

UNIVERSITY AT BUFFALO
ENGINEERING
TODAY

- Global health at core of bioinformatics center
- Resisting earthquakes, hurricanes, terrorism
- Information fusion aids national defense
- Quantum leaps in integrated nano
- Homeland security risk reduction



Bio focus
on matters of
Life



A MESSAGE FROM THE DEAN

A school, a university on the rise



IT'S THE 60TH YEAR and a new day in University at Buffalo Engineering. In the following pages, you'll see a school with a heritage of quality brimming with new life and discoveries—a school that deserves to be among the top engineering programs, within a university that is on course to become one of the country's top research institutions.

UB Engineering has grown in stature and in research expenditures, now at an all-time high of nearly \$40 million per year. Undergraduate and graduate enrollment are growing significantly, along with the faculty and its national reputation. This burgeoning status, in fact, has necessitated plans for a new \$75 million building (which are underway).

The school's commitment to research has been prominent in its participation with its 14 engineering-based research centers and nine multi-decanal collaborative centers, including the \$150 million public and private investment in the New York State Center of Excellence in Bioinformatics and Life Sciences.

As the new UB Engineering dean, I am excited about the new prospects and potential of the school's future. I hope to adapt my experience as dean of the private engineering college at Lehigh University into the best practices of this public institution. A prime example of this educational emphasis is the nationally recognized Student Excellence Initiative, a complete tutoring and mentoring program, in place since 1998, that stresses learning independence.

I invite you to consider the range of advancements that our school has achieved recently as we engineer our future into the top ranks of programs in the country.

Harvey G. Stenger Jr.

Professor and Dean

AREAS OF ADVANCEMENT

Research in UB Engineering touches virtually every aspect of our world, from early warning of catastrophic events to biomedicine breakthroughs. Most of the following research highlights closely align with the university plan for the future, entitled UB 2020, which places within reach a commanding research presence drawn from all sectors of the university.

COVER PHOTO:

HUI MENG (RIGHT), CODIRECTOR OF UB'S TOSHIBA STROKE RESEARCH CENTER, LEADS RESEARCH ON IMPROVING STROKE TREATMENT BY ENGINEERING BLOOD FLOW.



CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING
COMPUTER SCIENCE AND ENGINEERING
ELECTRICAL ENGINEERING
INDUSTRIAL AND SYSTEMS ENGINEERING
MECHANICAL AND AEROSPACE ENGINEERING

INFORMATION FUSION: assessing urgent situations

F **USING INFORMATION** to defuse complex situations—from urban warfare to disease outbreaks—is the objective of the National Center for Multisource Information Fusion (CMIF) research. Funded by the U.S. Department of Defense, the CMIF—under the direction of professor of industrial and systems engineering **Moises Sudit**—applies information fusion of multiple data sources using real-time algorithms which supports rapid and accurate decision-making. The CMIF's applications include asymmetric warfare, computational geometry for urban settings, cyber security, graph matching (as in forensics), and natural and man-made disasters.

Securing U.S. borders is an important emphasis of CUBRC as a major partner in the new \$15 million Homeland Security Center of Excellence located at the Johns Hopkins University. A number of UB Engineering researchers will be involved in studying how the nation can best prepare for, and respond to, potential large-scale incidents and disasters.

CUBRC, of which UB Engineering is a principal participant, ranked eighth nationally during fiscal 2005 with awards of \$51.3 million for U.S. Department of Defense contracts and grants to nonprofit organizations.

CHEMICAL AND BIOLOGICAL ENGINEERING
COMPUTER SCIENCE AND ENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL AND AEROSPACE ENGINEERING

BIOACTIVITIES:

qualities of life



IMPROVING STROKE TREATMENT through studies of the relationship between blood flow and brain aneurysms—professor **Hui Meng**'s mechanical engineering skills are being applied to biomedical engineering and the development of innovative methods for diagnosis and treatment of diseases and injuries. Such involvement plays a large role in UB's New York State Center of Excellence in Bioinformatics and Life Sciences, a

hub of life sciences expertise and innovation that encourages collaboration with industry, government, and researchers to improve the health and well-being of the world's population.


Associate professor of computer science and engineering **Daniel Fischer**, affiliated with the center, was among three UB winning research teams in last year's international "protein structure Olympics" of the Critical Assessment of Techniques for Protein

Structure Prediction. It was an unprecedented accomplishment for three teams from the same institution to make the most accurate blind predictions of an unknown protein structure.

Assistant professor of mechanical engineering **Susan Hua** was among the researchers involved in developing a microfluidic device that rapidly tests live cells for responses to any stimulus by using electrical resistance to measure changes in cell volume.

Associate professor **Sriram Neelamegham**, codirector of UB's Center for Bioengineering, and professor **Paschalis Alexandridis**, both of Chemical and Biological Engineering, recently received a \$1.5 million grant to study how the engagement of blood platelets by substrate-immobilized von Willebrand Factor under fluid flow leads to platelet activation and subsequent thrombus formation.





CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING
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EXTREME EVENTS:

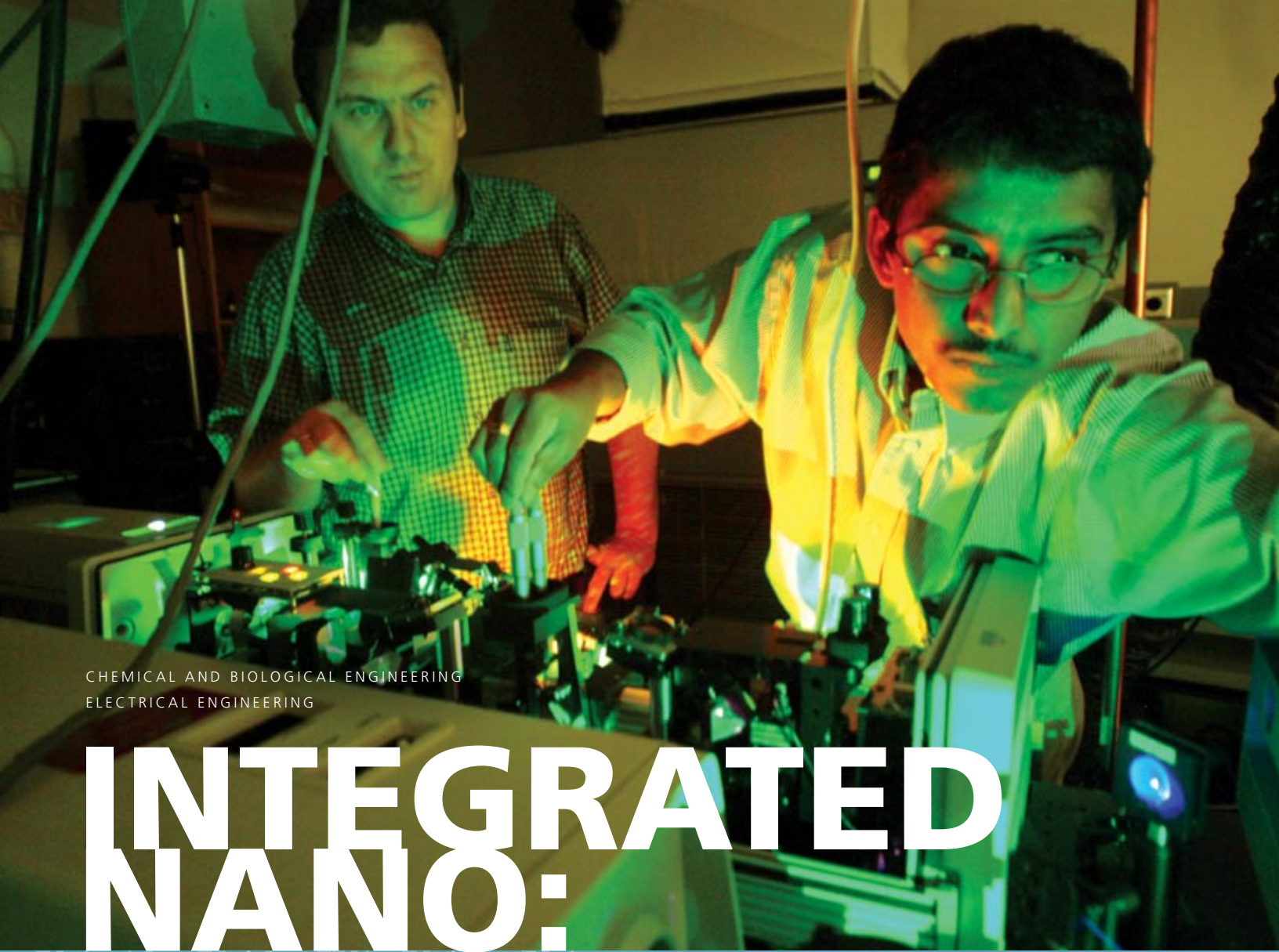
ultimate
preparation

A FULL-SCALE, WOOD-FRAME TOWNHOUSE built with fluid seismic dampers to test its ability to withstand earthquake intensity: that was the housing project erected in UB's Structural Engineering and Earthquake Simulation Laboratory (SEESL) as part of NEESWood, a National Science Foundation-funded project. Under principal investigator **Andre Filiatrault**, Civil, Structural and Environmental Engineering professor, the goal is to develop a better understanding of how wooden structures react to earthquakes so that larger structures can be built in seismic regions worldwide.

UB's MCEER has expanded its focus from earthquake engineering to improving resilience against extreme events of all sorts. For example, MCEER researchers were instrumental in reconnaissance work and research on the 2004 Indian Ocean tsunami and, more recently, Hurricane Katrina.

The multi-hazard approach is resulting in such projects of resilience as professor of CSEE and MCEER director **Michel Bruneau's** design for bridge piers that will be more resistant to terrorist attacks and earthquakes, and Niagara Mohawk Professor of mechanical engineering **Deborah Chung's** patented "smart concrete" with electrical properties that would strengthen levees and monitor their stability.

Improving post-disaster emergency response is a priority of the extreme focus. **James Llinas**, Industrial and Systems Engineering professor and founding director of UB's CMIF, noted that this science of efficiently organizing and interpreting massive amounts of information was first employed in a disaster mode minutes after the 9/11 attacks. Work on the integrated, automated fusion and decision-making software embedded in urban emergency management and crisis-management systems was recently funded by a \$2.5 million grant from the Air Force Office of Scientific Research award to CUBRC and UB Engineering.



CHEMICAL AND BIOLOGICAL ENGINEERING
ELECTRICAL ENGINEERING

INTEGRATED NANO:

good things come
in tiny packages

IT'S A NANO WORLD as UB engineers advance the future in billionths of a meter.

The New York State Office of Science, Technology and Academic Research (NYSTAR) granted a \$750,000 award to recruit **Jonathan Bird** as a professor in Electrical Engineering. Bird's research concentrates on nanoscale semiconductors that make detecting electron spin

and developing powerful quantum computers more feasible.

EE department chair **Vladimir Mitin** also received a \$750,000 NYSTAR award to conduct multidisciplinary research designed to develop and commercialize multifunctional nanosensors and sensor networks. Mitin's award, which recognizes him as a world-class researcher, is designed to enhance health care (espe-

cially for remote applications), to improve detection of contaminants, and to boost advances in quantum communication.

Paras Prasad, SUNY Distinguished Professor and EE faculty member, is using ceramic-polymeric nanoparticles both to image and deliver therapies in pancreatic cancer. This research is supported by a \$3.46 million grant from the National Cancer Institute.



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HOMELAND SECURITY:

a safer place

A S RECENT AS today's news, UB engineers are involved in a wide expanse of developments designed to maintain stronger homeland security and identification techniques.

The Center of Excellence in Document Analysis and Recognition (CEDAR), under the direction of SUNY Distinguished Professor **Sargur Srihari**, has built on its worldwide reputation in pattern recognition and handwriting analysis to advance into biometrics, forensic research, and information retrieval.

Rohini Srihari is leading a team in CEDAR that is developing an anti-ter-

rorism computer search tool to identify unintended revelation from unconnected Web sites. CEDAR is also developing computer-assisted handwriting analysis and a software system for medical emergencies that serves as early detection of bioterrorist threat or epidemic.

UB's Center for Unified Biometrics and Sensors (CUBS), directed by CSE professor **Venu Govindaraju**, takes a unique approach to developing technologies in biometrics—a key piece in homeland security strategies—by combining and “tuning” different biometrics to fit specific applications.

UB's Center of Excellence in Information Systems Assurance Research and

Education (CEISARE), directed by CSE associate professor **Shambhu Upadhyaya** and certified by the National Security Agency and the Department of Homeland Security, is helping Buffalo become a center for research, education, and new practices in cyber security and computer forensics.

Improving airport security is a goal of UB's Research Institute for Safety and Security in Transportation (RISST), studying human factors that contribute to errors and inefficiencies in security systems. The center's director is UB Distinguished Professor **Colin G. Drury** of industrial and systems engineering.

PRODUCTS MADE HERE

DEVELOPING PRODUCTS and bringing them to market has been a thrust of UB Engineering through several mechanisms, such as UB's New York State Center for Engineering Design and Industrial Innovation (NYSCEDI), the state's only engineering design research center utilizing large-scale virtual reality and scientific visualization. Using virtual prototyping and simulation, NYSCEDI researchers helped develop a new high-tech mattress to help prevent pressure ulcers.

A nanoparticle-based drug delivery to tumor cells was developed in a partnership with UB's Institute for Lasers, Photonics and Biophotonics and the Center of Excellence. The work has far-reaching implications for a variety of disease areas, including neurological and cardiac.

UB's Virtual Reality Lab developed a fingertip digitizer which, when worn on the tip of the index finger, can transfer to the virtual world the meaning and intent of common hand gestures, bringing great potential for a wide range of applications, from personal computing to medical diagnostics.

Other products in development include air sterilization technology to protect hospital patients from deadly infections; a pump to be used in a device that may help revolutionize the decontamination and purification of water, juices, and other liquids; and high-performance swimsuits that reduce drag and provide a competitive edge.

HONORS AND AWARDS

• **Eli Ruckenstein**, SUNY Distinguished Professor, was honored at the 2005 American Institute of Chemical Engineers during a special symposium celebrating his 80th birthday. He was praised for his dedication to chemical engineering and his continued publishing.



• **Colin G. Drury**, UB Distinguished Professor and head of UB's RISST, received the Federal Aviation Agency's 2005 Excellence in Aviation Research Award for his pioneering innovations to reduce human error in aircraft maintenance and inspection. Also, the Human Factors and Ergonomics Society presented him with the 2005 A. R. Lauer Safety Award for his work in safety fields as diverse as consumer products and chemical weapons disposal.



• **David Forliti**, assistant professor, won the Department of Defense Office of Naval Research (ONR) Young Investigator Program Award. He received the award in the long tradition of 25 other current UB faculty members who received either the NSF Career award or the ONR equivalent. The award includes a three-year research grant of \$355,000 that Forliti will use to conduct research aimed at boosting combustion efficiency for the U.S. Navy's Ramjet engine.



• **Robert E. Barnes**, associate dean for external affairs and adjunct associate professor, has won the 2006 Tau Beta Pi National Outstanding Adviser Award. He was nominated for the award by current and past students for his dedicated advisement to TBP New York Nu chapter and several student groups.



• **Michael Constantinou**, professor, and **Andrei Reinhorn**, Clifford C. Furnas Professor, received the 2005 Civil Engineering Research Foundation Charles Pankow Award for the application of an innovative damping system in the Torre Mayor building, Mexico City's tallest structure, which will help the tower resume operation immediately after an earthquake.



PROMINENT ALUMNI

THE ACCOMPLISHMENTS of UB Engineering alumni are prevalent throughout the world. Some recent honorees and advancements include:

• **Robert Goldsmith**, BS ME '51, was honored with the Clifford C. Furnas Memorial Award. He worked his way up from entry-level engineering to become president, chairman, and CEO of Rohr Industries, a Fortune 500 company.

• **Yanhong (Robin) Li**, MS CS '94, was awarded the George W. Thorn Award given to UB graduates under 40 in recognition of outstanding career or academic contributions. He is co-founder and CEO of Baidu.com, the Chinese search engine equivalent of Google and Yahoo.

• **Timothy Klein**, BS EE '84, was awarded the 2006 Engineer of the Year award by the UB Engineering

Alumni Association. He is president, CEO, and founder of ATTO Technology, Inc.

• **Christopher Scolese**, BS EE '78, was named as NASA chief engineer. He is responsible directly to the administrator for the overall review and technical readiness of all NASA programs.

STUDENT CLUBS MEET THE CHALLENGE

ROBOTS AND SOFTWARE developed by UB robotics students won national championships in the Small Size League of the RoboCup American Open in 2004 and 2005. At the RoboCup World Cup in Japan in 2005, the team won the Open Challenge Award for the most technically impressive freestyle presentation.

UB chemical engineering students finished fourth in last year's Chem-E-Car competition which kicked off the annual meeting of the American Institute of Chemical Engineers. The competition requires students to power shoebox-sized cars via a chemical reaction and carry a specified payload for a given distance.

Members of UB's Society of Automotive Engineers student chapter took top honors in the Clean Snowmobile Challenge at Michigan Tech University in 2005. Each competing team re-engineers a stock snowmobile to reduce emissions and noise, while maintaining or improving performance.

ENGINEERING A WORLD OF LEARNING

UB ENGINEERING'S far-ranging educational outreach begins at an early age with the annual "Math Is Everywhere" program, drawing hundreds of elementary and middle-school students from the community to engage in presentations and competitions at UB to encourage the development of critical math proficiency skills.

High school students learned state-of-the-art engineering techniques as they designed robotic toys in this summer's

Fisher-Price Cyber-Engineering High School Workshop. The NSF-sponsored WebTech program, partnering UB and Stony Brook engineering schools, offers Web-based instructional modules for high school students. High schoolers as well as community-college students learn nano science and technology in a \$900,000 NSF Advanced Technological Education program especially geared to those from low-income families and underrepresented backgrounds.

College courses are now available for the BEE Initiative, the world's first completely online bachelor's program in electrical engineering. UB Engineering and two other SUNY engineering schools collaborate on this initiative.

The Student Excellence Initiative helps UB Engineering students achieve their academic potential and build supportive relationships with peers and faculty. The excellence program is yielding

impressive gains in both retention and graduation.

Internationally, UB Engineering is the fourth most active U.S. engineering school in student exchanges. The Global Engineering Education Exchange, chaired by **D. Joseph Mook**, professor and chair, MAE, and assistant dean of international programs, includes leading institutions in 19 nations, among them some 35 U.S. member institutions.

ANOTHER RECORD REVENUE YEAR

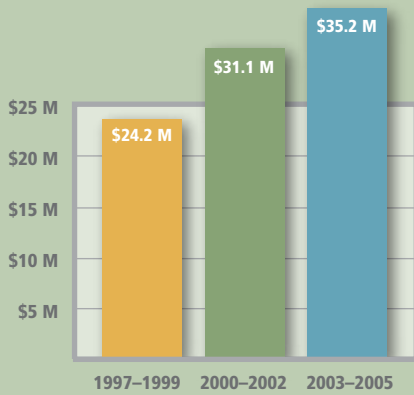
IT WAS A STRONG YEAR for the Center for Industrial Effectiveness (TCIE) in UB Engineering as record revenues were set for the second consecutive year with \$1,524,000. Business development activities led to 137 proposals, with pending proposals at the close of the fiscal year representing over \$814,000 in potential project value. The organization contracted 100 projects with businesses in Western New York, representing 55 different companies, 38 of them being first-time clients.

TCIE continues to focus on leveraging the resources and expertise of UB Engineering faculty, research and design centers, and graduate students. Faculty and students consult in a range of business and industrial environments. Twelve departments, labs, or centers were represented. Also, 56 graduate student positions were offered, providing opportunity to work directly on projects with area companies.

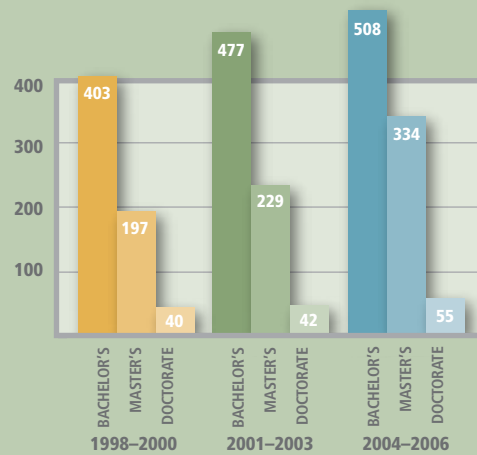
RESULTS ON THE RISE

BASED ON 115 FACULTY

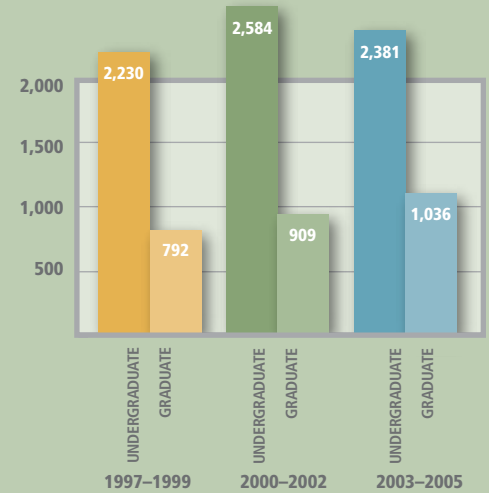
Annual Research Expenditures
(3 YEAR AVERAGES)



Annual Degrees Awarded
(3 YEAR AVERAGES)



Annual Enrollment
(3 YEAR AVERAGES)



NEW ENGINEERING BUILDING

TO MEET THE NEEDS of 21st-century research and teaching, a new \$75 million building is planned to house computer science and engineering, electrical engineering, and the CEDAR and CUBS research centers. New York State appropriated \$50 million for the building project with a philanthropic campaign in progress to supplement the state allocation.

ABOUT UB

THE UNIVERSITY AT BUFFALO is among the nation's premier public research institutions, with particular strengths in leading-edge life sciences research and high-performance computing.

Founded in 1846 as a private medical college and merged with the State University of New York system in 1962, UB today is New York State's premier public center for graduate and professional education, as well as the state's largest and most comprehensive public university. A member of the prestigious Association of American Universities, the University at Buffalo stands in the first rank among the nation's research-intensive public universities.



UB University at Buffalo *The State University of New York*

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