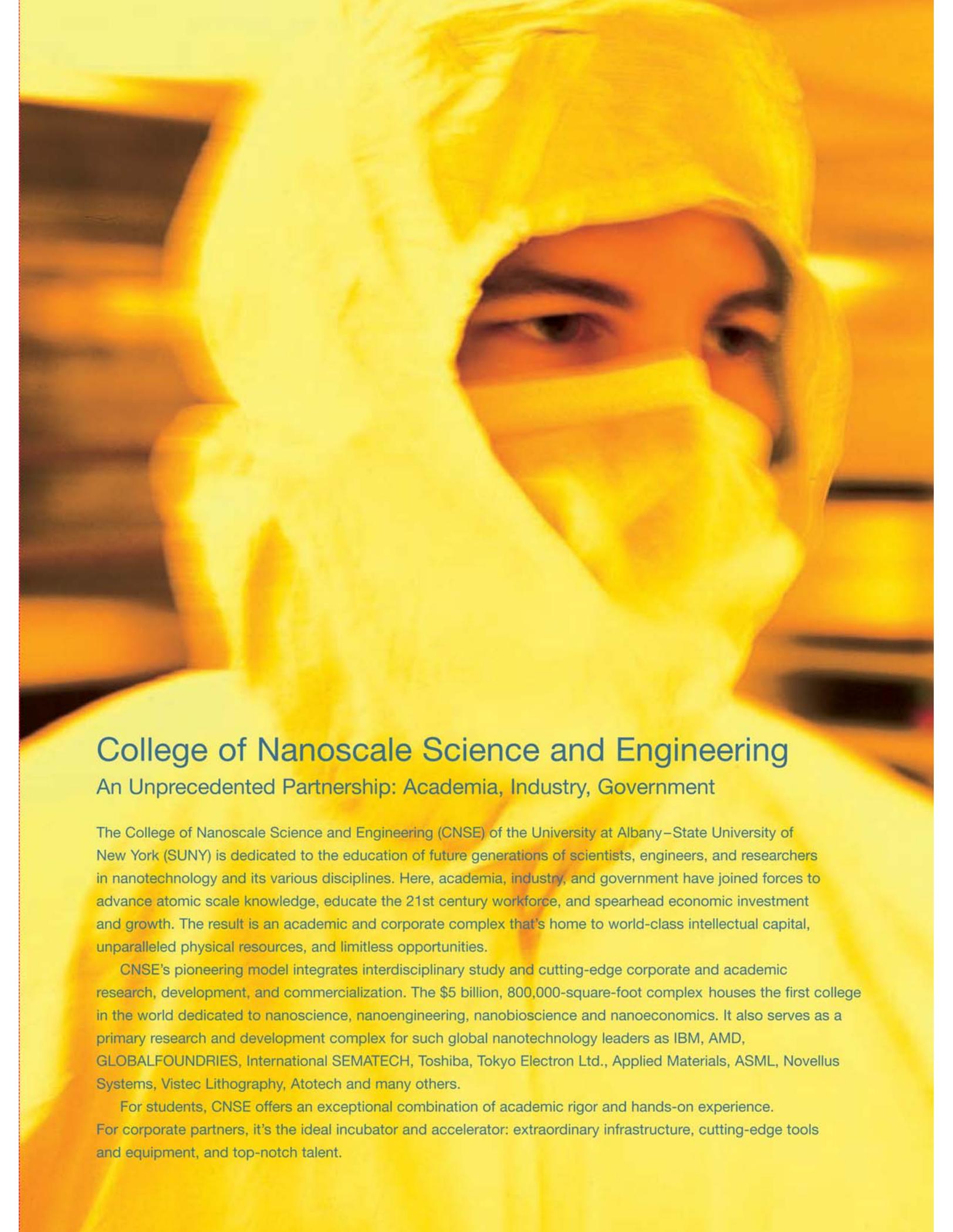


COLLEGE OF NANOSCALE SCIENCE & ENGINEERING

University at Albany, State University of New York



## College of Nanoscale Science and Engineering

### An Unprecedented Partnership: Academia, Industry, Government

The College of Nanoscale Science and Engineering (CNSE) of the University at Albany—State University of New York (SUNY) is dedicated to the education of future generations of scientists, engineers, and researchers in nanotechnology and its various disciplines. Here, academia, industry, and government have joined forces to advance atomic scale knowledge, educate the 21st century workforce, and spearhead economic investment and growth. The result is an academic and corporate complex that's home to world-class intellectual capital, unparalleled physical resources, and limitless opportunities.

CNSE's pioneering model integrates interdisciplinary study and cutting-edge corporate and academic research, development, and commercialization. The \$5 billion, 800,000-square-foot complex houses the first college in the world dedicated to nanoscience, nanoengineering, nanobioscience and nanoeconomics. It also serves as a primary research and development complex for such global nanotechnology leaders as IBM, AMD, GLOBALFOUNDRIES, International SEMATECH, Toshiba, Tokyo Electron Ltd., Applied Materials, ASML, Novellus Systems, Vistec Lithography, Atotech and many others.

For students, CNSE offers an exceptional combination of academic rigor and hands-on experience. For corporate partners, it's the ideal incubator and accelerator: extraordinary infrastructure, cutting-edge tools and equipment, and top-notch talent.

## Facts

The world's first college dedicated to nanotechnology and its various disciplines.

Most advanced research complex of its kind at any university in the world.

800,000-square-foot complex houses the only fully integrated, 300mm wafer computer chip pilot prototyping and demonstration line within 80,000 square feet of Class 1 capable cleanrooms.

More than 2,500 scientists, researchers, engineers, students, and faculty work on-site.

More than 250 global corporate partners, including the world's leading nanoelectronics companies.

Home to New York State Center of Excellence in Nanoelectronics and Nanotechnology.

Investment to date: \$5 billion in public and private funds.

[cnse.albany.edu/about\\_cnse/quick\\_facts.html](http://cnse.albany.edu/about_cnse/quick_facts.html)



## EDUCATION

Through education and workforce development, CNSE seeks to supply the critical mass of scientists, engineers, and technically savvy employees needed in the high-tech workforce of today and tomorrow. Education and training resources are available to meet the needs of equipment, materials, and integrated nanodevice manufacturers, as well as component suppliers.

## RESEARCH

CNSE is the site of some of the world's most advanced nanoscale research and development. Academic and corporate scientists are engaged in leading-edge research in fields including energy and power electronics, interconnect sciences, EUV lithography, and nanoelectronics.

## COLLEGE OF NANOSCALE SCIENCE & ENGINEERING

Students benefit from a unique combination of forward-looking curricula, world-renowned faculty, and unparalleled infrastructure and technology. They work side-by-side with corporate research partners, tackling real-world challenges and forging mutually beneficial relationships.

## BUSINESS

CNSE has more than 250 U.S. and global business partners. Many—including IBM, Tokyo Electron, Applied Materials (AMAT), ASML, and Vistec Lithography—consider the CNSE complex an integral component of their research and development roadmap.

## Academic Programs

The world's only college dedicated to nanoscale science and engineering, CNSE offers an unparalleled educational experience: next-generation curricula, extraordinary facilities, accomplished faculty, and on-site corporate research partners. CNSE students have access to more than \$5 billion in cutting-edge infrastructure. They work side-by-side with industry pioneers in the most extensive nanotechnology research facilities in the academic arena. And they master tools and equipment that are the envy of the industry—and unavailable anywhere else, neither on other campuses nor in corporate nanotechnology facilities.

All CNSE academic programs combine the fundamentals of nanoscale knowledge with the opportunity to delve into the advanced concepts that are at the core of cutting-edge discoveries. Degree candidates engage in hands-on research with real-world applications. They work under the guidance of professors, in collaboration with global nanotech companies, and as independent innovators. Their experience and connections provide a competitive advantage and open the door to post-graduate opportunities. In fact, the majority of CNSE graduates have landed positions at major corporate research labs or academic centers.



### Nanoscale Science, B.S.

CNSE is the world's first college to offer a comprehensive baccalaureate program in Nanoscale Science. The bachelor's degree in nanoscale science provides an academically rigorous preparation for students intending to pursue scientific, technical, or professional careers in nanotechnology-enabled fields or graduate studies in nanoscale science or nanoscale engineering, as well as other physical sciences such as materials science, physics, and chemistry. As a result, graduates will demonstrate the technical and professional proficiencies necessary to enable the identification, description, discovery, experimental investigation, and theoretical interpretation of nanoscale phenomenon and, as a result, become highly successful scientists, educators, and leaders in the global innovation economy of the 21st century.

### Nanoscale Science, M.S. and Ph.D.

Preparation for careers in nanoscale science, academic scholarship, or industrial, academic, or government research in nanosciences. Students choose from the following tracks: Molecular Materials and Architectures; Optoelectronic Materials and Architectures; Spintronic Materials and Architectures; Ultra-Thin Film Single and Multilayered Nanomaterial Structures; Nanoscale Materials Characterization, Analysis, and Metrology; Nanomaterials for Nanotechnology; and Economic Impacts of Nanoscale Science and Nanotechnology.

### Nanoscale Engineering, M.S. and Ph.D.

Expertise in the design, fabrication, and integration of nanoscale devices, structures, and systems in preparation for careers in nanoengineering, academic scholarship, or industrial, academic, or government research. Students choose from the following tracks: Nanoelectronics Engineering and Technology, Optoelectronics and Photonics Nanoengineering, Spintronics Nanoengineering, NanoSystem Engineering and Technology, Nanoengineering in Energy & Environmental Technologies, Nanolithography Engineering and Technology, and Nanobiology Engineering and Technology.



Nanoscale Science/  
Business Administration,  
M.S./M.B.A.

Nanoscale Engineering/  
Business Administration,  
M.S./M.B.A.

A cooperative effort between CNSE and the School of Business at the University at Albany, these dual-degree interdisciplinary programs prepare scientists and engineers for management careers in nanotechnology-based organizations. The goal is to develop nanotechnology industry-ready graduates who are capable of integrating science, engineering, business, and management.

“We work alongside industry giants, right here on-site, on research that pertains to actual industrial problems. We graduate with the skills and knowledge that are critical for real-world success.”

MARY VIOLA GRAHAM  
PH.D. CANDIDATE, CNSE

### NanoFab North

This \$175 million, 250,000-square-foot facility includes 35,000 square feet of cleanroom space with Class 1 capable 300mm wafer production. It also houses the world's first EUV alpha demo tool, equipment that's critical for the development and commercialization of EUV technology.

### NanoFab South

This \$50 million, 150,000-square-foot facility comprises 32,000 square feet of cleanroom space, classrooms, CNSE offices, and offices of corporate partners including Tokyo Electron, Applied Materials (AMAT), and ASML.

### NanoFab 200

Also known as the Center for Environmental Sciences and Technology Management (CESTM), this first nanofab facility—a \$16.5 million, 70,000-square-foot center—includes 4,000 square feet of cleanroom space, plus metrology labs and offices.

## Facilities A World-Class Nanotech Complex

CNSE's Albany NanoTech Complex is among the world's most impressive nanotechnology centers. Its state-of-the-art infrastructure and unparalleled tools and technology create the ideal setting for business incubation, technology acceleration, and prototype testing. Currently, more than 250 U.S. and international organizations access CNSE's laboratories, supercomputer center, scientific centers, and other shared-user facilities. Corporate and academic partners also receive unprecedented on-site support for short- and long-term research and development efforts.

Since the opening of NanoFab 200 just over a decade ago, CNSE's Albany NanoTech has earned a global reputation for its leading-edge capabilities, including major wafer processing, compound semiconductor processing, and metrology. The \$5 billion complex is home to four nanofab centers, complete with more than 80,000 square feet of cleanroom space—and the world's first extreme ultraviolet (EUV) lithography alpha demo tool.

A continued commitment to government and industry investment ensures that CNSE will remain in the forefront of nanotechnology research and applications.



### NanoFab East

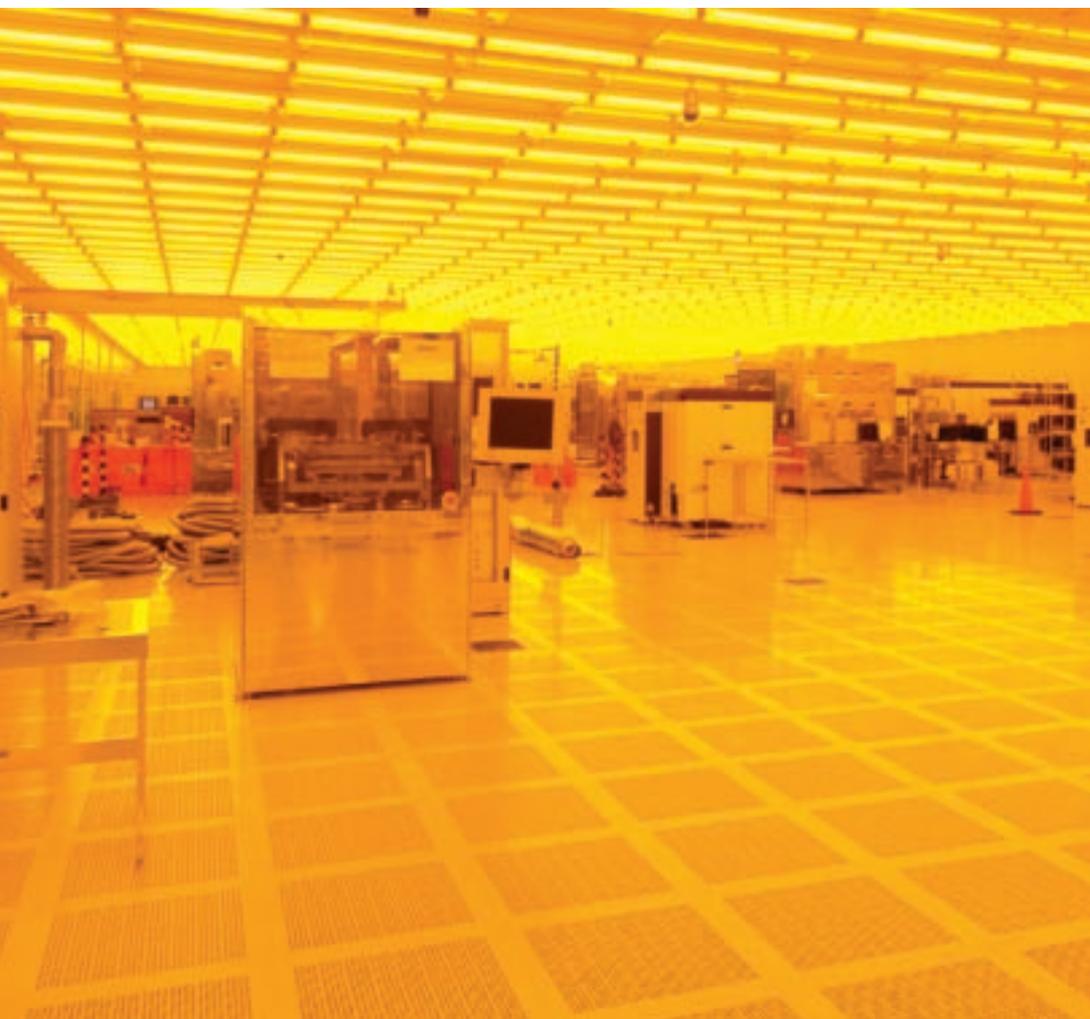
Part of a \$150 million expansion, this 250,000-square-foot office, laboratory and classroom building houses offices for CNSE and a variety of global corporate partners including IBM, the headquarters of International SEMATECH, and Vistec Lithography.

### NanoFab Central

This 100,000-square-foot building, also part of the most recent expansion, provides an additional 15,000 square feet of 300mm wafer, Class 1 capable, cleanroom space.

“People from our company want to come to CNSE because of the capabilities and opportunities here.”

**MIKE SPLINTER**  
PRESIDENT AND CEO, APPLIED MATERIALS



# Centers and Programs

Throughout the CNSE complex, academic and corporate partners are engaged in research that has the potential to transform traditional science and engineering and contribute to breakthroughs in fields as diverse as electronics, defense, health care, telecommunications, energy, and the environment.



## Strategic Technology and Commercialization Partnerships

### Center for Semiconductor Research (CSR)

A multi-phase cooperative program on computer chip technology nodes; partners include IBM, AMD, Toshiba, Tokyo Electron Ltd., and Applied Materials (AMAT).

### International SEMATECH

A 12-member global consortium of major computer chip manufacturers that has established its global headquarters and operations at CNSE. SEMATECH-administered centers include the EUV Resist Test Center, EUV Mask Blank Development Center, EUV Process Development Center, Alternative Lithography Technologies Center, 3D Interconnect Center and Advanced Metrology Center.

### Applied Materials (AMAT) R&D Center

A \$300 million center focusing on immersion lithography; AMAT's only R&D facility outside its headquarters in San Jose, California.

### Center for National Nanotechnology Innovation & Commercialization (NNICC)

Established through a research partnership between the U.S. Army Research Laboratory (ARL) and CNSE to develop nanotechnology-driven products and devices that support Army combat operations and enhance the protection of its troops.

### International Multiphase Program for Lithography Science and Engineering (IMPLSE)

A collaborative effort, with ASML and IBM, focusing on 193nm immersion and EUV technologies.

### International Venture for Nanolithography (INVENT)

A global industry-university consortium for R&D, education, and technology deployment for nanolithography applications; partners include Advanced Micro Devices (AMD), ASML, IBM, and Micron Technology.

### New York Center for National Competitiveness in Nanoscale Characterization (NC<sup>3</sup>)

A joint collaboration between the National Institute of Standards and Technology (NIST), through its Center for Nanoscale Science and Technology (CNST), and CNSE to tackle some of the most critical challenges facing the nanotechnology industry, including obtaining precise measurements at the atomic and sub-atomic levels.

### Center for NanoScale Lithography

A joint effort between CNSE and Vistec Lithography to accelerate development of Vistec's E-beam lithography technology and build a highly educated, skilled workforce.

For more information: Visit us online at [cnse.albany.edu/inforequest](http://cnse.albany.edu/inforequest). Complete the Request for Information, and we will contact you as soon as possible.



## Albany Integration Model

Companies worldwide are drawn to CNSE by its Albany Integration Model, a singular business paradigm that allows them to tap technology, tools, and intellectual capital that's specific to the needs of their organization. No other facility can match this combination of flexibility, resources, and access to the best in the industry.

## Academic Research

### TEL Technology Center, America

Tokyo Electron Ltd.'s only R&D facility outside Japan: a \$300 million center established to conduct R&D of cutting-edge semiconductor materials and processes.

### The International Renewable Energy Technology Institute (IRETI)

CNSE was selected on behalf of New York State to participate in this global consortium designed to accelerate the adaptation and implementation of renewable energy technologies around the world.

### Computer Chip Hybrid Integration Partnership (CHIP)

A cross-regional partnership between SUNY Institute of Technology (SUNYIT) and CNSE to expand the region's physical and intellectual abilities, and resulting in development of a state-of-the-art Computer Chip Commercialization Center at SUNYIT and an advanced Computer Chip R&D Integration Center at CNSE.

### Center for Advanced Technology in Nanomaterials and Nanoelectronics (CATN2)

A CNSE-led consortium of research universities and nanoelectronics, optoelectronics, telecommunications, defense, and nanobiotechnology companies.

### Center for Sustainable Ecosystem Nanotechnologies

CNSE's Center for Sustainable Ecosystem Nanotechnologies provides critical design and analysis, pilot prototyping, and proof of concept to enable advanced systems and structures for integration within a host of renewable energy technologies.

### Center for Advanced Interconnect Science and Technology (CAIST)

An academic partnership led by CNSE and currently including Binghamton University, Columbia University, Cornell University, Lehigh University, Massachusetts Institute of Technology, Penn State, Rensselaer Polytechnic Institute, Stanford University, University of Florida, University of Maryland, University of North Texas, University of Texas at Arlington, and University of Texas at Austin.

### Energy and Environmental Technology Applications Center (E2TAC)

A public-private partnership that focuses on CNSE's nanotechnology applications for alternative energy and environmental technologies.

### Focus Center New York

Established by the Semiconductor Industry Association and the Defense Advanced Research Programs Agency at CNSE; addresses long-term challenges in developing next-generation computer chips.

### Institute for Nanoelectronics Discovery and Exploration (INDEX)

One of four such research institutes in the country, the CNSE-led INDEX includes Harvard University, Yale University, Massachusetts Institute of Technology, California Institute of Technology, Columbia University, North Carolina State University, University of Virginia, Purdue University, Georgia Institute of Technology, Rensselaer Polytechnic Institute, Intel, Micron, AMD, IBM, Texas Instruments, and Freescale Semiconductor, Inc.

# College of Nanoscale Science and Engineering

## A World-Class Experience

“In terms of facilities, there’s no comparison. No other school has such an extensive collection of semiconductor manufacturing and analysis tools—some of which aren’t even available in industry yet.”

**CHRISTOPHER MILLER**  
PH.D. CANDIDATE, CNSE

“While at CNSE, I had the opportunity to network with leading industry partners—including IBM, Intel, Texas Instruments, and more—and to collaborate on cutting-edge technologies. The teamwork and industry-style management provided excellent preparation for my work at IBM.”

**YU ZHU**  
PH.D., CNSE 2006,  
ADVISORY ENGINEER, IBM THOMAS J.  
WATSON RESEARCH CENTER

“CNSE provides hands-on experience that can’t be duplicated in any other academic environment. It produces scientists and professionals who are well-qualified and highly sought after in the field of semiconductor manufacturing, development, and research.”

**FILIPPOS PAPADATOS**  
PH.D., CNSE 2006,  
UNIT PROCESS DEVELOPMENT ENGINEER  
300MM SILICIDE/METALS (MOL)—  
MICROELECTRONICS DIVISION,  
IBM, EAST FISHKILL

“This is a unique environment, an opportunity to receive a well-rounded education and participate in industrial and academic research that places me at the forefront of nanotechnology.”

**CHIMAOBI MBANASO**  
PH.D. CANDIDATE, CNSE

“If you want to make movies, you go to Hollywood. If you’re in the business of nanotechnology, you go to Albany.”

**PAPKEN DER TOROSSIAN**  
EXECUTIVE CHAIRMAN,  
VISTEC LITHOGRAPHY

“We’re absolutely thrilled to be part of what’s happening at CNSE. It really represents the future for us as a firm—and for all of us in the Capital Region.”

**TOM BIRDSEY,**  
PRESIDENT & CEO, EYP

