**



## **Dr. Jeffrey Morse**

Managing Director, National Nanomanufacturing Network  
NSF Center for Hierarchical Nanomanufacturing  
University of Massachusetts - Amherst

**Advanced Roll-to-Roll Nanofabrication Facility at the University of Massachusetts**



## **Dr. Ravi Bellamkonda**

Dean, Pratt School of Engineering  
Professor, Department of Biomedical Engineering  
Duke University

**Nanocarriers to Treat Gliomas of the Brain**

# Breakout Sessions

## **Breakout Session 1**

1/18, 3:25-4:25PM

### ***Future Research Directions***

Oliver Brand, SENIC, NNCI CO

### ***Working with Users / User Support***

Tobi Beetz, nano@stanford

### ***Education & Outreach***

Nancy Healy, SENIC, NNCI CO

### ***Non-Traditional Users***

Maude Cuchiara, RTNN

### ***NNCI Website***

David Gottfried, SENIC, NNCI CO

## **Breakout Session 2**

1/19, 10:25-11:25AM

### ***Facility Operations***

Gary Spinner, SENIC

### ***Marketing & User Recruitment***

Ben Myers, SHyNE

### ***Computational Resources***

Azad Naeemi, NNCI CO

### ***Societal & Ethical Implications***

Jamey Wetmore, NCI-SW, NNCI CO

### ***Advisory Board Meeting***

# NNCI “Play Calling Armband”



CNF	Cornell Nanoscale Science and Technology Facility
CNS	Center for Nanoscale Systems
KY MMNIN	Kentucky Multi-Scale Manufacturing and Nano Integration Node
MANTH	Mid-Atlantic Nanotechnology Hub
MINIC	Midwest Nanotechnology Infrastructure Corridor
MONT	Montana Nanotechnology Facility
NanoEarth	Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure
NCI-SW	Nanotechnology Collaborative Infrastructure Southwest
NNF	Nebraska Nanoscale Facility
NNI	Northwest Nanotechnology Infrastructure
RTNN	Research Triangle Nanotechnology Network
SDNI	San Diego Nanotechnology Infrastructure
SENIC	Southeastern Nanotechnology Infrastructure Corridor
SHyNE	Soft and Hybrid Nanotechnology Experimental Resource
nano@stanford	NNCI Site @ Stanford
TNF	Texas Nanofabrication Facility



***National Nanotechnology  
Coordinated Infrastructure (NNCI)***



National Nanotechnology  
Coordinated Infrastructure



# Outline

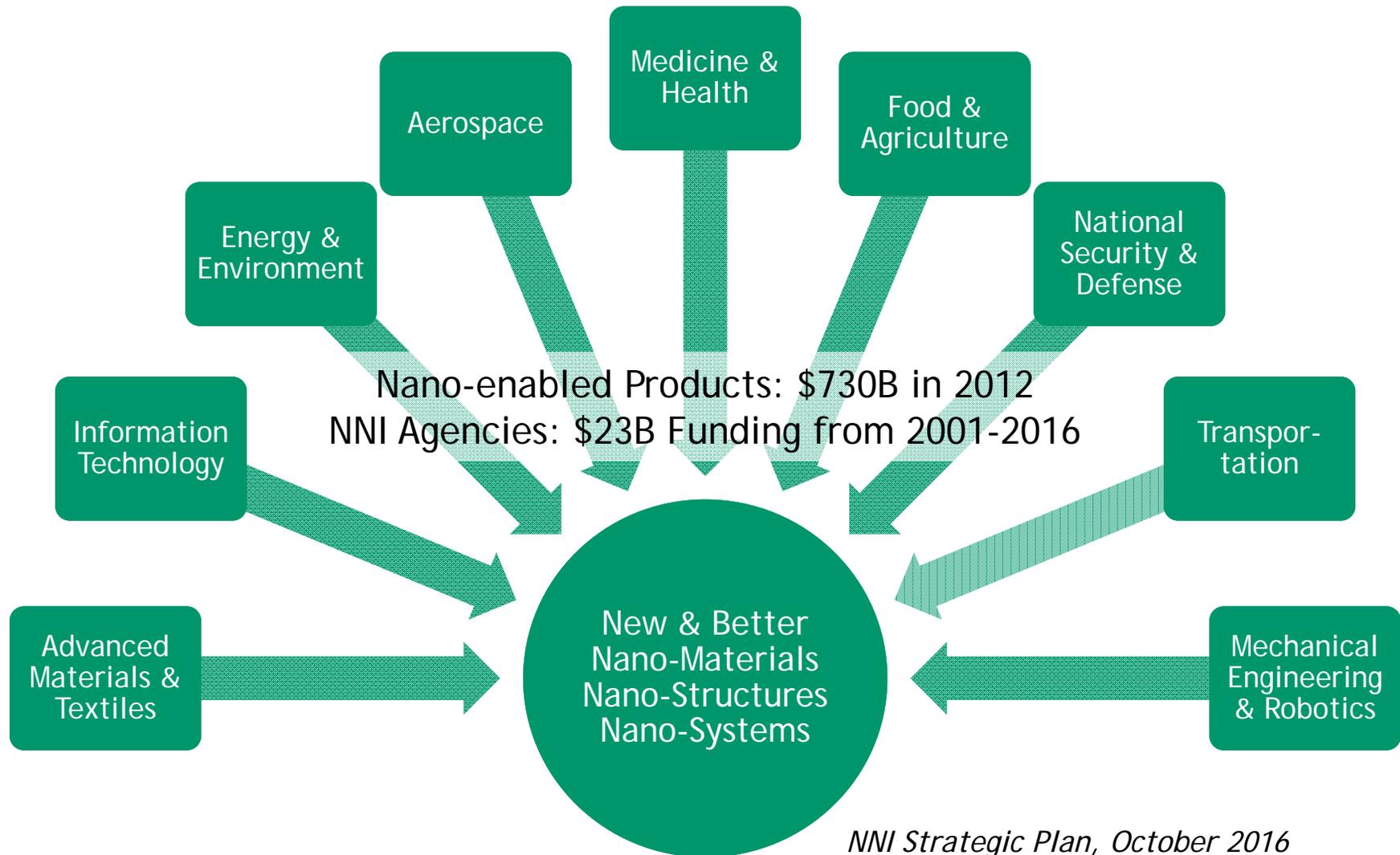
- Nanotechnology Impact and Challenges
- NNCI Year I Facilities Usage
- NNCI Coordinating Office (NNCI CO)
  - Organization
  - Initiatives: Webpage, Sub-Committees & Working Groups, NNCI Conference, Annual Reporting
  - Questions & Discussion

# NNCI Associate Director Reports

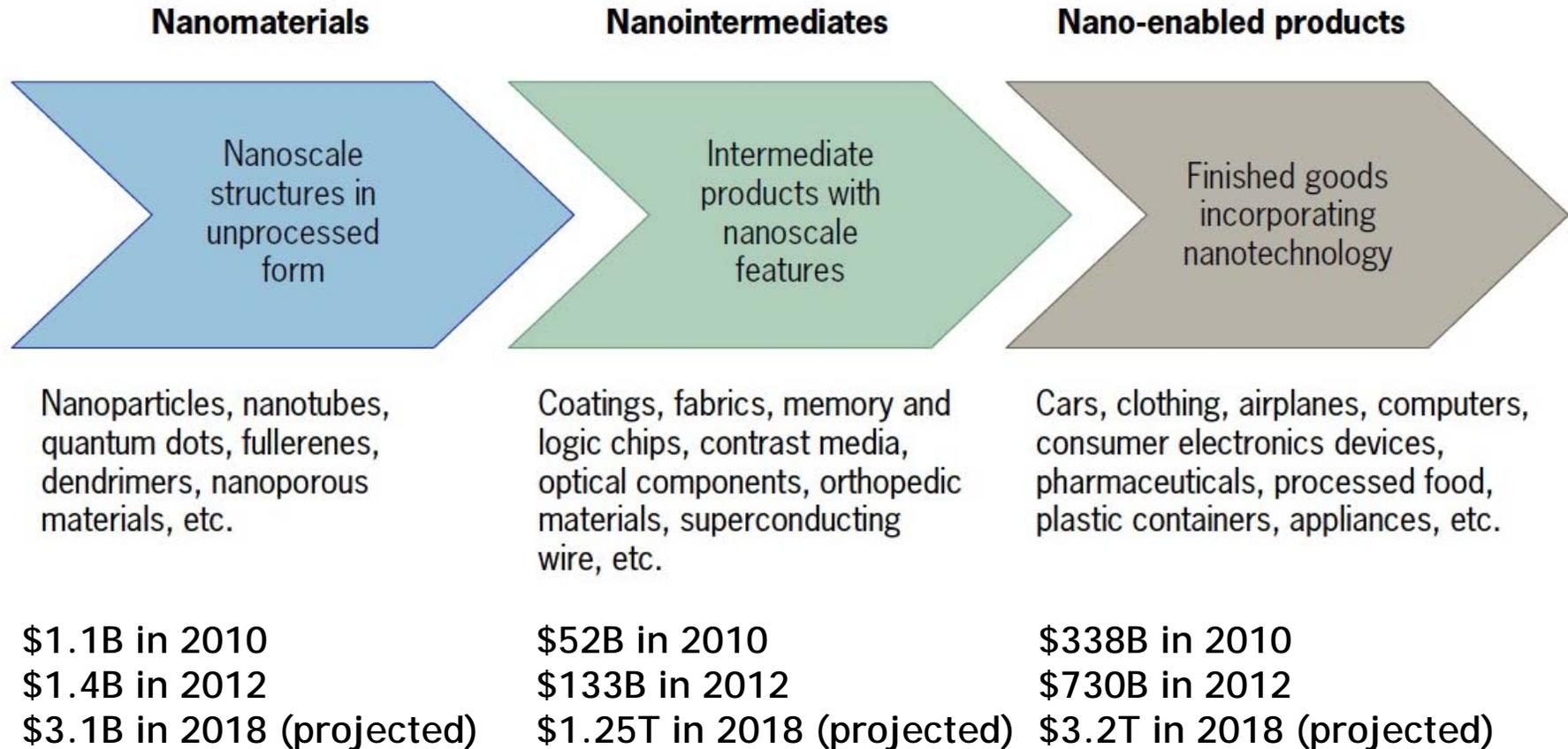
- Education & Outreach  
Dr. Nancy Healy  
11:20-11:35
- Societal & Ethical Implications  
Dr. Jamey Wetmore  
11:35-11:50
- NNCI Computation  
Dr. Azad Naeemi  
11:50-12:05
- Plus Breakout Sessions



# Nanotechnology Impact



# Nanotechnology Value Chain



# Need for Easy Access to Infrastructure

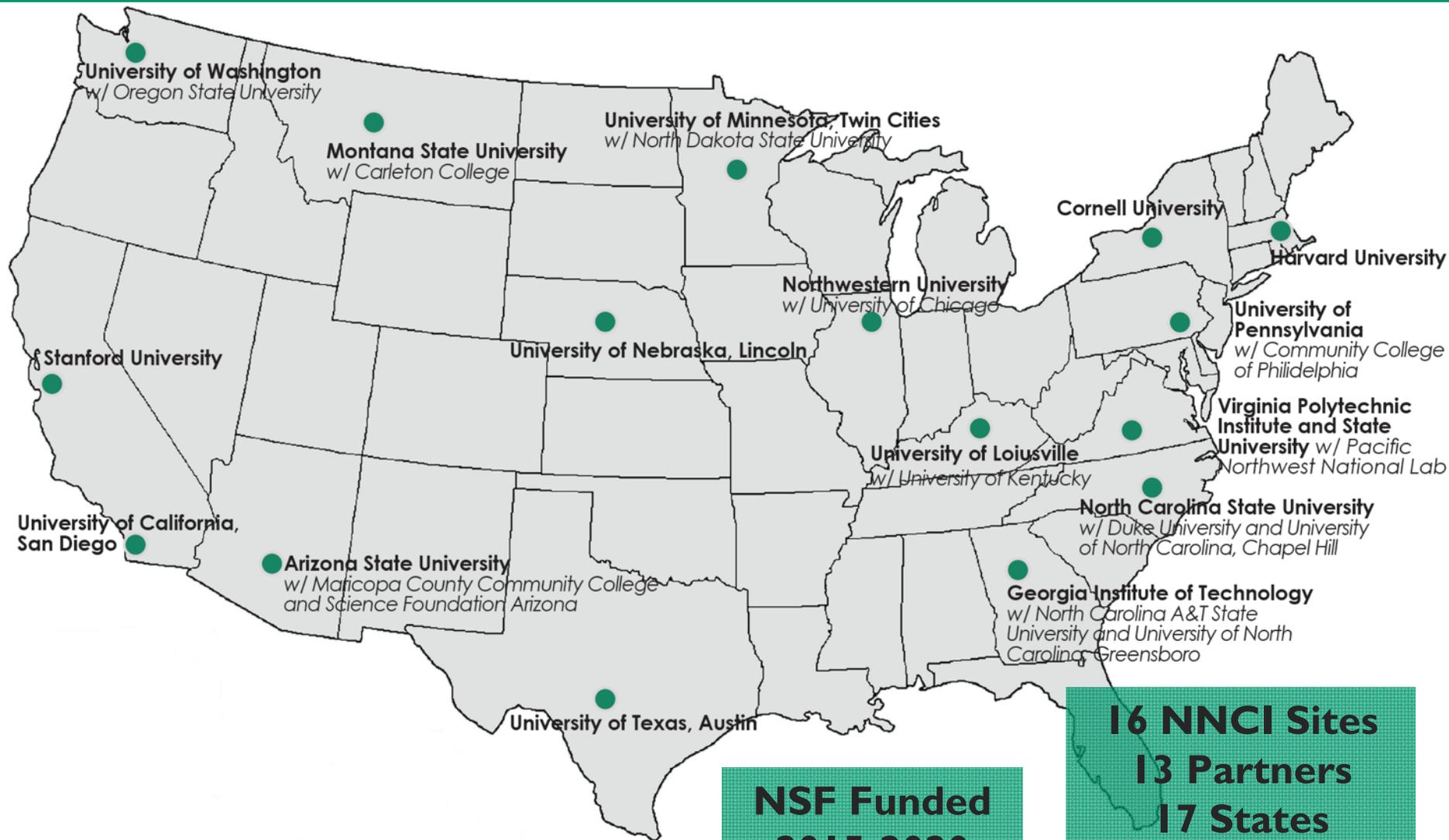
- PCAST Assessment of NNI, October 2014: DOE's NSERC, NCI's NCL, NIST's CNST, and NSF's NNIN “provide essential infrastructure for nanotechnology discovery and exploration. They provide ready access to specialized tools that are generally too expensive for each laboratory, institution, or company to acquire. They provide essential training in interdisciplinary nanoscale approaches and techniques to new generations of researchers, industrial engineers, and entrepreneurs.”
- PCAST Assessment of NNI, October 2014: “The commercialization of nanotechnology innovations depends heavily on the successful development of nanofabrication and nanomanufacturing procedures.”
- PCAST Assessment of NNI, October 2014: Recommendation 11: The NSF, NIH, DoE, DoD, and the NIST “should strongly support nanoscale research centers and infrastructure networks to ensure the effective training of a new generation of transdisciplinary scientists and engineers, in particular by strongly supporting the Next-Generation National Nanotechnology Infrastructure Network.”
- NNI Strategic Plan, October 2016: “**Goal 3: Develop and sustain educational resources, a skilled workforce, and a dynamic infrastructure and toolset to advance nanotechnology.**”

# National Nanotechnology Coordinated Infrastructure (NNCI) Goals

- Provide open access to **state-of-the-art nano-fabrication & characterization facilities** and their tools across US and **staff expertise**
- Use these resources to support **education & outreach (E&O)** as well as **societal & ethical implications (SEI)** in/of nanotechnology
- **Network approach to make whole more than the sum of its parts**
- Successor to National Nanotechnology Infrastructure Network (NNIN)



# National Nanotechnology Coordinated Infrastructure (NNCI)



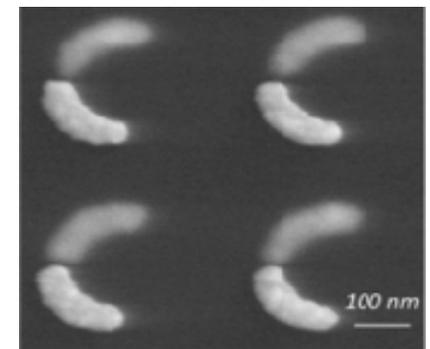
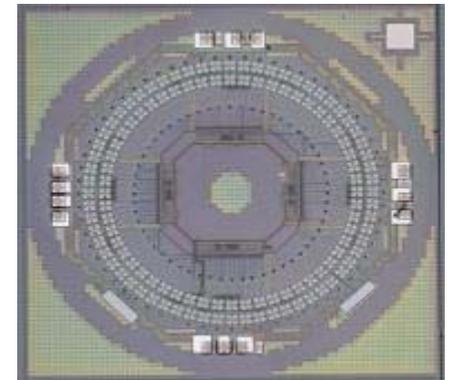
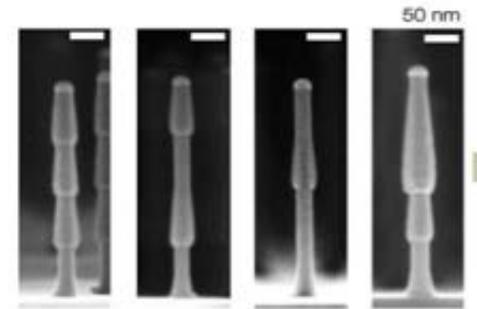
**NSF Funded  
2015-2020  
\$81M total**

**16 NNCI Sites  
13 Partners  
17 States  
67 Facilities  
>2000 Tools**



# How are these Facilities used today?

- Top-down (lithography defined) and bottom-up (material synthesis) nanofabrication
- Nanoscale imaging and metrology
- Range from materials & processes to complex devices, systems & their applications
- Large variety of disciplines: nanomaterials, nanoelectronics; MEMS/NEMS; sensors; energy; life sciences & health care; environmental & geosciences; food & water; IoT; defense; ...
- Education, training, workforce development & outreach

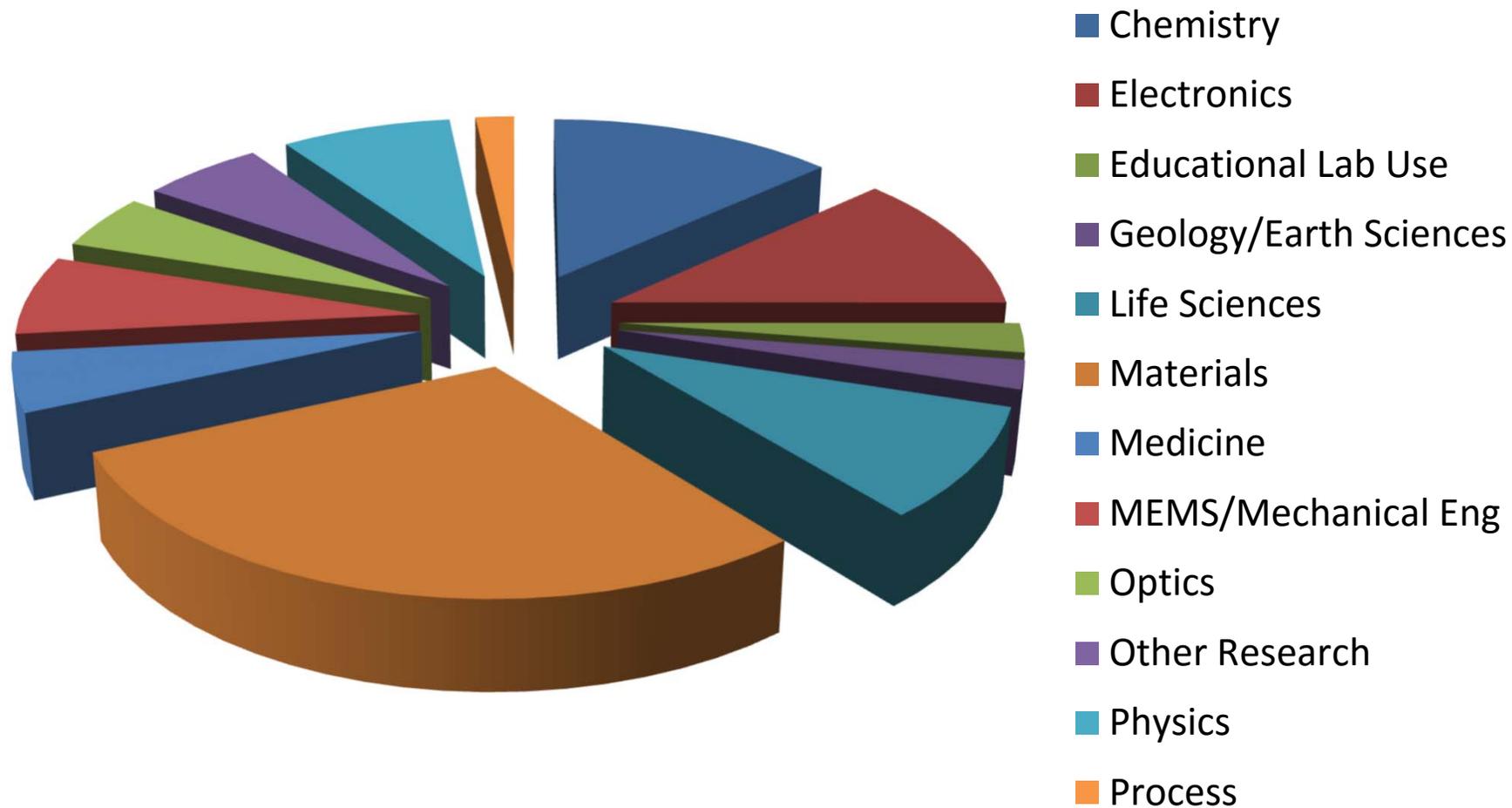


# NNCI Year I User Statistics (10/2015-09/2016)

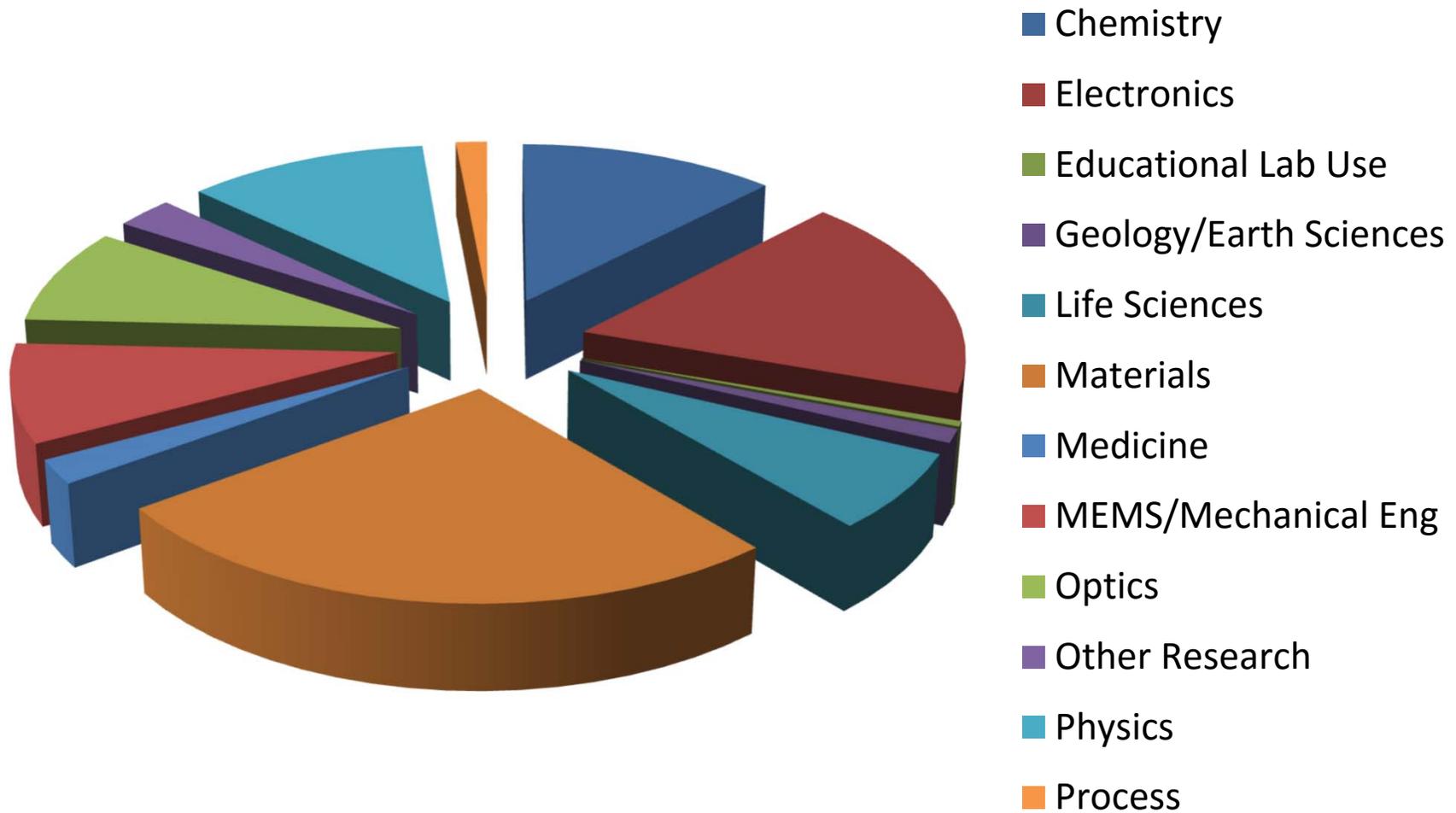
	NNCI Network	NNCI Sites Mean (Min - Max)
Unique Facility Users	10,675	667 (80 - 1,446)
Unique External Users	2,561 24.4%	160 (13 - 461) 24.4% (14.9% - 42.1%)
Industry Users	1,410	88 (6 - 202)
External Academic Users	1,151	72 (7 - 352)
Average Monthly Users	4,427	277 (40 - 679)
Users Trained	4,116	257 (36 - 699)
Facility Hours	>900,000	57k (3.6k - 175k)
External Facilities Hours	>170,000 20.2%	10,800 (322 - 50,500) 20.2% (1.4% - 43.4%)
Hours/User	85	85 (27 - 293)

*Note: approx. 32,000 annual PhD  
in science/engineering*

# NNCI User Data – Users by Discipline



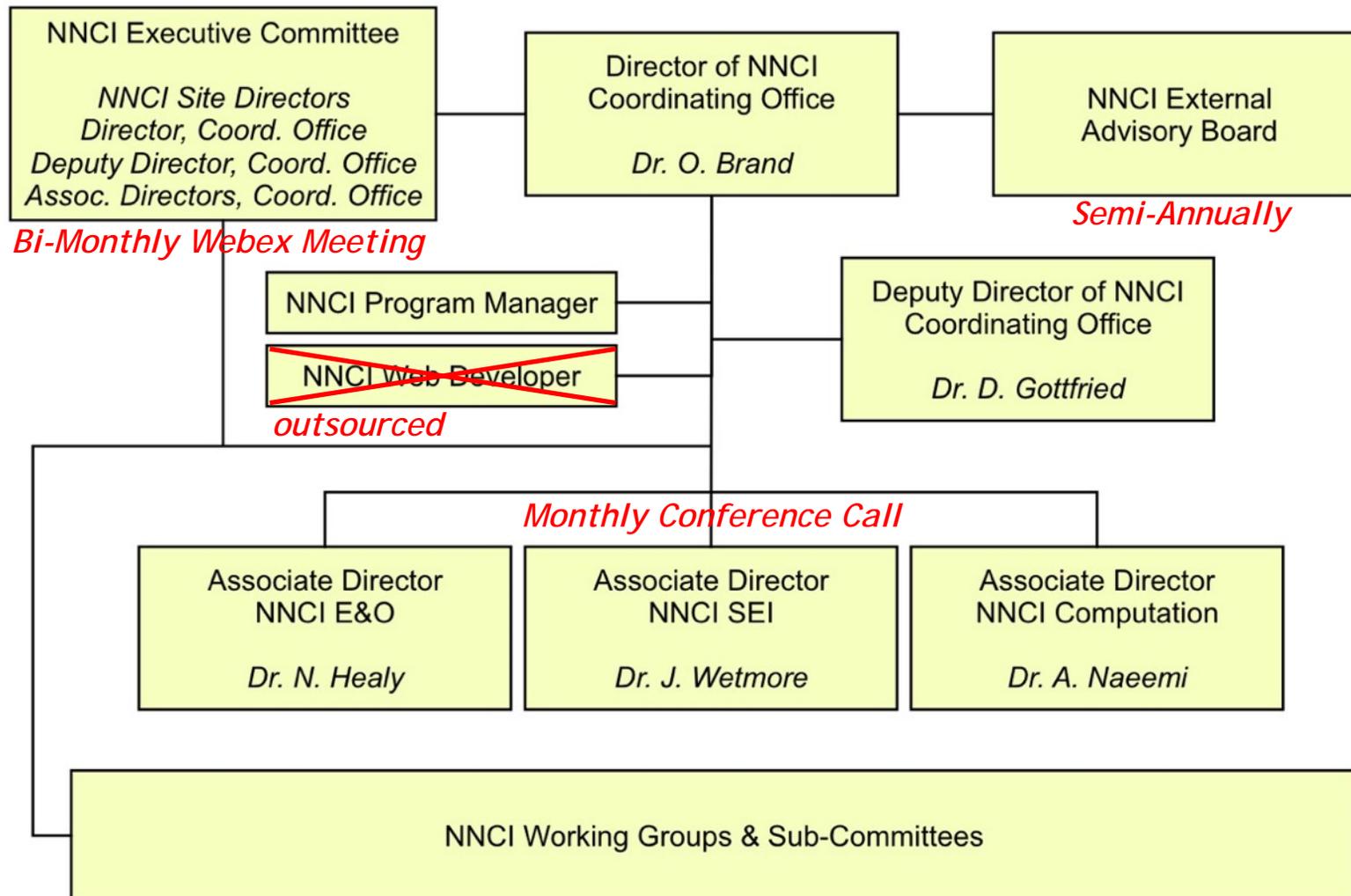
# NNCI User Data – Hours by Discipline



# Overall Coordinating Office Objectives

1. Facilitate and promote the NNCI network, rather than trying to direct it
2. Use creative means to incentivize the sites for participation in network activities
3. **Assist in making the network more than the sum of its parts**

# CO Organizational Structure



www.nnci.net



About Sites Tools Experts Resources Learn



# NNCI Website – Phase I (December 2016)

- **Overall design implementation**
- **Basic NNCI information**
- **Individual site pages**
- **Tool database (>2000 tools)**
- **Experts database (>200 experts)**
- **Contact forms** – general information and new user gateway
- **Education and outreach**
- **SEI**
- **Additional resources:**  
Other nano infrastructure, link to computation at nanoHub)
- **NNCI news blog**

# NNCI Website – Phase 2 (beginning Feb. 2017)

- **Improvements to contact forms**
- **Improvements to tools/experts databases**
- **Improvements to site pages**
- **Possible changes to NNCI sites map**
- **Additional resources content**
  - Recipes with rating system
  - Technical reports
- Private pages for working group activity
- Private page for user statistics uploading by sites
- Requested changes and additions based on NNCI staff input

# Sub-Committees

- **Diversity**  
Mike Hochella (NanoEarth) - Lead
- **Metrics**  
Stephen Campbell (MINIC) - Lead
- **National and International Relations**  
Vinayak Dravid (SHyNE) - Lead
- **New Equipment and Research**  
Kevin Walsh (KY MMNIN) - Lead
- **Entrepreneurship**  
Mark Allen (MANTH) - Lead
- **Workforce Development**  
Trevor Thornton (NCI-SW) - Lead
- **Building the User Base**  
Nan Jokerst (RTNN) – Lead

**“Subcommittees of the Executive Committee will be formed to tackle high-level issues related to the NNCI network as a whole”**

# Working Groups

## Network Support WG – Technical WG – Research Area WG

- **Equipment, Maintenance and Training**

Meredith Metzler (MANTH) - Lead

- **Vendor Relations**

Mike Khbeis (NNI) - Lead

- **EBeam Lithography**

Devin Brown (SENIC) - Lead

- **Etch Processing**

Vince Genova (CNF) - Lead

- **REU**

Lynn Rathbun (CNF) - Lead

- **K-12 and Community**

Jim Marti (MINIC) – Lead

- **Assessment & Evaluation**

Nancy Healy (SENIC) - Lead

- Planned: EHS, Geo & Env. Sciences, Life Sciences, Add. Manufacturing, ...

“One of the greatest strengths of the NNCI network is without doubt the combined staff expertise of the individual sites. To leverage this expertise at the network level, we propose the formation of various *working groups* composed of staff members from the NNCI sites.”

# NNCI Conference

- 2017: University of Pennsylvania
- 2018: University of Washington
- 2019: Cornell University
  
- What is the best time of the year for the conference?  
Planned for October timeframe from Year 2 on
- Shall we open up the conference beyond NNCI participation?
- What is the “ideal” conference length?
- What topics should be kept/dropped/added?
- **Please complete the Feedback Form!!!!**

# Annual Reporting

## **Annual Site Reports**

- Responsibility of individual NNCI Sites
- Due 3 months before award anniversary, i.e. July 1
- Include only 8 months of user data from reporting year
- Format as was established with Year 1 report

## **Annual Coordination Office Report**

- Due 3 months before award anniversary, i.e. January 1 (because of conference date later in Year 1)
- Include 12 months of user data from all sites (October-September)
- Include 3-page highlights from each site, committee reports

# Use NNCI Conference to Discuss Challenges & Opportunities!

## At the NNCI Site Level

- How can I maintain a state-of-the-art (evergreen) infrastructure?
- How can I attract (and retain) the required staff expertise?
- How can we best serve our customers?

## At the NNCI Network Level

- How can we be more than the sum of our parts?
- How can we help (external) users? Especially from non-traditional areas?
- How can we help each other?
- How can we help/collaborate with other nanotechnology facilities/centers?
- How can we help nanotechnology start-ups?
- How can we educate the general public?
- How can we become the world-leading nanotechnology infrastructure network?

Thank You!



<http://www.nnci.net>