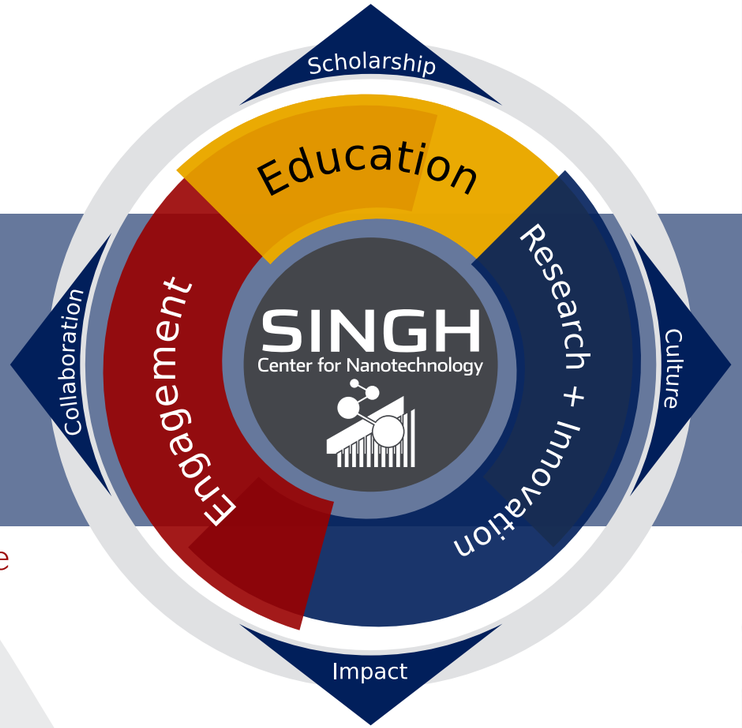
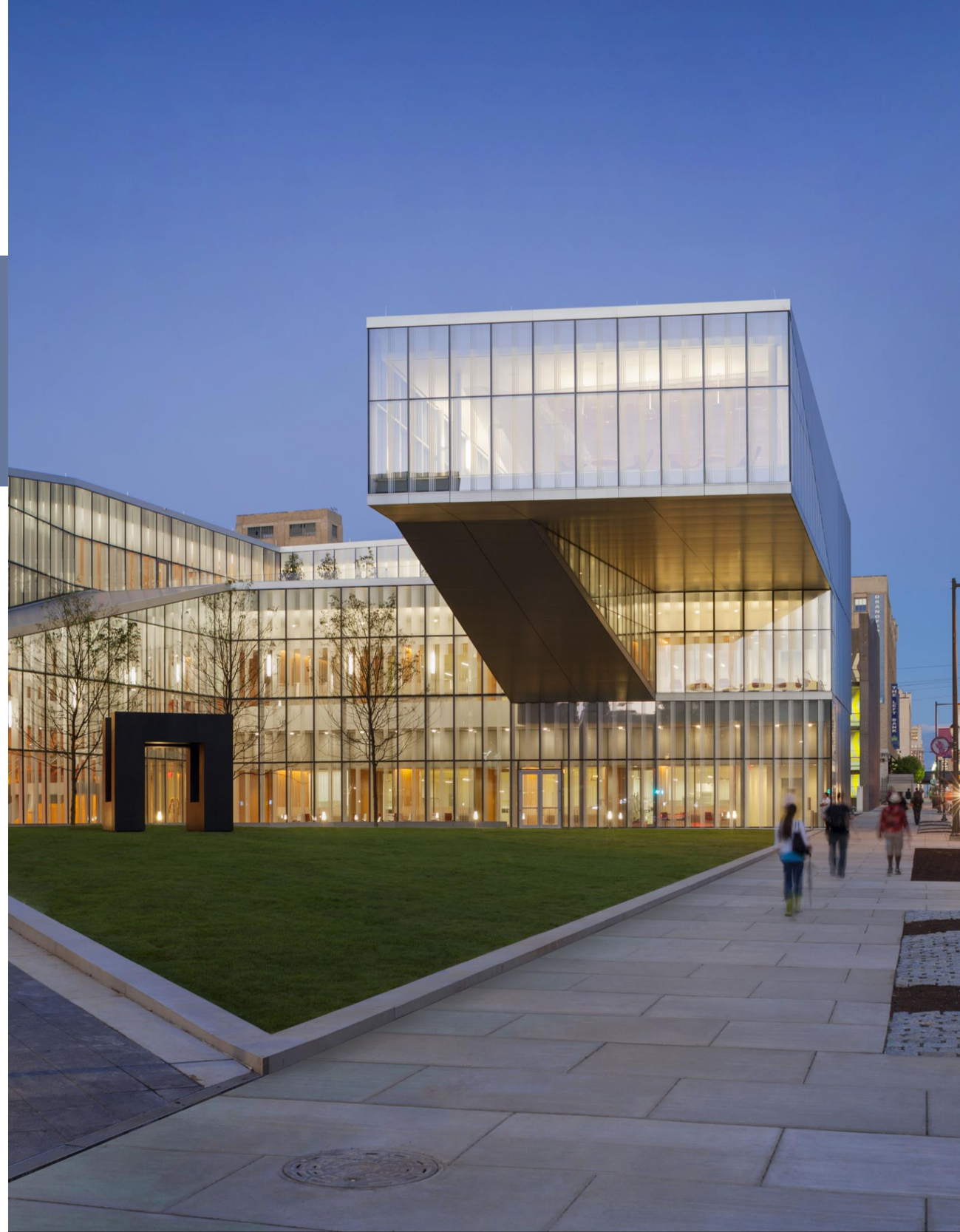
The Singh Center for Nanotechnology

2025 Executive Strategic Plan

Educate Influence Catalyze





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Foreword

SINGH Center for Nanotechnology

The Executive Strategic Plan of the Singh Center for Nanotechnology 2025 serves as a set of guiding principles for the next five years of our Center. As the Center and the field of nanotechnology rapidly evolve, this plan summarizes our mission, values, priorities, and metrics for success through 2025.

Opening its doors in 2014, the University of Pennsylvania Singh Center for Nanotechnology quickly received national recognition, joining fifteen other premier sites across the nation as the Mid-Atlantic Nanotechnology Hub (MANTH) of the National Science Foundation's (NSF) National Nanotechnology Coordinated Infrastructure (NNCI) program. We credit this achievement and recognition to the caliber of our dedicated, expert professional staff and faculty, and to Penn's commitment to providing and maintaining the valuable infrastructure necessary to support nanotechnology research, development, and education within the Philadelphia region that is home to several top tier research institutions. At the outset, our overarching goal was to support Penn's extensive expansion into nanotechnology research, while joining our colleagues on the national stage of premier nanotechnology centers. At this juncture, it is therefore appropriate to ask what the Singh Center is committed to achieving in the next five years.

In trying to anticipate and adapt to the changes that will shape nanotechnology in through 2025, we should begin with what we already know. At present, more than 50% of the combined work performed in the Singh Center core facilities (Nanoscale Characterization Facility, Scanning and Local Probe Facility, and Quattrone Nanofabrication Facility) is grounded in the life sciences. With approximately 47.5% of Penn's $1 billion research enterprise being funded by the Department of Health and Human Services and given the physical adjacency of the Perelman School of Medicine (PSOM) to both the School of Engineering and Applied Science (SEAS) and School of Arts and Sciences (SAS), this fact is unsurprising. For this reason, PSOM investments in the Singh Center, specifically with the addition of the new cryogenic transmission electron microscope, will enable us to serve an expansive new user base. This internal dynamic is only further expanded by the external concentration of U.S. based pharmaceutical and medical device companies of which 87% call the Philadelphia area home. In addition, we look to capitalize on the strong presence of materials companies and investments in energy emerging on campus and beyond.

As indicated by trends in the scientific literature, the continuing investments into nanotechnology and the resultant discoveries, it also seems likely that nanotechnology centers will play a significant role in enabling quantum materials, quantum sensors, and hardware for quantum computing. Another potential area of growth includes the design and fabrication of the very "things" (such as nano-enabled transducers) that will drive the future Internet of Things. In parallel with these trends, we are seeing a smaller fraction in so-called "traditional" (e.g., multi-mask silicon processing) users of our Center, which is likely a consequence of the transition of these fields from the academy to industry.

As research and innovation continues to evolve, the Center's resident experts will be required to be agile learners and remain current with advances in nanotechnology: this means maintaining opportunities for professional development, access to new and relevant instrumentation, and continued education of the users under their charge. While leading this change, we must continue to maintain an environment that fosters scholarship, collaboration, and a culture of support and safety for our users. In parallel, we will strive to provide meaningful metrics to our stakeholders.

During our planning process, we took a hard look at our internal strengths and weaknesses, as situated in the canvas of opportunities and threats that surround us. Moreover, we came to understand what falls under our purview and the elements that are beyond our ability to control and measure. Based on this process, we have identified our vision, mission, and priorities for the next five years, while developing a set of metrics for success that are guided by the pillars of community, impact and leadership. These metrics will serve as benchmarks for the development of initiatives that will allow us to maintain a leading position in nanotechnology.

The Singh Center for Nanotechnology Leadership

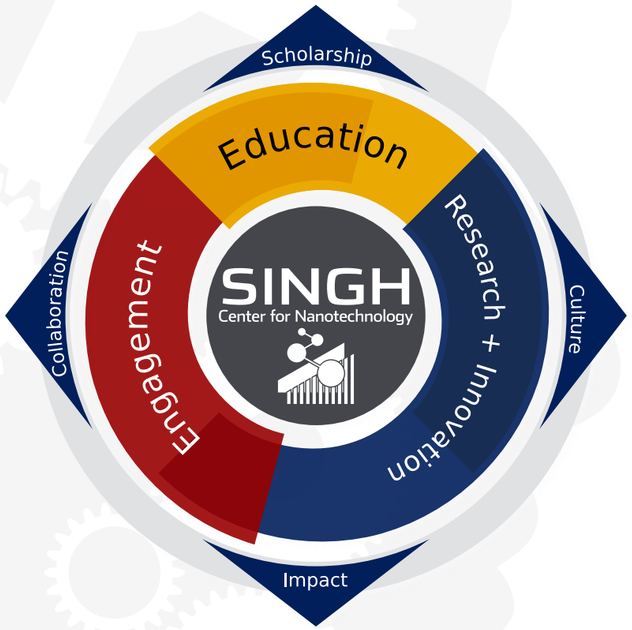
Our Role

SINGH Center for Nanotechnology

Our Vision

EDUCATE, INFLUENCE, and CATALYZE

As a recognized center of excellence that is committed to the Penn Compact, we strive to further influence and push the frontiers of nanotechnology forward by acting as a nexus in knowledge exchange for our community of scholars, researchers and innovators; creating scientific and economic impact; and mobilizing our community to be leaders in our field and beyond.



Our Mission

Our mission is to drive cutting-edge scholarship, productive collaboration, and a positive culture in nanotechnology for the region and all those we impact. We will reach this objective through the constant examination of our three pillars of achievement by:

Community: Openly inviting and encouraging experimentation and innovation, ultimately enhancing the learning experiences, educational outcomes and research+innovation productivity of our users;

Impact: Strategically aligning and leveraging our assets, including our state-of-the-art equipment base, Penn's deep intellectual roots in nano-science, and our experienced entrepreneurial network, developing programming that meets the needs of our community and partners;

Leadership: Continually to invest in the development of our expert professional staff to meet evolving needs; and hosting traditional and non-traditional educational programs to develop future leaders in nanotechnology.

Our Priorities

Education
Research+ Innovation
Engagement

Our Values

Scholarship
Culture
Collaboration
Impact

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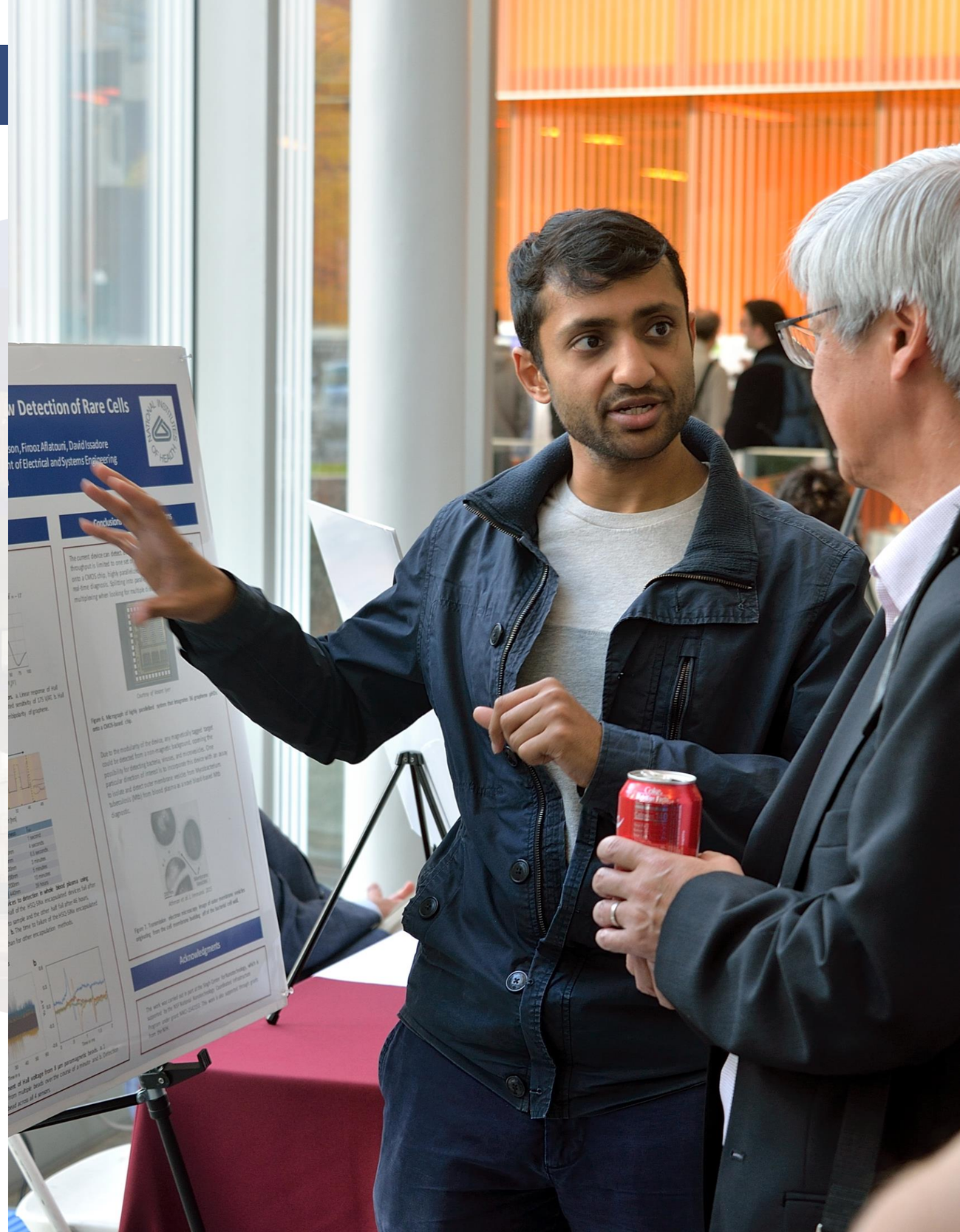

Our Priorities and Goals

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Education

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World class education requires access to state-of-the-art and emerging technologies: tomorrow's nanotechnologists will emerge from the Singh Center for Nanotechnology.

Our Priorities

As an integral part of the University's research enterprise, the Center is a learning laboratory for our users and a nexus for facilitating the exchange of knowledge across disciplines. Whether they are engaged as an undergraduate, graduate, post-doc, intern, or visiting scholar, our Center provides a dynamic place to apply knowledge, develop proficiency with instrumentation, and to engage with colleagues, resident experts and thought leaders. As a community, our connections with industry and academic experts provide our graduates with opportunities for growth and future success in diverse institutions, organizations and enterprises. Equally important in our mission to serve Penn and beyond, our innovative outreach programs, facility tours, boot camps, training sessions, and workshops, provide unique and valuable educational opportunities for our participants and our staff.

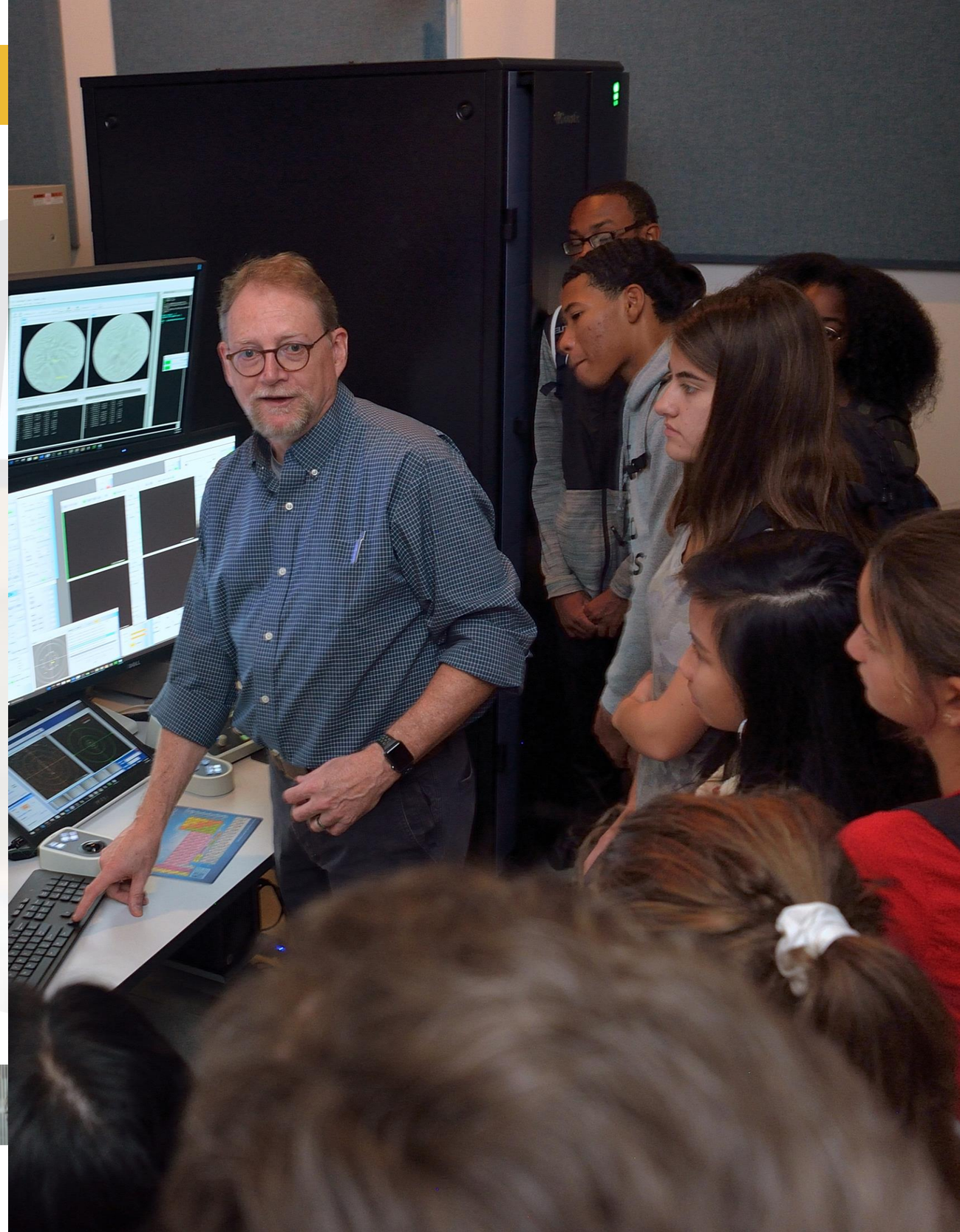
Our Goals

Success in education will be evaluated in relation to the three pillars of our mission:

Community: Across our internal and external communities, we will maintain and further develop recognized coursework, internships, fellowships and outreach programs.

Impact: We will continue to improve the quality and experience of our educational programming, expanding the number of participants in our outreach programs and those impacted by our undergraduate/graduate curriculum.

Leadership: Our graduates will emerge as leaders in nanotechnology as we follow their careers and measure the impact of their output.



Research + Innovation

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We provide an unprecedented resource for world class research. From the laboratory to the market, tomorrow's technology will be born in the Singh Center for Nanotechnology.

Our Priorities

Interdisciplinary, cutting-edge discovery and research are integral to Penn's vision and part of the fabric that defines the Center. As a community, our commitment to remaining at the forefront of developments in the field will allow us to shape the future of our discipline in areas of interest to all our stakeholders. Given the regional concentration of biotech firms, medical schools and start-up incubators, the Center's support for translational research reflects expansive bench-to-bedside innovation. Moreover, we continue to foster exciting innovations in energy storage, materials research, quantum technologies, photonics, and other fields. Facilitating research with the help of dedicated expert staff and faculty, we turn big ideas into small realities.

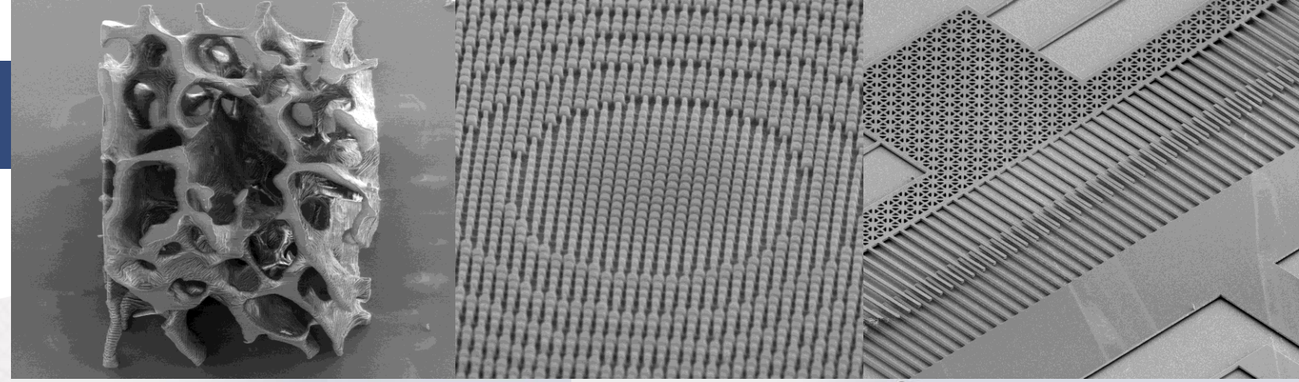
Our Goals

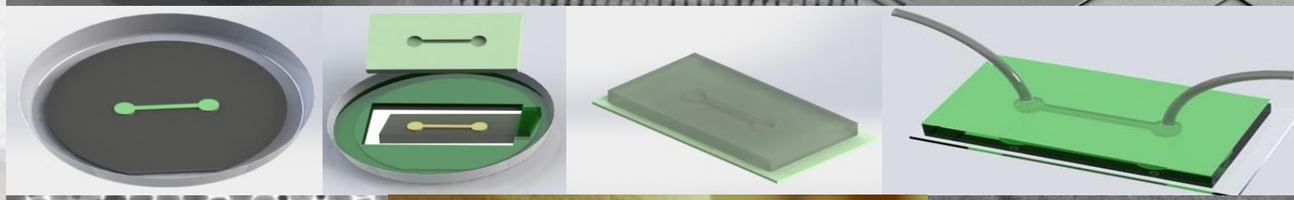
Success in research+innovation will be evaluated in relation to the three pillars of our mission:

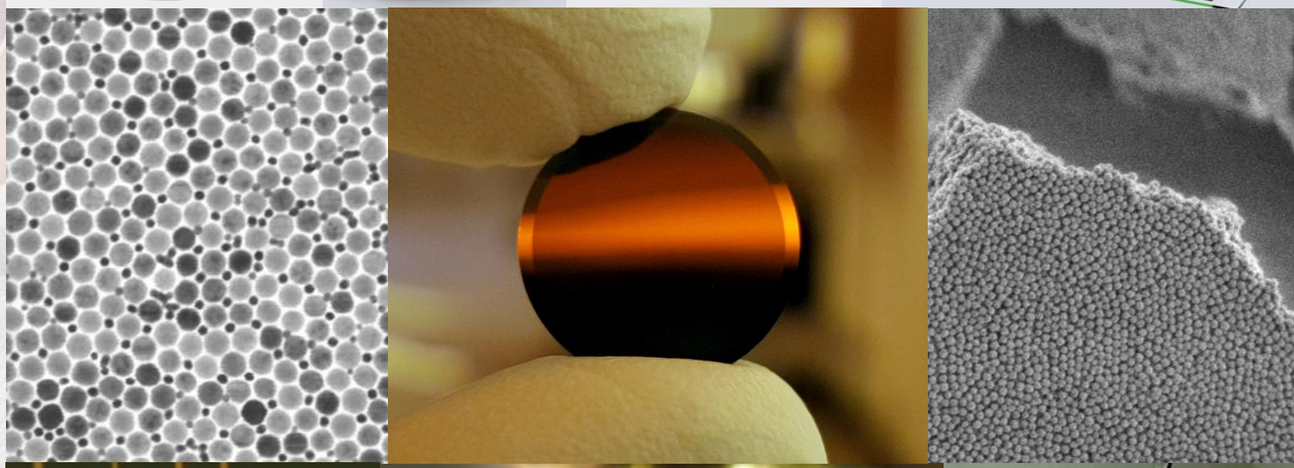
Community: The relevance, growth and impact of our community's research and innovation will continue to be recognized.

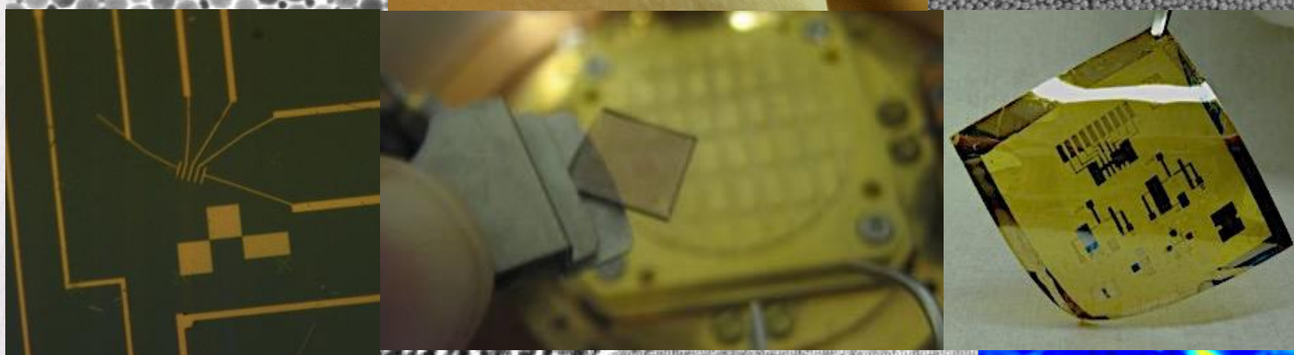
Impact: Our center will continue to be leveraged to secure funding to increase the volume of tangible deliverables in research and innovation.

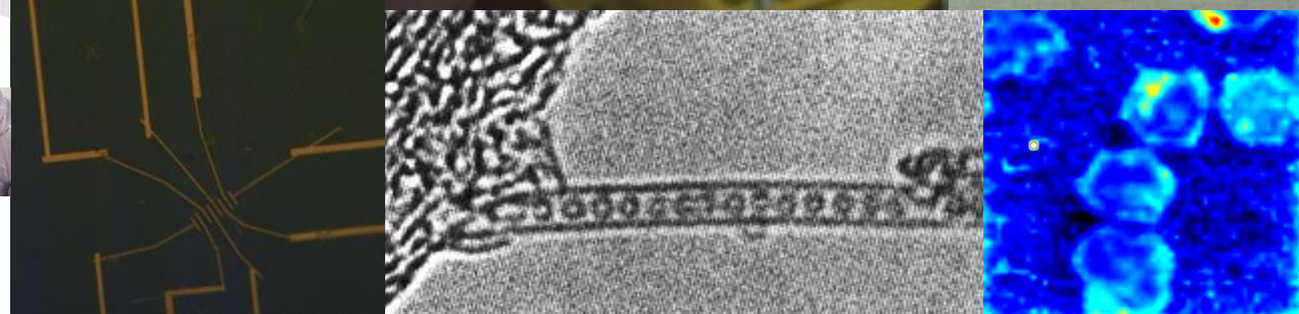
Leadership: We will continue to be sought for our expanding repertoire of resources, skills, and instrumentation.











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Engagement

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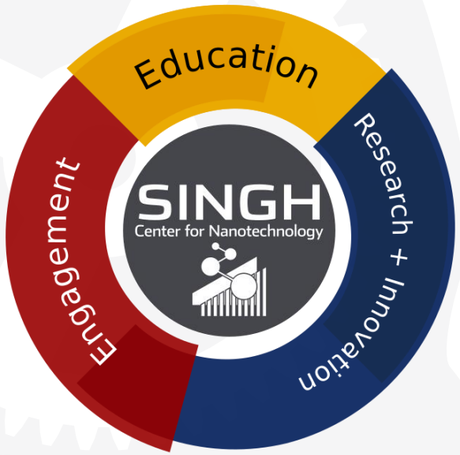
By inviting, inspiring, and celebrating the success of our internal and external collaborators, we cultivate community. From scholars and researchers to innovators, the nexus around which our community continues to emerge is the Singh Center for Nanotechnology.



Our Priorities

The Center sits in an accessible urban environment, housing state-of-the-art facilities, expert professional staff, and world-class faculty researchers. There are over a hundred colleges and universities in the Philadelphia region, which is also home to an extensive local economy that ranges from startups to over ten Fortune 500 companies. We engage with our community by providing access to expert staff and unique facilities/tools, while consistently promoting internal and global collaboration.

Our Goals

Success in engagement will be evaluated in relation to the three pillars of our mission:

Community: The visibility of the scholarship, collaboration, and culture of the Center will continue to expand.

Impact: We will play an integral role with our community in defining the future direction of nanotechnology.

Leadership: We will constantly seek to expand our community by increasing the number of our collaborators, inviting diverse perspectives and viewpoints in our shared objectives.

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Our Action Plan

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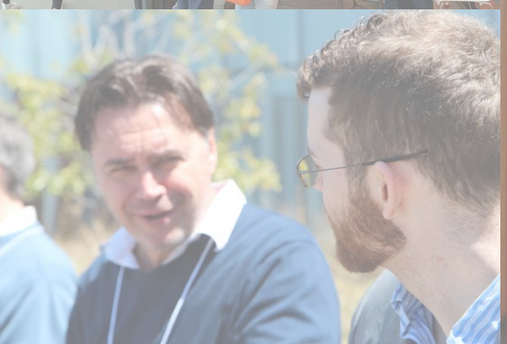

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Our Initiatives

Our Annual Action Plan consists of 9 core initiatives. Outlined below, where applicable, are current and future programs that will help carry out each initiative and will facilitate the pillars of achievement in community, impact and leadership within each of our priorities.

- Singh Center for Nanotechnology Annual User Meetings
- Knowledge Creation and Exchange
  - Scholarly Commons Publications
  - Online Video Trainings
  - Wednesday Open Forum
  - Workshops for Soft Lithography, Computer Aided Design (CAD) and Data Preparation
  - General Project Facilitation through Singh Center Staff Assistance
  - Singh Center Staff Professional Development
  - Vendor Lunch and Learns
  - Industrial Workshops (i.e., Nanotechnology Bootcamps, Mini Courses)
- Internship Program and Support
  - Graduate Student Fellows Program (GSF)
  - NNCI Research Experience for Undergraduates (REU)
  - Internships for High School and the Community College of Philadelphia
- Penn Coursework and Program Support
  - Nanotechnology Master's Program
  - Material Science Engineering Lab and Coursework Support
  - Electrical and Systems Engineering Lab and Coursework Support
  - Vagelos Integrated Program in Energy Research (VIPER) Project Support
- Community Outreach
  - Nano Day
  - Engineering Summer Academy at Penn (ESAP)
  - Tours and Site Visits for K-12, Local Colleges Undergraduate Classes
- Conference and Meeting Participation
  - AVS International Symposium and Exhibition
  - University, Government Industry, and Micro/Nanoelectronics Symposium (UGIM)
  - The International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication (EIPBN)
  - The Meeting for Advanced Electron Beam Lithography (MAEBL)
  - Mid-Atlantic Nanofab Manager's Meeting
  - International Power Supply-on-Chip (PwrSoC) Workshop
- Funding/Grant Support
  - Letters of Support for SBIR/STTR
  - General PI + Grant Proposal Support
  - Innovation Seed Grant (ISG)
- Facility Operations and Coordination
  - CLUB Nano Program for External Engagement Facilitation
  - Instrument Reservation and Interlock System (IRIS) for Tool Management/Billing
  - Capital Replacement Plan/Program
- Public Relations and Communication
  - Monthly Socials
  - Electronic Newsletter

Annual Action Plan

SINGH Center for Nanotechnology

Program Initiative	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Metrics
Annual User Meetings										■			Attendee/Participant Count, Demographic and Feedback
Knowledge Creation and Exchange													
Scholarly Commons Publications Online Video Trainings Wednesday Open Forum Workshops for Soft Lithography, Computer Aided Design (CAD) & Data Preparation General Project Facilitation through Singh Center Staff Assistance Singh Center Staff Professional Development	■	■	■	■	■	■	■	■	■	■	■	■	Access/Download/View Count Attendee Count, Demographic and Feedback Assistance Hours
Vendor Lunch and Learns	■	■	■	■	■	■	■	■	■				Attendee Count, Demographic and Feedback
Industrial Workshops (i.e., Nanotechnology Bootcamps, Mini Courses)						■	■	■					
Internship Program and Support													
Graduate Student Fellows Program (GSF)	■	■	■	■	■	■	■	■	■	■	■	■	Participant Count, Demographic, Feedback and Career Path
NNCI Research Experience for Undergraduates (REU)						■	■	■					
Internships for High School and the Community College of Philadelphia				■	■	■	■	■					
Penn Coursework and Program Support													
Nanotechnology Master's Program Material Science Engineering Lab and Coursework Support Electrical and Systems Engineering Lab and Coursework Support	■	■	■	■				■	■	■	■	■	Participant Count, Demographic, Feedback and Career Path
Vagelos Integrated Program in Energy Research (VIPER) Project Support				■									Participant Count, Demographic and Feedback
Community Outreach													
Nano Day										■			Participant Count, Demographic and Feedback
Engineering Summer Academy at Penn (ESAP)						■	■	■					
Onsite Tours and Site Visits for K-12 and Local University/College Classes	■	■	■	■	■				■	■	■	■	
Conference and Meeting Participation													
AVS International Symposium and Exhibition										■			Participant and Publication Count, Role
University, Government Industry, and Micro/Nanoelectronics Symposium (UGIM)						■							
The International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication (EIPBN)					■								
The Meeting for Advanced Electron Beam Lithography (MAEBL)				■									
Mid-Atlantic Nanofab Manager's Meeting				■						■			
International Power Supply-on-Chip (PwrSoC) Workshop										■			
Funding/Grant Support													
Letters of Support for SBIR/STTR General PI + Grant Proposal Support Innovation Seed Grant (ISG)	■	■	■	■	■	■	■	■	■	■	■	■	Participant Count, Demographic and Outcome ISG: Raised Capital and Source
Facility Operations and Coordination													
CLUB Nano Program for External Engagement Facilitation Instrument Reservation and Interlock System (IRIS) Research Facilities Development Fund Program Capital Replacement Plan/Program	■	■	■	■	■	■	■	■	■	■	■	■	CLUB Nano: Participant Count, Demographic and Feedback
Public Relations and Communication													
Monthly Socials Electronic Newsletter	■	■	■	■	■	■	■	■	■	■	■	■	Attendee/Readership Count Feedback Monthly Socials: Demographic

2025 Executive Strategic Plan Overview

SINGH Center for Nanotechnology

Vision + Mission

Educate
Influence
Catalyze

Priorities

- Education
- Research + Innovation
- Engagement

Goals

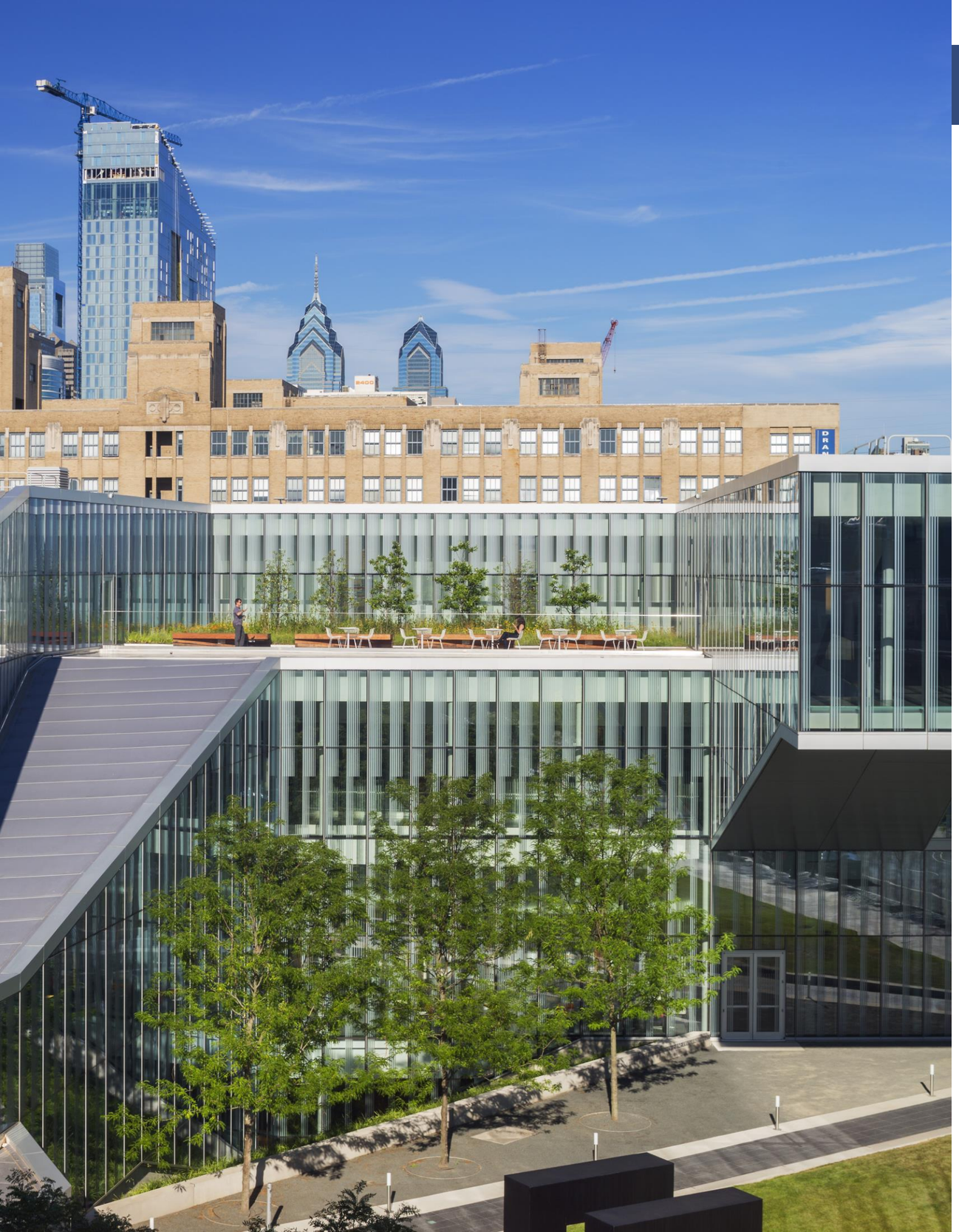
- Community
- Impact
- Leadership

Initiatives

Goals	Annual User Meetings	Knowledge Creation and Exchange	Internship Program and Support	Penn Coursework and Program Support	Community Outreach	Conference and Meeting Participation	Funding/Grant Support	Facility Operations and Coordination	Public Relations and Communication
Education									
Community	✓	✓	✓	✓	✓				
Impact	✓	✓	✓	✓	✓				✓
Leadership	✓	✓	✓	✓	✓	✓			
Research + Innovation									
Community	✓	✓	✓			✓	✓		✓
Impact	✓	✓	✓				✓	✓	
Leadership	✓	✓				✓	✓	✓	✓
Engagement									
Community	✓	✓	✓		✓	✓	✓		✓
Impact	✓	✓				✓	✓	✓	
Leadership	✓	✓				✓	✓	✓	✓

Educate Influence and Catalyze

Annual Action Plan



Acknowledgements

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Strategic Planning Steering Committee

Co-Chairs
Mark Allen, Scientific Director, Singh Center for Nanotechnology
Gerald Lopez, Director of Business Development, Singh Center for Nanotechnology

Matthew Brukman, Director of the Scanning and Local Probe Facility
Noah Clay, Director of the Quattrone Nanofabrication Facility
Kristin Field, Director of Education and Professional Development
G. Patrick Watson, Director of User Programs
Doug Yates, Director of Nanoscale Characterization Facility

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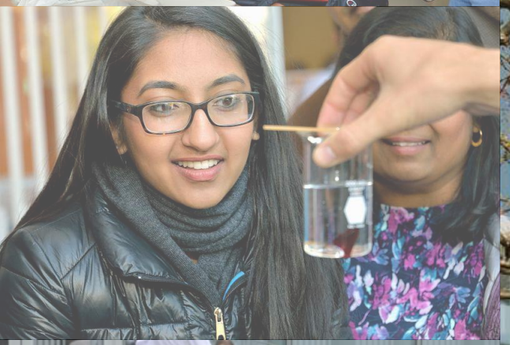

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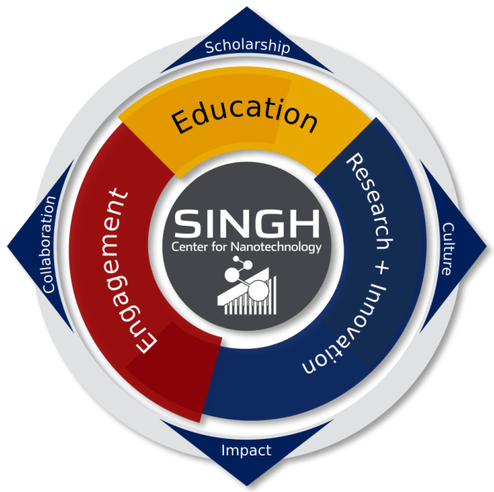

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