Welcome to the
6th Annual NNCI Conference
2nd Virtual Annual NNCI Conference

National Nanotechnology Coordinated Infrastructure

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NNCI Coordinating Office Report

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Welcome and Thank You

Welcome:

- External Advisory Board Members
- NSF Program Directors
- NNCO Leadership
- Invited Speaker
- NNCI Site Leadership and Staff
- Guests

Thank You:

- SHyNE and NNCI Coordinating Office Staff
- NSF for Continued Support

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NNCI Advisory Board

Reggie Farrow
NJIT

Andrew Greenberg
U Wisconsin

Elaine Cohen Hubal
EPA

Angelique Johnson
Entrepreneur

Joe Magno
NIIT

Richard Osgood
Columbia U

Kurt Petersen
Entrepreneur

Tom Theis
Utopus Insights

Ken Wise
U Michigan

National Nanotechnology Coordinated Infrastructure

Outline

- What is NNCI?
- NNCI Statistics
- NNCI Impact
- NNCI Programs
- Poll Questions

- **Associate Director Reports: 4-5PM EDT today**

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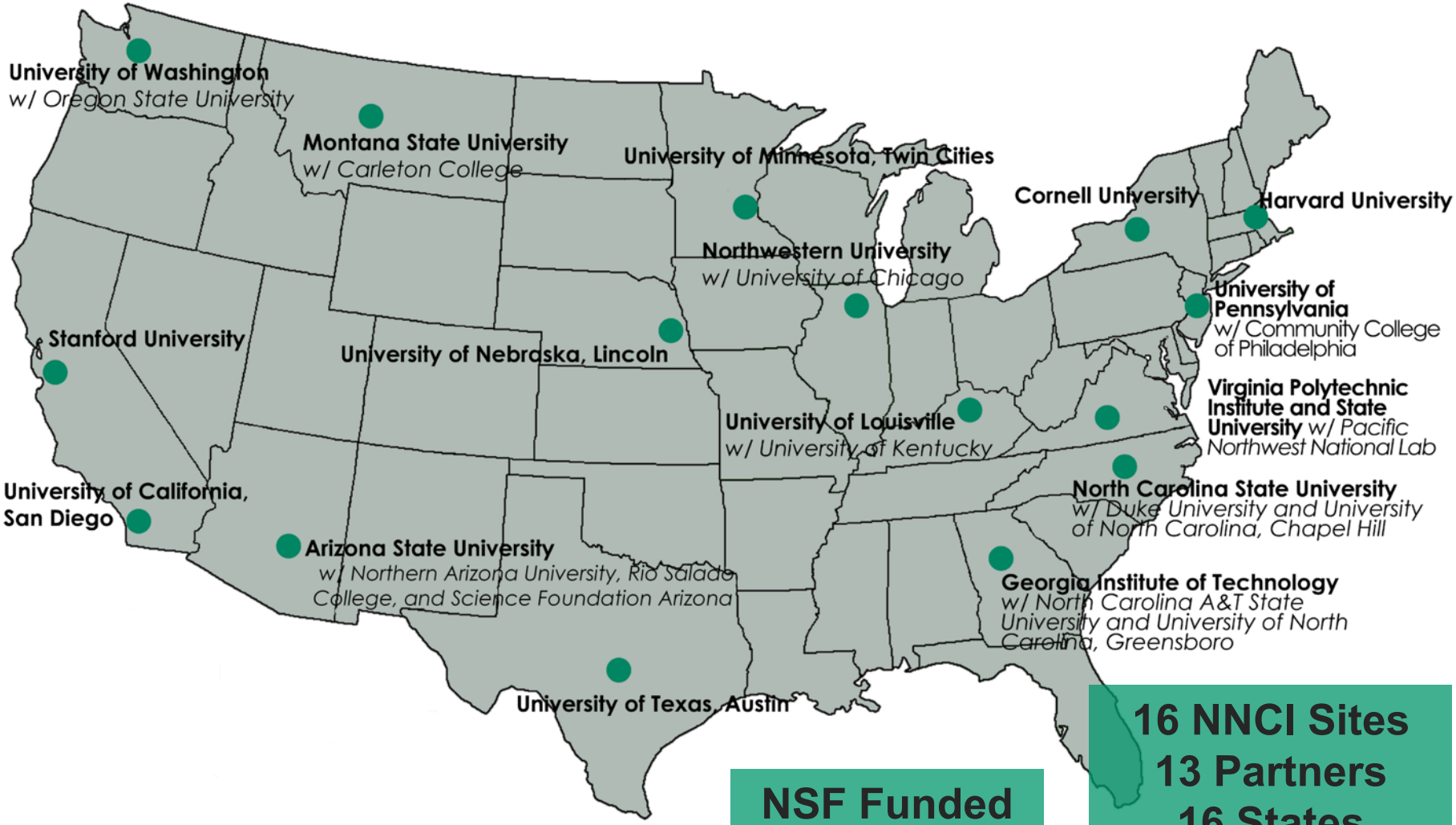
NNCI Network



NSF Funded
2015 - 2025
$165M total

16 NNCI Sites
13 Partners
16 States
69 Facilities
>2,200 Tools

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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)** programs in/of nanotechnology
- **Network approach to make whole more than the sum of its parts**

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NNCI User Statistics Year 1 – Year 6

	Year 1 10/15-9/16	Year 2 10/16-9/17	Year 3 10/17-9/18	Year 4 10/18-9/19	Year 5 10/19-9/20	Year 6 (6 months) 10/20-3/21
Unique Facility Users	10,909	12,452	13,110	13,355	10,501	7,535
Unique Ext. Users	2,567 23.5%	3,176 25.5%	3,379 25.8%	3,852 28.8%	2,833 27.0%	1,764 23.4%
Industry Users	1,413	1,669	1,870	1,961	1,529	1,073
Ext. Academic Users	1,060	1,295	1,365	1,531	1,064	533
Avg Monthly Users	4,429	4,911	5,001	5,292	3,654	4,037
New Users Trained	4,116	4,563	4,981	5,194	2,813	1,762
Facility Hours	909,151	939,230	1,006,764	1,149,788	767,255	440,011
Ext. Facilities Hours	173,511 19.1%	191,494 20.4%	228,441 22.7%	298,986 26.0%	197,368 25.7%	110,978 25.2%
Hours/User	83	75	77	86	73	58
Total User Fees	$34.3M	$37.5M	$40.5M	$43.7M	$29.4M	$18.1M

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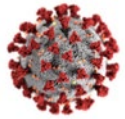
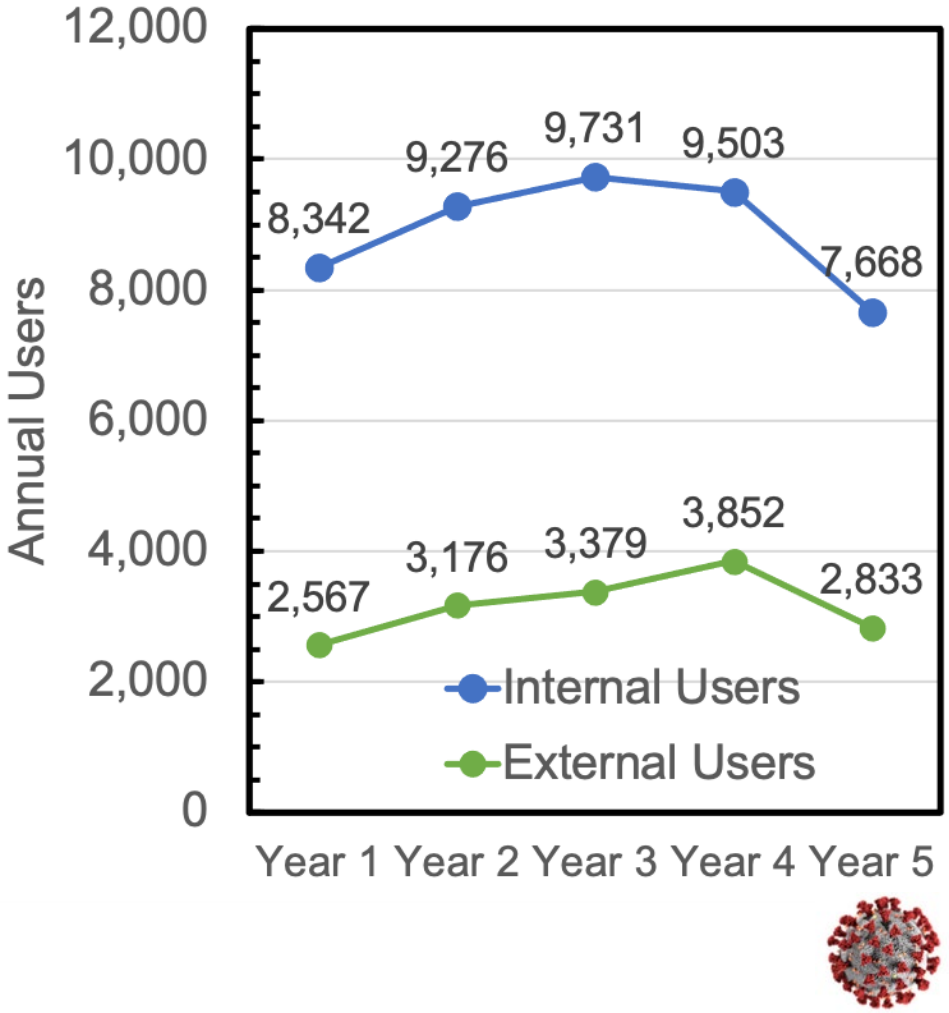
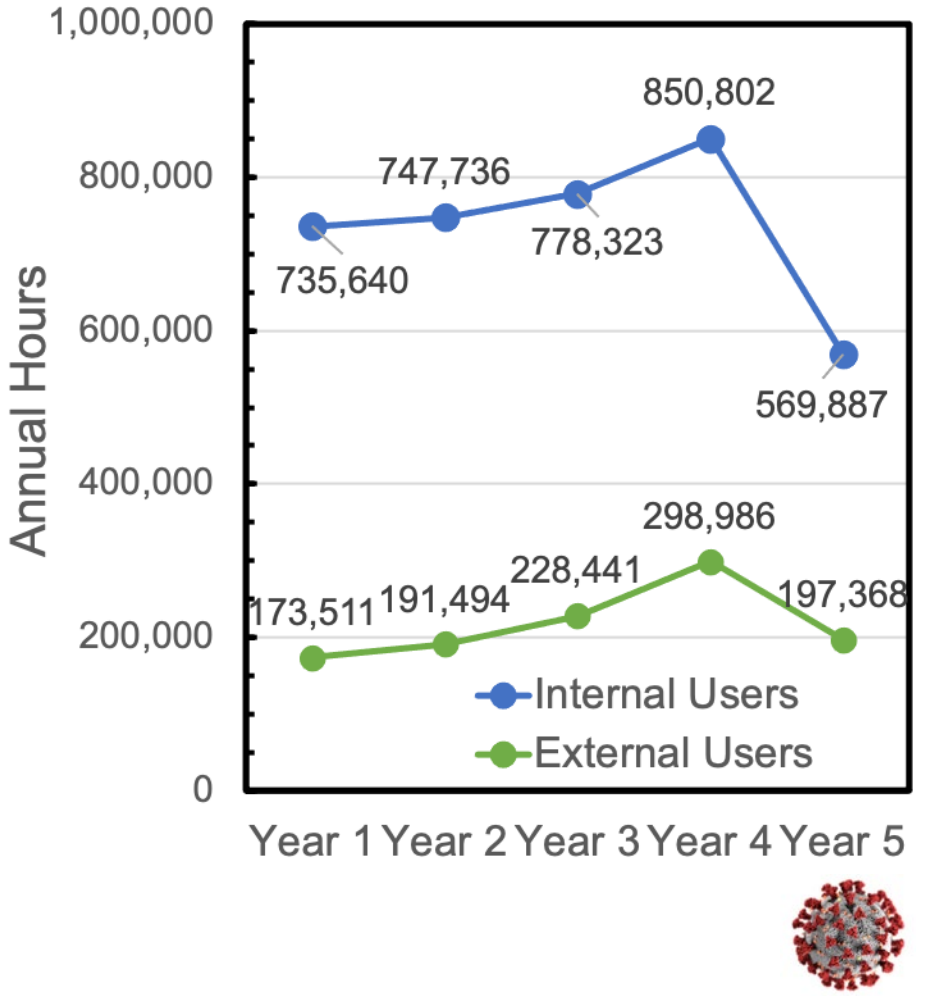


NNCI Users & Hours: Years 1-5





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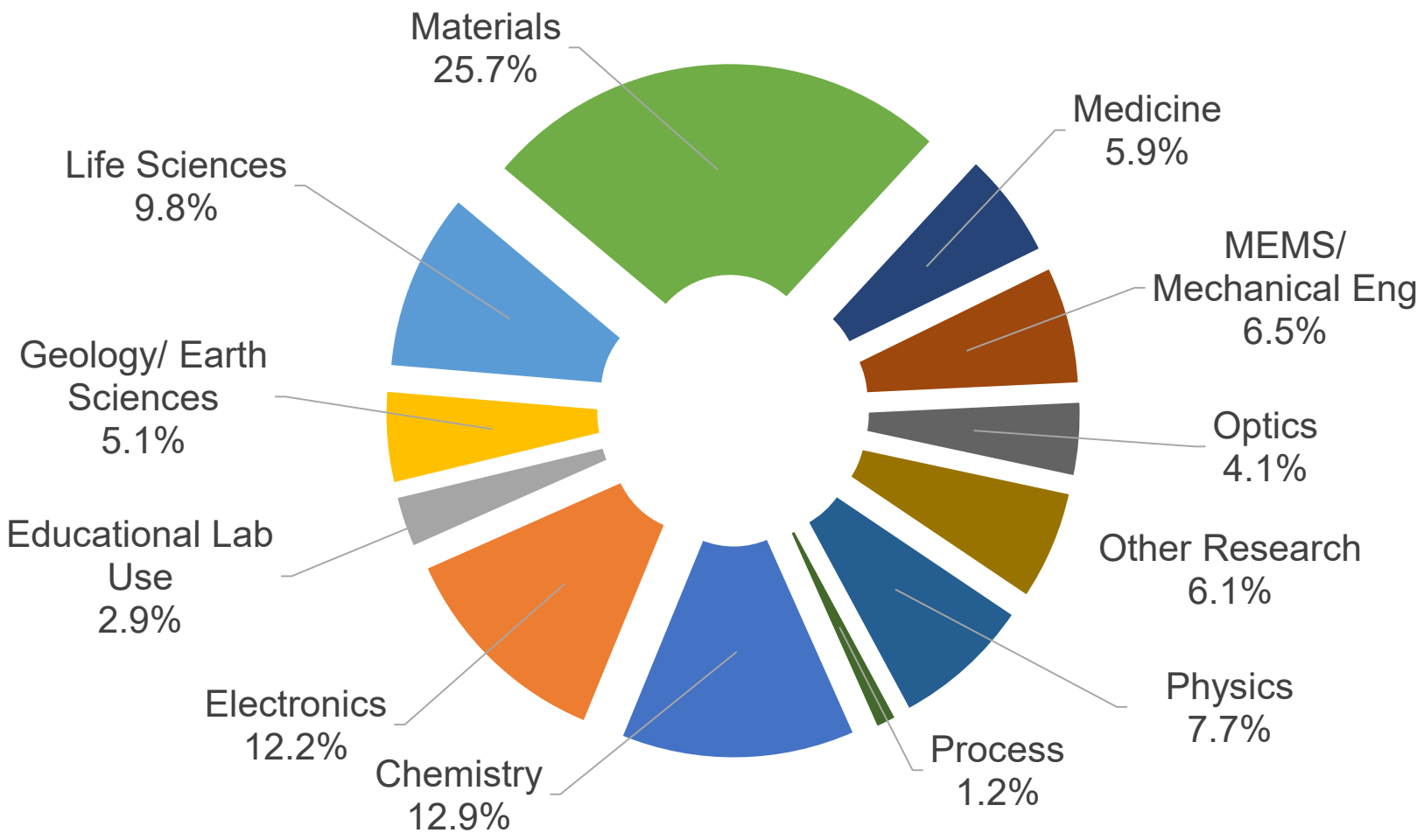
NNCI Users by Discipline – Year 5



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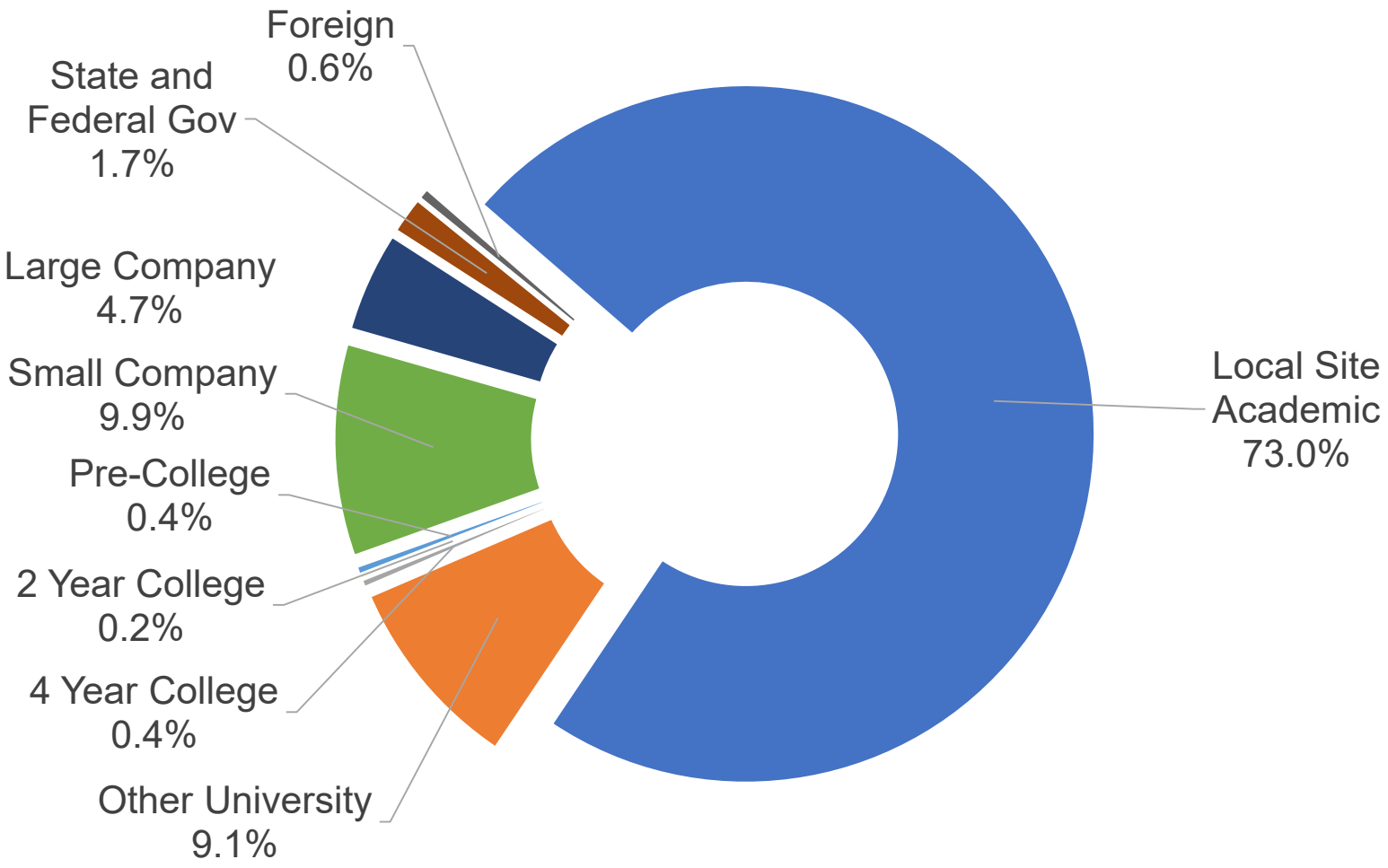
NNCI Users by Affiliation – Year 5



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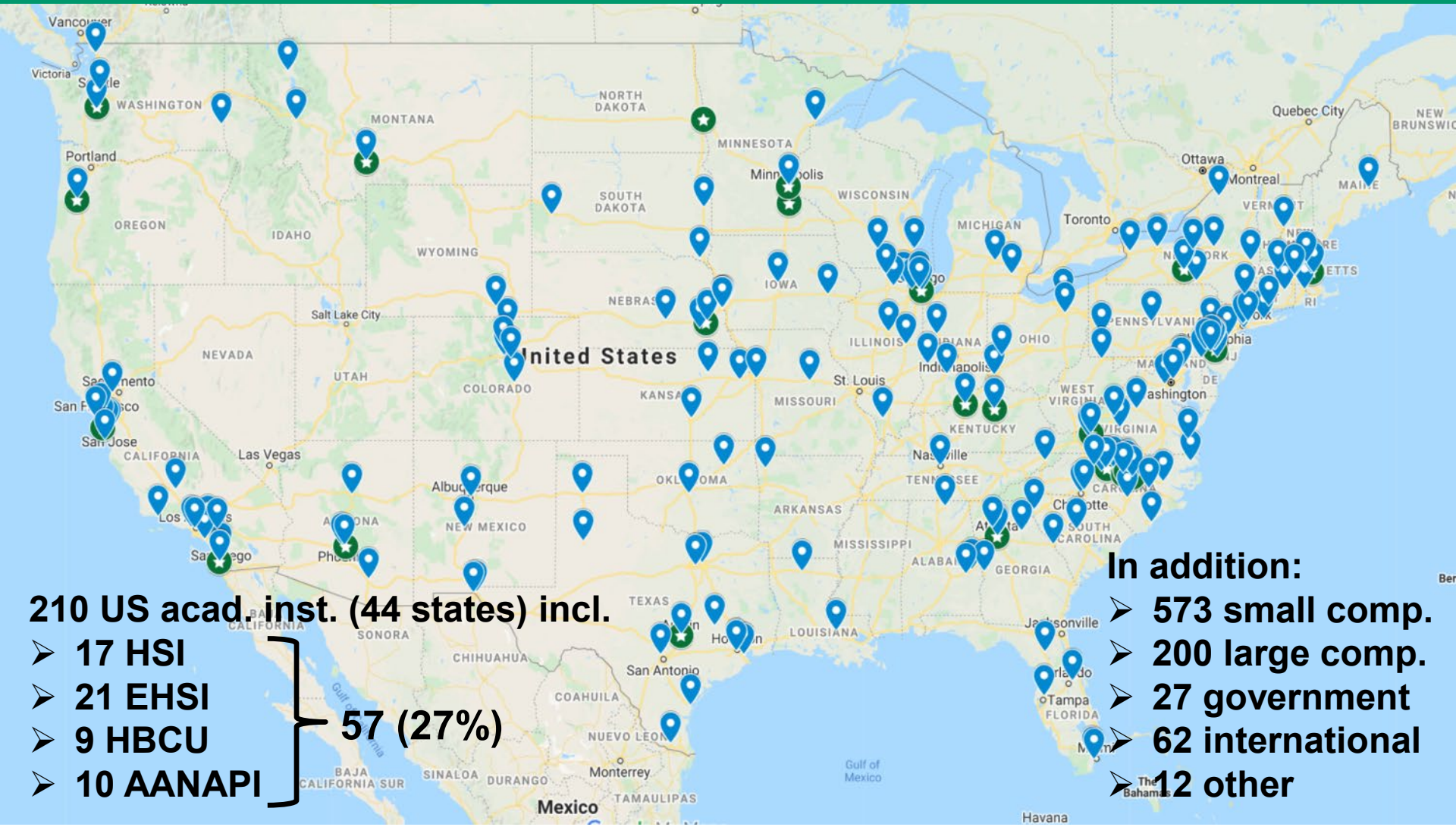
NNCI Year 5 US Academic Institutions (210)



210 US acad. inst. (44 states) incl.

- 17 HSI
- 21 EHSI
- 9 HBCU
- 10 AANAPI

57 (27%)

In addition:

- 573 small comp.
- 200 large comp.
- 27 government
- 62 international
- 12 other

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NNCI Years 4 and 5 – 12 Months Comparison

	Year 4 10/2018-09/2019	Year 5 10/2019-09/2020	Δ
Unique Facility Users	13,355	10,501	-21%
Unique External Users	3,852 / 28.8%	2,833 / 27.0%	-26%
Industry Users	1,961	1,529	-22%
External Academic Users	1,531	1,064	-31%
Other External Users	360	240	-33%
Average Monthly Users	5,292	3,654	-31%
New Users Trained	5,194	2,813	**-46%**
Facility Hours	1,149,788	767,255	-33%
External Facilities Hours	298,986 / 26.0%	197,368 / 25.7%	-34%
Hours/User	86	73	-15%
Total User Fees	$43.7M	$29.4M	-33%

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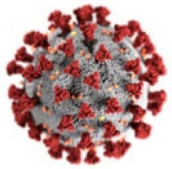
Note: most NNCI facilities were closed for 3+ months in Year 5



NNCI Years 5-6 – 6 Months Data Comparison

	Year 5 (6 months) 10/2019-03/2020 "Pre-Closure"	Year 6 (6 months) 10/2020-03/2021 "Post-Closure"	Δ
Unique Facility Users	9,328	7,535	-19%
Unique External Users	2,451 / 26.3%	1,764 / 23.4%	-28%
Industry Users	1,297	1,073	-17%
External Academic Users	937	533	**-43%**
Other External Users	217	158	-27%
Average Monthly Users	4,999	4,037	-19%
New Users Trained	2,130	1,762	-17%
Facility Hours	505,830	440,011	-13%
External Facilities Hours	128,856 / 25.5%	110,978 / 25.2%	-14%
Hours/User	54	58	**+7%**
Total User Fees	$19.0M	$18.1M	-5%

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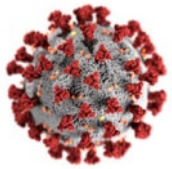
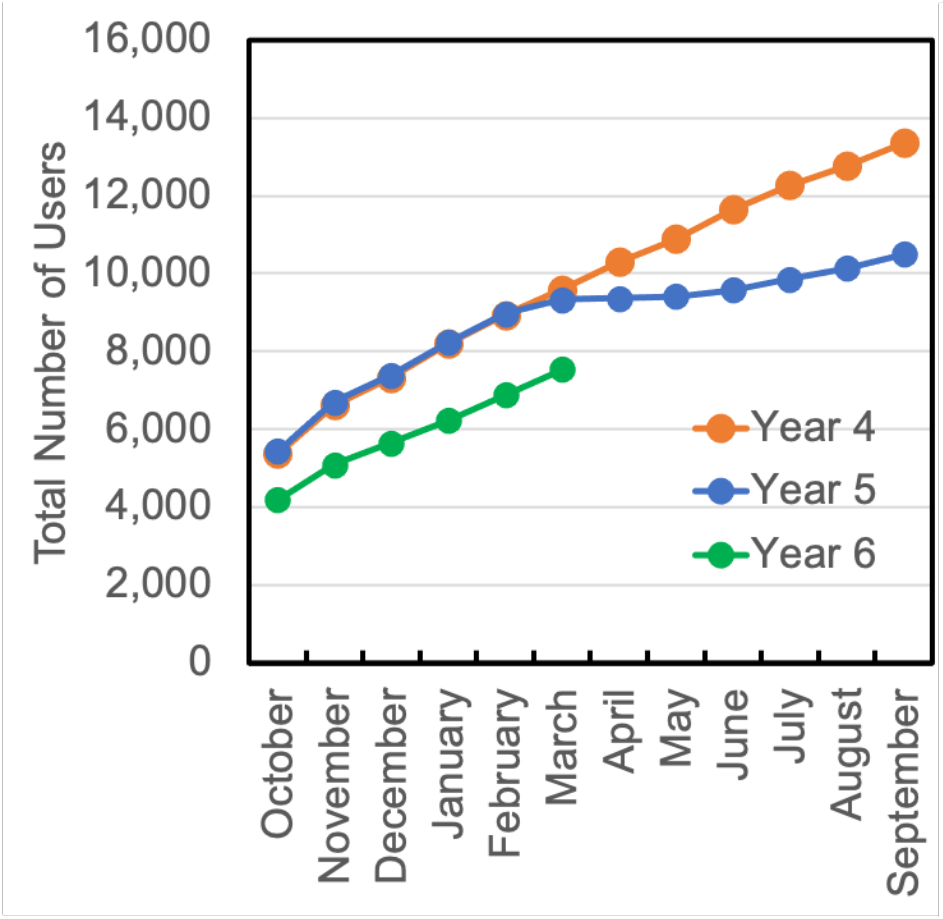
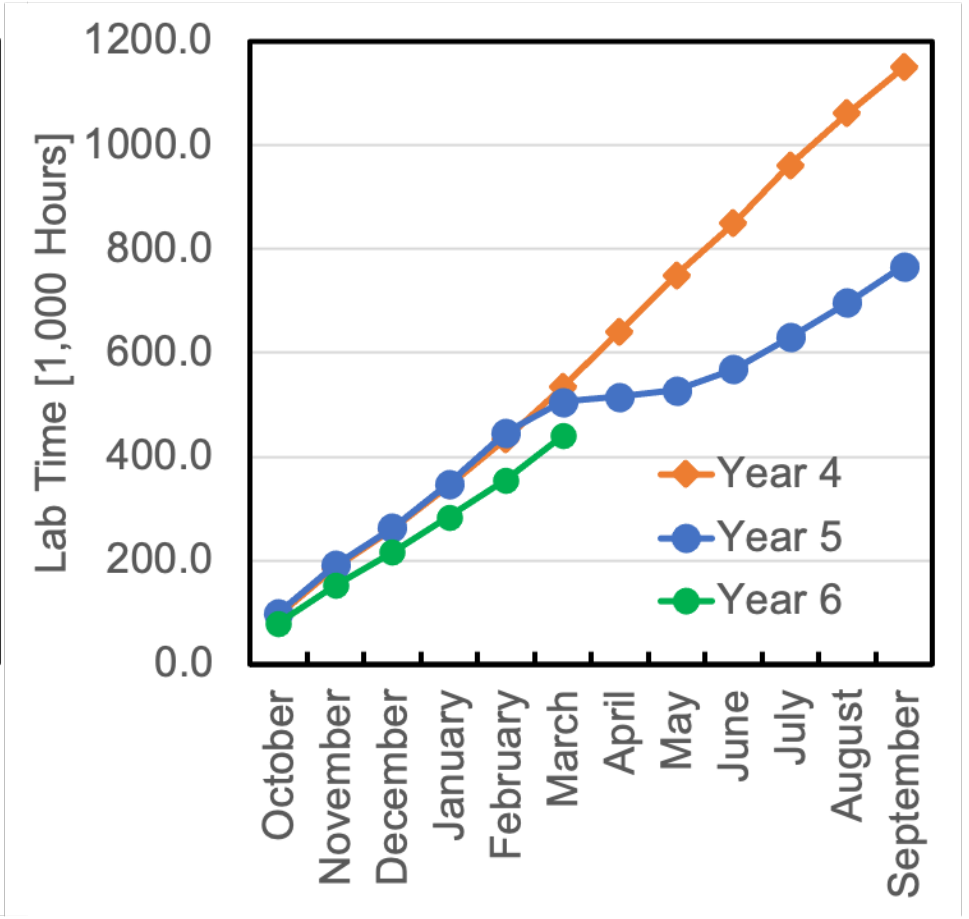
Note: 6 months data!



NNCI Users & Lab Time: Years 4-6





Year 4: October 2018 – September 2019
Year 5: October 2019 – September 2020
Year 6: October 2020 – September 2021

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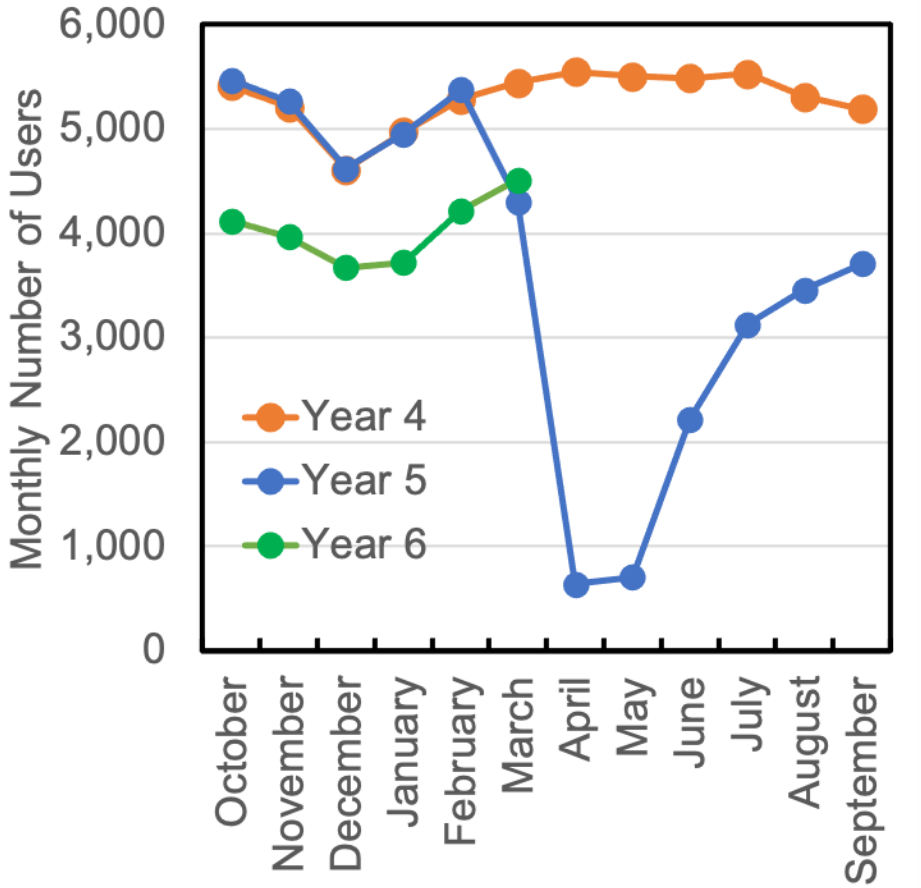
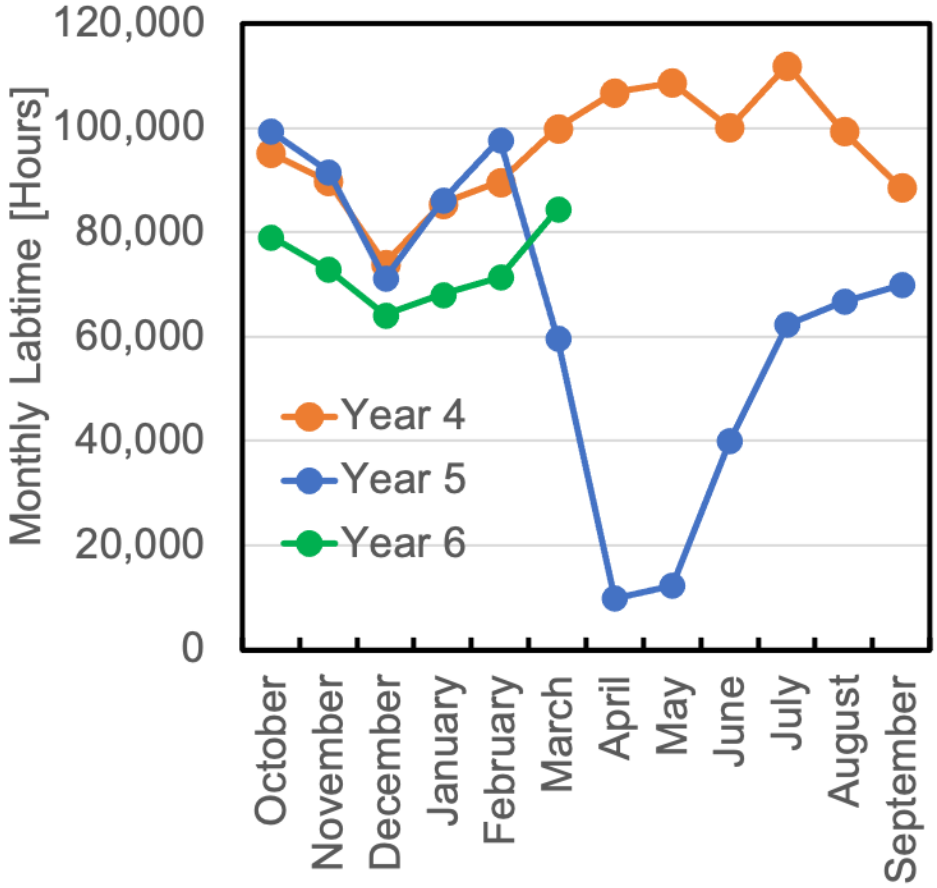
Monthly NNCI Users & Lab Time: Years 4-6





Year 4: October 2018 – September 2019
Year 5: October 2019 – September 2020
Year 6: October 2020 – September 2021

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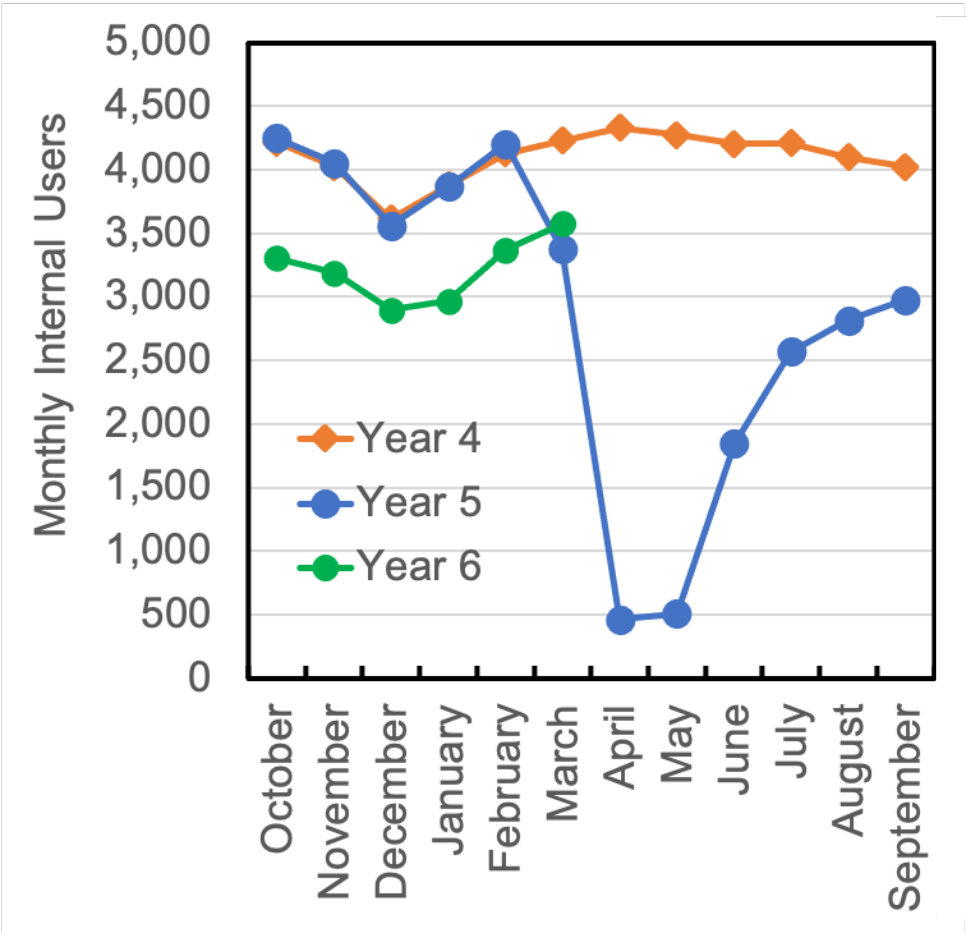
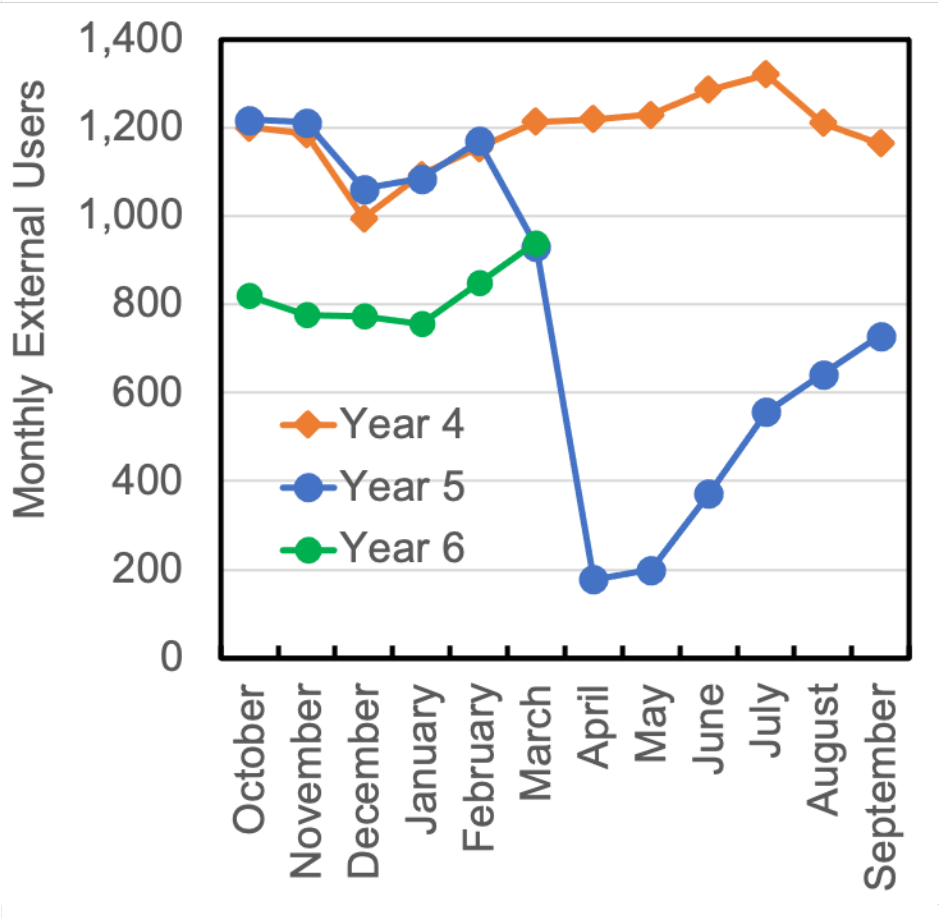
NNCI Internal vs. External Users: Years 4-6





Year 4: October 2018 – September 2019
Year 5: October 2019 – September 2020
Year 6: October 2020 – September 2021

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NNCI Impact

- Scholarly Impact - Publications
  - NSF award citations
- Supported Funding Sources
- Supported Major Centers
- Regional Nano Networks

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NNCI Impact – Publications CY 2018 & 2019

Publication Type	CY 2018	CY 2019
Internal User (Site) Papers	2,775	2,761
External User Papers	357	293
Internal User Conference Presentations	1,160	1,069
External User Conference Presentations	124	62
Books/Book Chapters	41	39
Patents/Applications/Invention Disclosures	563	690
Total	5,020	4,914

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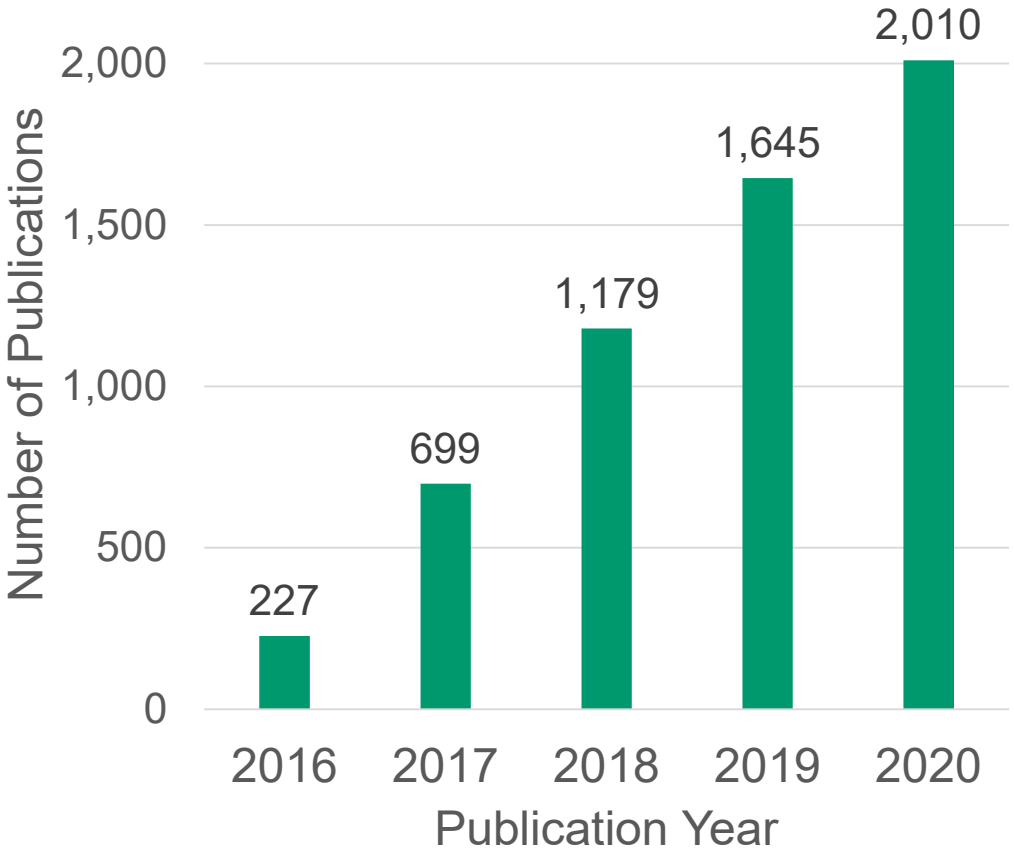
NNCI Impact – Pubs with NNCI Acknowledgement



*Through Feb. 1, 2021

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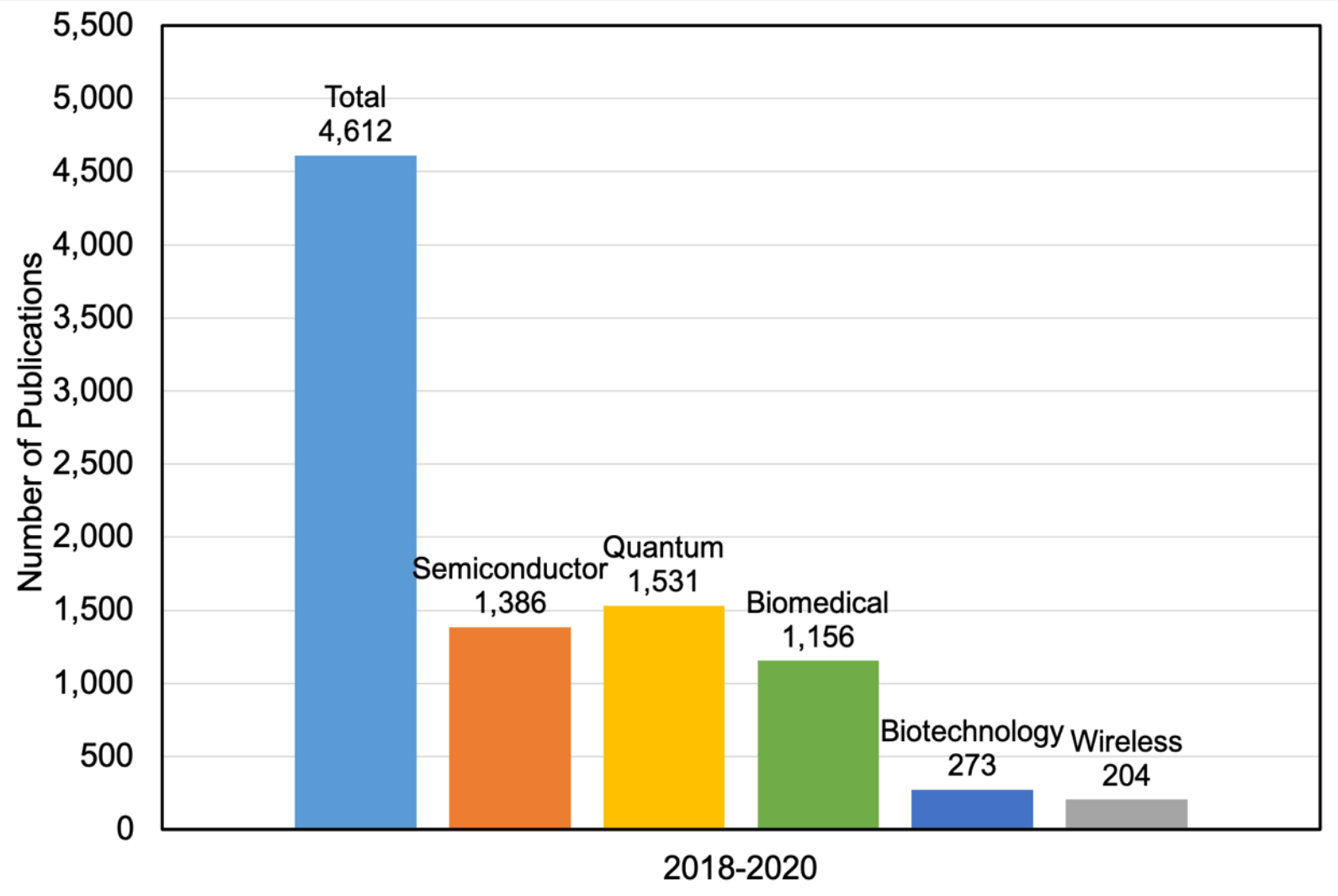
NNCI Impact – Seeding Industries of Tomorrow



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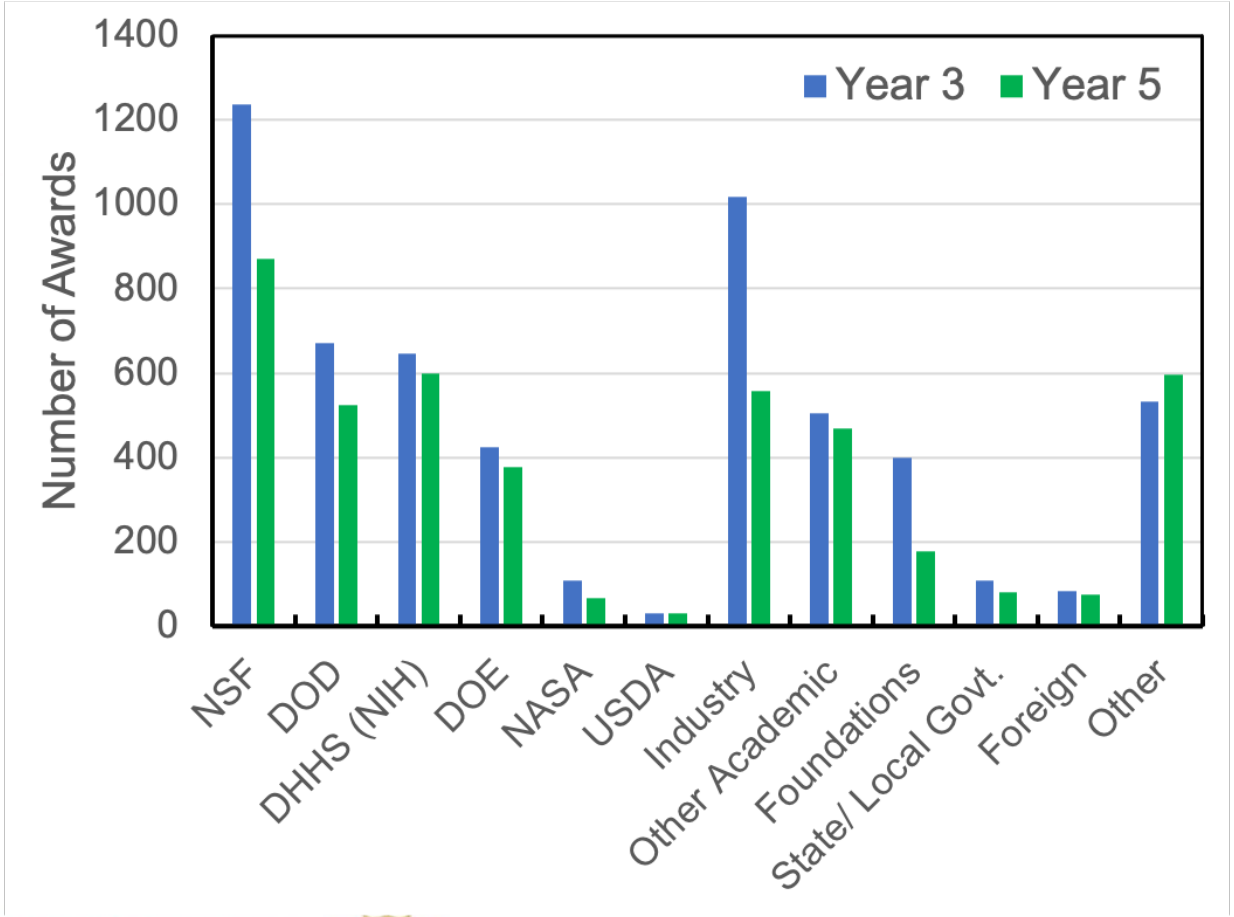
See 2021 NNI Strategic Plan, page 21

NNCI Impact – Supported Research Awards

Year 3: **5,754** unique user research awards/grants from **2,860** PI
Year 5: **4,415** unique user research awards/grants from **2,416** PI



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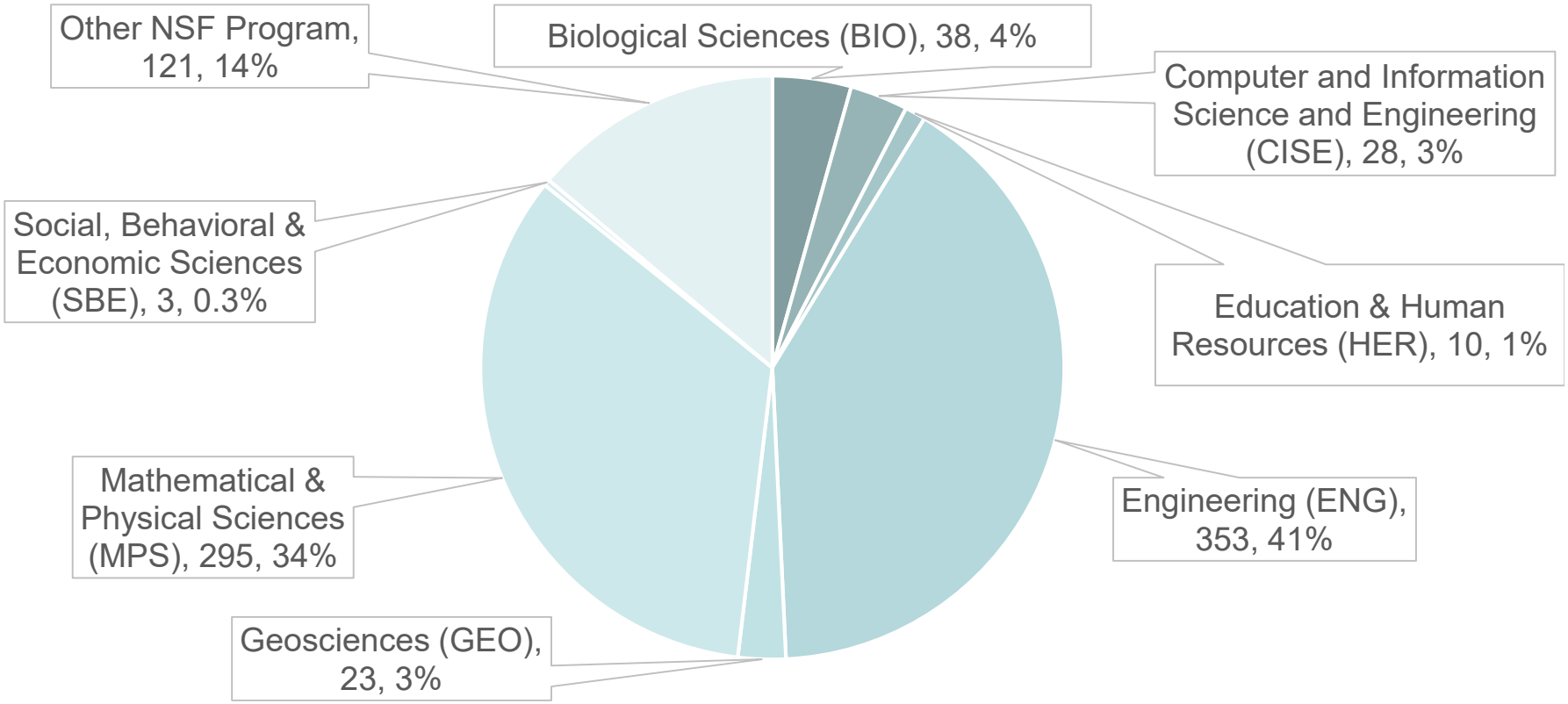
NNCI Impact – Supported NSF Awards

NSF Funding Sources by Directorate
Year 5: **871** unique user research awards/grants from **680** PI



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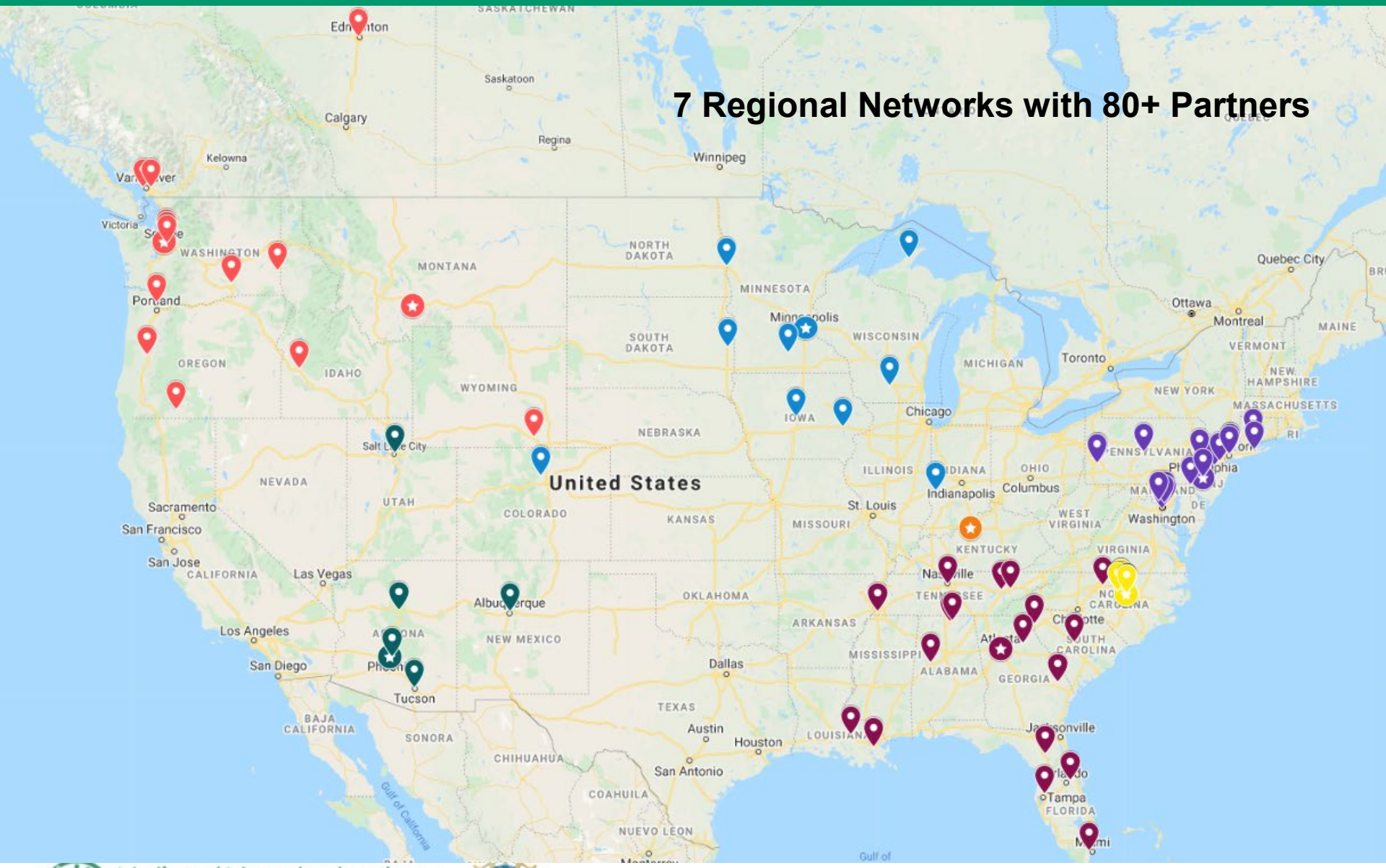
NNCI Impact – Research Centers

40+ Research Centers incl.

- 13 NSF ERC
- 3 NSF STC
- 7 NSF MRSEC
- 1 NSF MIP
- 3 DoE EFRC
- 5 NIH
- 1 SRC
- 1 NIST

- All 6 “Class of 2021” NSF STC NNCI universities lead 3

NNCI Regional Nano Networks



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https://nnci.net/regional-networks

NNCI Programs

- Subcommittees & Working Groups
- Research Communities
- NNCI Seminar Series
- NNCI User Survey
- NNCI Image Contest

Sub-Committees & Working Groups

Sub-Committees

1. **Diversity**
   Bill Wilson (CNS)
2. **Metrics & Assessment**
   Christian Binek (NNF)
3. **Global and Regional Interactions**
   Vinayak Dravid (SHyNE), Yuhwa Lo (SDNI)
4. **Research and Funding Opportunities**
   Chris Ober (CNF), Jim Cahoon (RTNN)
5. **Nanotech Infrastructure of the Future**
   Debbie Senesky (nano@stanford)
6. **Building the User Base**
   Shyam Aravamudhan (SENIC)

Working Groups

1. **Equipment Maintenance**
   Jeremy Clark (CNF)
2. **Environmental Health & Safety**
   Andrew Lingley (MONT)
3. **Vendor Relations**
   Charles Veith (MANTH)
4. **E-Beam Lithography**
   Devin Brown (SENIC), Stanley Lin (Stanford)
5. **Etch Processing**
   Vince Genova (CNF)
6. **Photolithography**
   Pat Watson (MANTH)
7. **Atomic Layer Deposition**
   Michelle Rincon (Stanford), Mac Hathaway (CNS)
8. **Imaging and Analysis**
   David Bell (CNS)
9. **Workforce Dev. and Community Colleges**
   Ray Tsui (NCI-SW)
10. **K-12 and Community**
    Jim Marti (MINIC)
11. **Assessment & Evaluation**
    Quinn Spadola (SENIC)
12. **Technical Content Development**
    Maude Cuchiara (RTNN)
13. **Societal and Ethical Implications**
    Jamey Wetmore (NCI-SW)
14. **Innovation and Entrepreneurship**
    Matt Hull (NanoEarth)

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NNCI Research Communities

Research Communities are outward facing helping to develop products that benefit the larger scientific and engineering communities; activities may include

- NNCI-sponsored symposia/workshops/webinars
- Road-mapping exercises
- Identifying future infrastructure needs

Research Community	Leader(s)	
Nanotechnology Convergence	Jacob Jones (RT…	…-SW, SDNI, KY-MMNIN
Nano Earth Systems	Trevor … …arth), and …cets (MONT)	nano@stanford
Nano-Enabled … Interc…	…llen (MANTH)	CNF, SENIC, NNF, KY-MMNIN
…um	Andrew Cleland (SHyNE), Robert Westervelt (CNS), and Steven Koester (MINIC)	TNF, NNF, NNI, MONT, RTNN, SENIC, CNF
…erstanding the Rules of Life	Vinayak Dravid (SHyNE)	MINIC, NNI, MONT, CNF, MANTH, SENIC

More information: Tomorrow, Nov. 3, 12:45 – 2:00 EDT
Do we need more RC? E.g., semiconductors/microelectronics

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NNCI Seminar Series

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NNCI Computation Webinar

November 10, 2021 | 4PM - 5PM ET

The Evolution of Process TCAD in Semiconductor R&D and Manufacturing

Shela Aboud, Ph.D. | Sr. Product Marketing Manager, Synopsys

Abstract: Today, nearly every aspect of an integrated circuit is designed using electronic design automation (EDA) software. Technology computer aided design (TCAD) tools are used for modeling front-end-of-line manufacturing, including the fabrication (Process TCAD) and electrical characterization (Device TCAD) of individual transistors. These tools have been utilized over the last six decades to help realize Moore's law scaling – the driver behind the exponential increase in transistor density – alleviating the high cost of expensive fabrication experiments. The development of each logic node has, in turn, driven the development of the TCAD tools to account for new fabrication and manufacturing techniques.

In this talk, I will discuss how Process TCAD has evolved to keep up with technology evolution and how new drivers in electronics applications, such as 5G, IoT, and autonomous vehicles are driving the next generation process TCAD tools.

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Access the Event @ | https://tinyurl.com/NNCIcompTCAD

SCAN ME

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https://nnci.net/nnci-events

https://www.youtube.com/channel/UCN1IaymO8KcA_fMEB1FhPgQ/featured

2021 NNCI User Survey – Preliminary Results

- Responses so far: **595**
  Affiliations: 67% NNCI university; 10% non-NNCI academia;
  19% Industry; 2% Government
- How did you find out about NNCI facility?
  1. Current user; 2. Referral from current user; 3. University webpage;
  4. Web search; 5. Direct contact by facility
- Overall satisfaction with NNCI facility: **4.51** (1-5 scale)
- NNCI facility had a positive impact on my work: **4.66** (1-5 scale)
- Would you recommend the NNCI facility to a colleague? **96.5%** Yes

- Ratings are slightly lower than in previous years – COVID effect?

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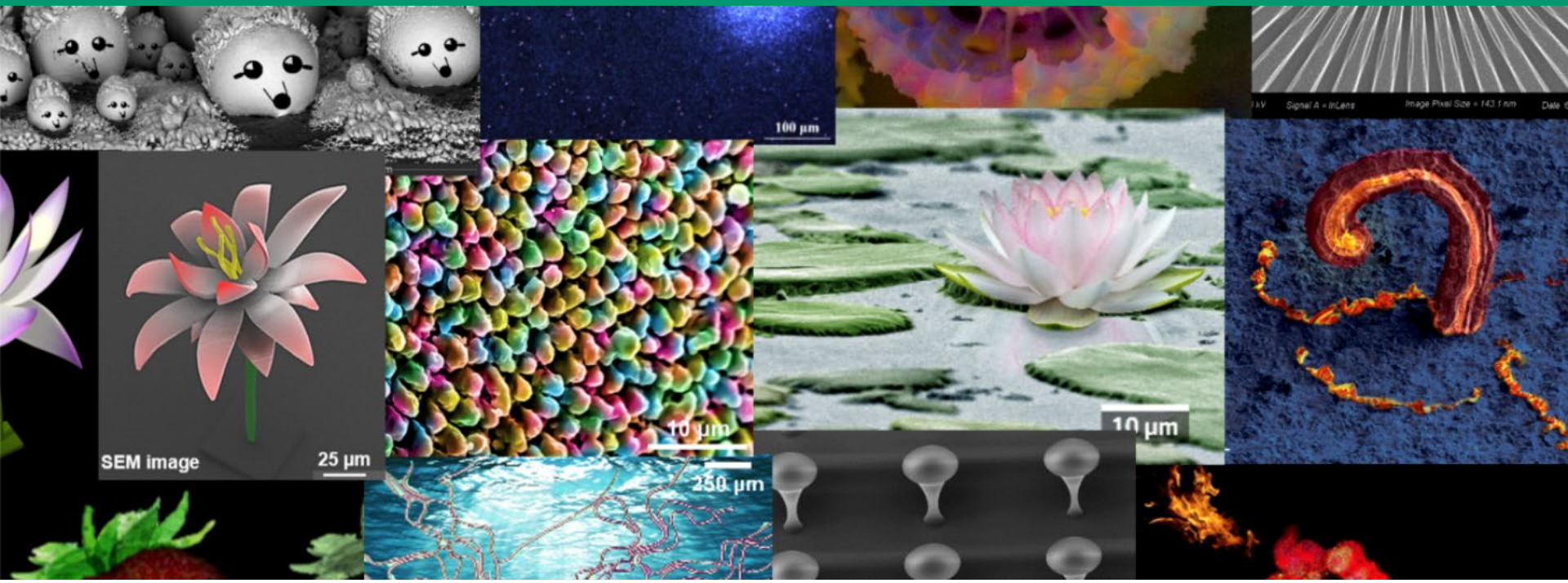
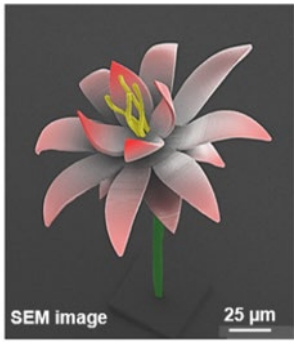
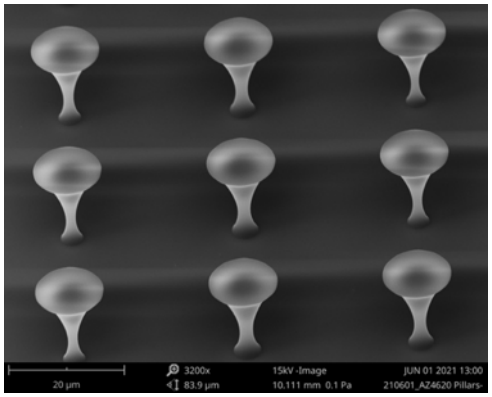
2021 - Plenty of Beauty at the Bottom





Most Stunning (NNF)



Most Unique (RTNN)

Most Whimsical (NanoEarth)

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https://www.nnci.net/plenty-beauty-bottom

Time for Some Poll Questions

- Poll Link: https://pollev.com/brianmcglade961 (see also chat)
- You don't have to enter a name – the poll is anonymous
- Some questions are multiple choice, some require you to enter text
- For 2 questions, you can upvote/downvote entered information
- We will save the results and share with the sites

Thank You!

http://www.nnci.net