

MARCH 17, 2015

THE NEXT LEVEL

A leadership white paper explores the University's plans for the rest of the decade.

By Joel Seligman

Throughout our years together, we have sought to be a University whose quality places it among the leading research universities in this country, consistent with our core values of academic excellence, academic freedom, diversity, and commitment to our community.

In the past 10 years, we have become a stronger University with the successful initiation and financing of major new projects in the Medical Center and each school.

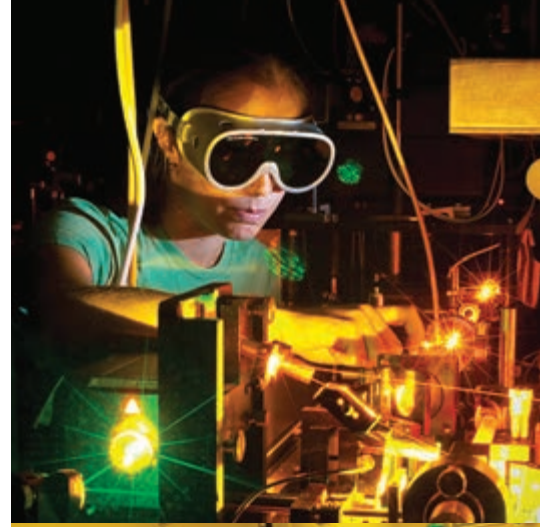
This year we are celebrating how far we have come.

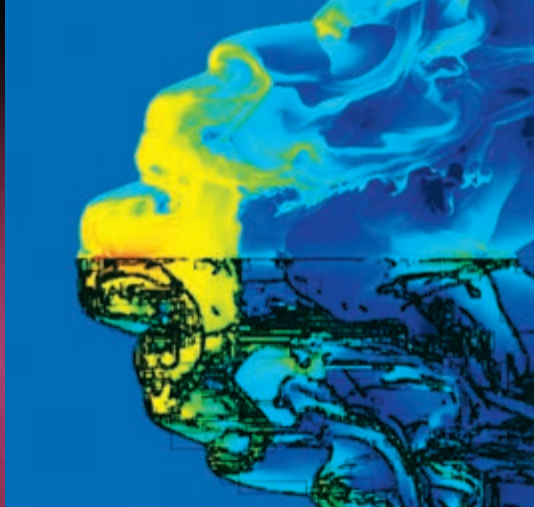
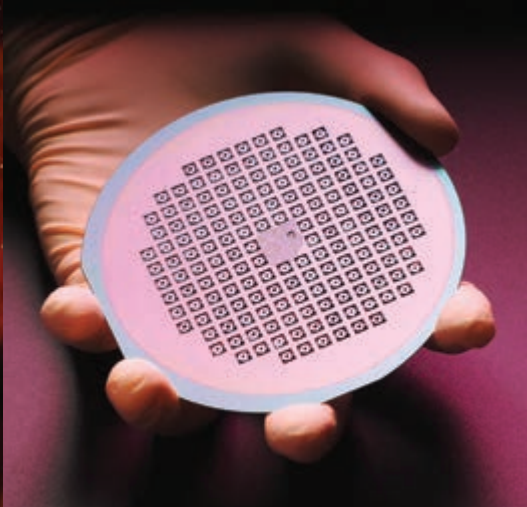
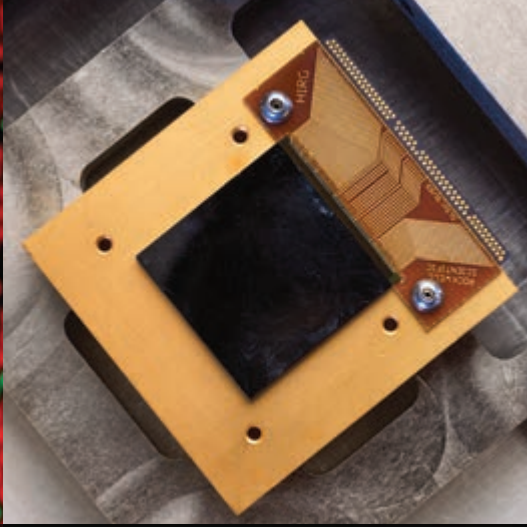
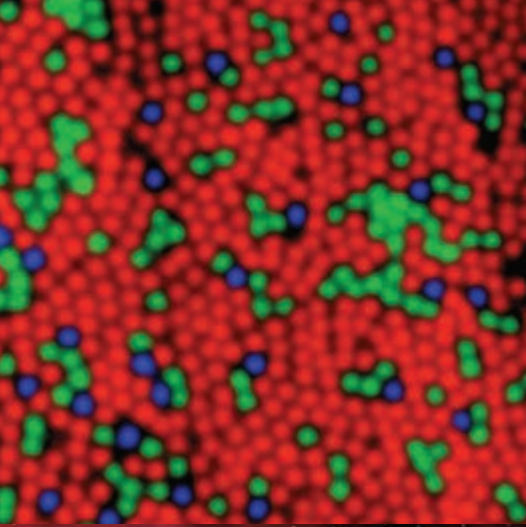
We are ready for the Next Level.

During 2016–2020, before we are likely to initiate our next capital campaign, the senior leadership and I will work to articulate the key University initiatives that we believe will be most effective in accelerating our progress.

We view these key University initiatives as having three characteristics: (1) an ennobling social purpose; (2) where the University can make a material difference; (3) necessarily at sufficient scale.

Rigorously applying these criteria, we particularly commend four new or enhanced major initiatives:





Data Science

Once we raise the additional \$50 million sought in our October 2013 strategic plan, we still will have a long way to go to fully be one of the nation's leading data science programs. A major effort here is essential. Information technology is redefining the way we think, analyze information, and make decisions. Data science is ubiquitous. We would like to focus on specific areas in which we are most likely to achieve best in class or near best in class programs:


Predictive Health Analytics

Some of the biggest advances in health care will come from using data to predict individual health outcomes on the basis of treatments, genomics, as well as lifestyle and behavioral factors. We will build on programs at the Medical Center to utilize data science and biomedical informatics to improve health and health care delivery. The Clinical and Translational Science Institute's Bioinformatics Group, for example, provides systems and support to enhance research and data acquisition from the Medical Center's health records system. Professor Henry Kautz, the Robin and Tim Wentworth Director of the Institute for Data Science, is a nationally recognized leader in data mining social media to identify global disease outbreaks in their earliest stages.

Cognitive Systems and Artificial Intelligence

The University has long been home to internationally recognized research in cognitive science and artificial intelligence. Modeling and replicating human perception is an illustration of one of the most ambitious domains in data science. To illustrate, Rajeev Raizada, assistant professor of brain and cognitive sciences, uses magnetic resonance imaging analysis to understand the way the brain encodes and processes information. This type of work in the next decades will provide the foundation for neuroscientists to use brain scans to diagnose the underlying causes of learning disabilities such as dyslexia and to detect impairments before children struggle or fail in school.

Analytics on Demand

The ultimate goal for large-scale data analysis is to relieve the end user from the need to understand details of a platform in order to have the computer system determine the optimal use of resources. Sandhya Dwarkadas, chair of the Department of Computer Science, for example, works at the interface of hardware and software. A focus of her research is scalable support for parallelism—that is, communication and coordination mechanisms that allow computational tasks to be executed simultaneously, easily and in a portable manner. Her research helps build the basic infrastructure needed to help end users, such as medical practitioners, extract scientific knowledge from data. Along with Professor Michael Scott, Dwarkadas helped pioneer a revolutionary new approach to parallel computing called “transactional memory.” In 2011, IBM's BlueGeneQ became the world first computer to implement hardware transactional memory. 



DEALING WITH DATA

Physics doctoral student Jim Baker examines data sets from his research at the VISTA Collaboratory, a 1,000-square-foot visualization display that renders massive data sets in real time. The resource gives faculty and researchers the ability to visualize and analyze complex data instantaneously and collaboratively with colleagues and students. Baker is working with Benjamin Miller, associate director of the Health Sciences Center for Computational Innovation and professor of dermatology, biochemistry and biophysics, and biomedical engineering, to develop optical biosensors small enough and sensitive enough to detect individual viruses or virus particles that are only one ten-millionth of a meter in size.



PLANNING PROCESS

The ideas outlined in the Next Level document are grounded in a strategic planning process that began in 2008. Each planning process covered five-year periods:

THE 2008-13 STRATEGIC PLAN

We Have Only But Begun

In 2008 the University, the Medical Center, and each of our schools adopted ambitious strategic plans. We now have achieved virtually all of our 2008 goals:

- When normalized for faculty size in 2013, the most recent year for which we have data, we rank 16th in federal research and development expenditures among the 176 top-funded research universities and were awarded \$350 million in total sponsored research in 2014.
- Our student body has grown from 8,329 total students in 2004 to 11,060 this past fall. Since 2005 we have received \$195 million in commitments for scholarships, fellowships, and other support for students.
- Undergraduate student quality and diversity have been strengthened. At the College we have seen increases of high school GPAs from 3.56 to 3.83 and the two-score equivalent SAT increase from 1304 to 1375 between 2005 and 2014. Simultaneously the percentage of our underrepresented minority and international students has increased.
- Since 2005, applications to the medical school have increased by 39 percent. The medical school acceptance rate is now 5.5 percent, making the school one of the most selective medical schools in the country.
- Tenured, tenure-track, medical, and other instructional staff have grown from 2,009 in 2004 to 2,542 in 2014. Since 2005 the University has created or received commitments to create 93 new endowed professorships, deanships, or directorships.
- New programs have been developed, including the Health Sciences Center for Computational Innovation, the Clinical Research Institute, the Center for Integrated Research Computing, the Del Monte Neuromedicine Institute, and 17 new majors in Arts, Sciences & Engineering.
- Twenty-nine new major facilities projects have been completed, initiated, or planned since 2005 with an aggregate budget of \$850 million. Outside the Medical Center this includes Goergen Hall, Eastman Theatre Renovation and Expansion, LeChase Hall, Rettner Hall, and O'Brien Hall.
- The Medical Center has been particularly active with several new projects, including the James P. Wilmot Cancer Center (opened in 2008, expanded in 2012), the Saunders Research Building, and the Golisano Children's Hospital, substantial implementation of the Electronic Medical Records system, and new regional hospital affiliations, most notably F. F. Thompson.
- The University facilitated the separately financed development of Brooks Crossing and College Town and worked with local, state, and federal governments to secure funding for the new Interstate 390 road network, which provides the basis for future growth at the University.
- We have grown as of December 31, 2014, to be the Greater Rochester region's largest employer with 26,673 total headcount, an increase of 905 during the past year. This makes the University the 8th largest private employer in New York State and the largest private employer in upstate New York, with (CONTINUED ON PAGE 33)



MAKING SENSE OF NEUROLOGICAL DISORDERS

In a promising approach that tries to take advantage of a genetic flaw at the root of one form of muscular dystrophy, Charles Thornton, the Saunders Family Distinguished Professor in Neuromuscular Research—shown here with Kirti Bhatt, a technical associate in Thornton's lab—is exploring ways to modify RNA that interferes with the ability of muscle cells to communicate properly. By targeting the problematic RNA, Medical Center researchers hope they can induce the cells to function properly, reversing the effects of myotonic muscular dystrophy.

Neuroscience and Neuromedicine

The brain has a unique ability to “rewire” and heal itself in response to injury, disease, and normal aging—a phenomenon known as neuroplasticity. New technologies such as robotics, neural prosthetics, and stem cell biology, together with advances in functional brain imaging and the cognitive sciences, portend major advances early in the 21st century in neuroscience and neuromedicine. Our University has outstanding neuromedicine clinical programs, a world-class brain and cognitive sciences infrastructure, as well as basic and translational neuroscience research programs which address learning and memory, brain development, and fundamental wet-bench research into neural structure

and function. These strengths will be further enhanced with the priority that the Medical Center has attached to the recruitment of an outstanding inaugural science director for the Del Monte Neuromedicine Institute and the recently announced Rochester Neurorestorative Institute.

We particularly will focus on three applications of neuroplasticity:

Stroke and Neurorestoration

Stroke is the leading cause of major disability in our country and the fourth leading cause of death.




The Medical Center's Comprehensive Stroke Center offers world-class treatment and prevention of stroke, is the region's only Comprehensive Stroke Center and has the area's only dedicated Neuromedicine Intensive Care Unit. The vision of the Medical Center is that all those who suffer strokes will leave the hospital walking, talking, and comprehending. To achieve that, University and Medical Center faculty will collaborate across campus on (1) stroke rescue and secondary stroke prevention, (2) regulating neural regrowth and repair, and (3) ways to preserve and recover higher cognitive and language functions. Research programs in the Rochester Neurorestorative Institute will focus on neural pathways, neural prosthetics, and neuromodulatory devices (human-machine interfaces) and robotics, harnessing the resources of Hajim School of Engineering & Applied Sciences and the School of Medicine and Dentistry.

Institute for Developmental Disabilities

Individuals with developmental disabilities require comprehensive lifelong support that ranges from health, to education and employment, to recreation. The Institute for Developmental Disabilities will provide for the full range of needs of adults and children, including those with autism spectrum disorders—which now affects around 1 in 68 American children. Existing programs at the Medical Center will conduct research into brain development and communication (including the acquisition of language and the processing of sound) as well as studies of neural

connectivity and neuroplasticity, and the underlying genetic and cellular root causes of developmental disabilities. The long-range goal is to be at the forefront of efforts to develop new therapies that can better treat or prevent developmental disorders.

Neurodegenerative and Neuromuscular Diseases

Our University is one of the world's leading research centers in neurodegenerative diseases such as Parkinson's and Huntington's diseases and neuromuscular disorders. For Parkinson's patients, our Deep Brain Stimulation program gives hope and shows promise for treating depression and obsessive compulsive disorder. With respect to Parkinson's and Huntington's diseases, computational models and wearable electronic devices are enabling doctors to develop more personalized therapies for those with movement disorders. Advanced telemedicine is dramatically increasing access to care. At the same time, fundamental research into neural-immune interactions is revealing how the brain becomes damaged as a consequence of chronic neuroinflammation and how neuroplasticity is regulated through the interplay between neurons and immune cells in the brain. Collectively, these combined strengths position our University to take a leadership role in this critically important area. 

an increasing role in the community as the provider of an estimated 50,300 direct and indirect jobs, more than \$2.8 billion in direct and spillover wages, \$70 million in uncompensated health care in 2011 and since 1996, 58 new start-up companies using University-licensed technology.

- We have reduced our endowment payout rate from 6.9 percent in 2000 to 5.8 percent in this year's budget.
- We publicly launched *The Meliora Challenge* Campaign in October 2011, our first comprehensive capital campaign since 1924. Through December 31, 2014, we have raised \$1.172 billion in cash and commitments, or 98 percent of the June 30, 2016, goal of \$1.2 billion.

THE 2013-18 STRATEGIC PLAN

Aiming Higher

In 2013 the University, the Medical Center, and each school adopted new strategic plans that emphasize the greatest possible quality in our academic, clinical, and creative arts programs, consistent with cost efficiency. In the University plan:

Our fundamental objective is to strengthen our position as one of this nation's leading research universities.

- This means strength not only in research, but also as a University that is strong in the liberal arts, science and engineering undergraduate education, professional training in the schools of business, education, medicine, and nursing, outstanding clinical care throughout our health system, and commitment to the creative arts exemplified by the Eastman School of Music.
- For the entire University, the recruitment, support, and retention of the most accomplished and diverse faculty, staff, and administrative leadership is a top priority.
- A top University priority is the creation of the Institute for Data Science, the expansion of data science faculty and programs across the University, and the construction of a new data science facility.
- We will implement a University Research Strategic Plan to strengthen the vitality of the research mission.
- We will emphasize improvements to infrastructure and renovating classrooms, laboratories, and library space to provide our faculty, students, and staff with state-of-the-art facilities.

A University That Emphasizes Quality Education

- The College of Arts, Sciences & Engineering is building on its momentum in residential education to enhance its curriculum by adding new majors, including a new undergraduate business degree developed with the Simon Business School; teaching, learning, and research opportunities that employ digital technology; increasing student retention; affording opportunities for student research; and strengthening career preparation. By 2018, Arts, Sciences & Engineering will increase its faculty from 350 to 380; increase its two-score equivalent SATs for entering students from 1368 to at least 1400; increase applications from approximately 16,000 to 20,000; and increase six-year student graduation rates from 85.6 percent to 88 percent.
- The School of Medicine and Dentistry and the School of Nursing are implementing the Institute for Innovative Education to provide education across the entire Medical Center and better employ information technology in medical education. The institute will oversee the development of an ambitious program in simulation education.
- The Simon School is developing new programs in business analytics and pricing and leading efforts to develop a branch campus in New York City.

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FOCUSING ON PERFORMING ARTS

Rainya Heath '14 (left) and Kasandra Reyes '17 perform a movement exercise during a class taught by dance instructor Darren Stevenson (far right) during a class in the Linda E. Sloan Studio in Todd Union, a rehearsal and student gathering space that opened last year. The renovated space is named in recognition of support from Linda Fisher Sloan '67 and her husband, University Trustee Tom Sloan '65, '67 (MS), and is part of an ongoing initiative to establish facilities for the performing arts on the River Campus.

Humanities and the Performing Arts

Through our classroom experience, scholarship, and creative works, the humanities and the performing arts are essential to the success of virtually every major research university. Our University long has had world-class programs in performing arts through the Eastman School and increasingly has established prowess in Arts, Sciences & Engineering through our music, theater, and dance programs. Our humanities departments long were among the most notable at the University, but particularly in the post-2008 recessionary world, we have seen a decline in student enrollments in the humanities as students have focused more on the career relevance of their studies. We will have stronger students in the professions

of medicine, nursing, engineering, business, or law or among those who seek an advanced degree in science or in the humanities if we reaffirm our commitment to the liberal arts ideal of our undergraduate education through major new commitments to the humanities, including the humanities-oriented social sciences and the performing arts at Eastman, the Memorial Art Gallery, and in Arts, Sciences & Engineering. Specifically we recommend:


Creation of an Institute for the Performing Arts on the River Campus that includes music, dance, and theater. This institute will provide a vehicle to enhance our support for the performing



arts by making them more visible and prominent both within the University and outside the University. Within Arts, Sciences & Engineering, the institute will strengthen the quality of student life and strengthen cocurricular activities. The institute also will strengthen collaborative bonds among Arts, Sciences & Engineering and the Eastman School and Memorial Art Gallery. Initially the institute will develop a strategic and operational plan. An important step will be to invest in infrastructure for the performing arts. Arts, Sciences & Engineering has developed a plan for a new theater on the River Campus, inspired by the philanthropy of Tom and Linda Sloan. Arts, Sciences & Engineering also is moving to create a new major in dance and is reviewing other curricular initiatives.

Creation of a Humanities Center in Arts, Sciences & Engineering, located in Rush Rhees Library, for students and faculty from all schools in the University. In the humanities and humanities-oriented social sciences, there is a rich history of successful multidisciplinary engagement. We have recognized this in the support we provide through our Humanities Project. Our challenge is to build on the success of our departments and create a Humanities Center that becomes a functional and physical hub of these aspects of multidisciplinary

life in the University. This type of approach has been developed at several peer universities. A review of the 26 AAU private research universities, for example, found that 13 had established a Humanities Center to champion the humanities and often also the performing arts through public outreach, curricula, faculty and student support, conferences, workshops, or symposia, often organized around year-long themes, provided support for fellows (both internal and external) and to augment departmental contributions to the undergraduate humanities curriculum. A first step in developing the Humanities Center will be the appointment of a director for the Humanities Center who will work with faculty, students, and key board members on development of a strategic plan that will provide the basis for an enhanced commitment to the humanities and address prioritization of new or augmented programs.

Strengthening programs that involve Arts, Sciences & Engineering and the Eastman School as well as the Memorial Art Gallery. It is anticipated that the Eastman School will complete a new strategic plan and develop a request for proposals for development of Block F, the 1.6-acre undeveloped property near Eastman Theatre on Main Street. The Memorial Art Gallery also is anticipated to revise its strategic plan. 

- The Eastman School is developing new undergraduate and master's programs in fields such as convergent media, music leadership, and online education.
- Our schools generally, led by the School of Nursing and the Warner School, are expanding or implementing hybrid or other online education, especially in master's programs.

A University Known for Improving Health Care

We will improve health care for our community through transformative approaches to clinical care that are nationally recognized:

- The new Accountable Health Partners will become the region's leading accountable care network, recruiting a substantial number of additional primary and specialist physicians into its network by 2018.
- The University of Rochester Medical Faculty Group will become a model of an integrated University-based practice that includes centralized administration and a compensation plan based on performance, service, and quality.
- The Medical Center will further its current recognition of specialty areas in the top 50 in the *U.S. News Best Hospitals* rankings, especially within its Centers of Excellence, including the Wilmot Cancer Institute and the Golisano Children's Hospital.
- We will open the new Golisano Children's Hospital in 2015 and achieve recognition for our Pediatric Programs of Excellence.
- The School of Nursing is expanding its UR Medicine Center for Employee Wellness, which began with University employees in 2013 to additional employers throughout the region.
- The Eastman Institute for Oral Health is expanding its community services to underserved patients with special needs and strengthening its position as a leading institution in oral health research and specialty dental training.

A University Known for Service to the Community

We will strengthen our service to the community and society by:

- Enhancing programs to support Rochester K-12 education, health care, and community programs.
- Enhancing our position as the regional and national leader in economic development and technology commercialization.
- Strengthening technology commercialization and new venture creation consistent with our academic mission through active engagement of the business community and expansion of the technology development fund.
- Completing major projects, including the expansion of Brooks Crossing and College Town.

In the 18 months since the adoption of the October 2013 strategic plans, we have made significant progress implementing these and related plans. Notably:

- The University adopted its first University Research Strategic Plan in October 2013. Among other key initiatives, the Institute for Data Science has been created. To date we have raised approximately \$25 million in philanthropic commitments and \$1.5 million in new state support toward the additional \$50 million goal that we announced in October 2013 on top of the earlier \$50 million raised in this area. These funds have allowed us to initiate planning for a new facility to house the institute and to endow the institute's directorship. We will dedicate the Institute for Data Science Building and celebrate the naming of the Institute for Data Science in October 2016.

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CONNECTING WITH COMMUNITY

Warner School doctoral student Kristana Textor (center) works with East High School seniors Shanquise Albert (right) and Bejonta Patterson (left) as they work on a project in Science Stars!, a science education program led by April Luehmann, associate professor at the Warner School of Education. The program is one of several that Warner faculty and students undertake throughout the region to help improve education and teaching. Starting in July, the University begins its largest such initiative, when it becomes the administrative leader for East High, working with administrators, teachers, students, staff, and school district officials to improve educational outcomes for students in Greater Rochester's largest school.

The Revitalization of Our Community

Progress for our University is bounded by the progress of the Greater Rochester community. The stronger our community is, the stronger the University will be. While Rochester's suburbs today generally are doing well, the City of Rochester is struggling with the highest rate of extreme poverty of any comparably sized city in the United States. The Rochester City School District perennially has graduation rates below 50 percent. We will focus on three core areas which can contribute to strengthening the Greater Rochester community:

Community Engagement

Virtually every school at the University has developed or is developing ways to strengthen community engagement. The College, for example, has more than 15 volunteer programs that involve placements for undergraduates in the community and in recent

years has been notable for pioneering ways to integrate teaching and scholarship with the community. Among other examples, Arts, Sciences & Engineering students study criminal justice in a course taught by Rochester faculty and leaders in the criminal justice system and put their knowledge of biomedical engineering into practice by building adaptive technologies in partnership with faculty and local organizations. The College is currently establishing a Center for Community Engaged Education. The Medical Center continues to play a central role in community health improvement. Recently the Medical Center established the Rochester Center for Health Informatics, whose mission is to use data science to measure, study, and improve population health in our community and to serve as a model for other communities. The Medical Center also has developed STEP, an introductory component of the school's pipeline programs that involves medical



students, residents, and fellows in providing support for underrepresented and economically disadvantaged 7th through 12th graders, and the Center for Community Health, which has become a community leader in expanding and developing community-health partnerships. The frieze of the Eastman Theatre reads, “for the enrichment of community life,” and Eastman’s Community Music School and Eastman Pathways for K-12 students are widely admired. The Memorial Art Gallery hosts more than 9,000 K-12 students a year in its education programs.

K-12 Education

A paradox for Rochester and indeed many cities is that inadequate high school graduation rates often coexist with a growing need for new entrants to the workforce at levels beginning with high school graduation. The Finger Lakes Regional Economic Development Council has made workforce development a priority. Drawing on the University’s experience developing the detailed Educational Partnership Organization plan for East High School, which incorporates best practices from the most successful public, private, and charter schools, Warner can become a national leader in the development, assessment, and implementation of best practices for public—including charter—and private K-12 schools in our most challenged cities, potentially through the establishment of a Center for the Revitalization of Urban K-12 Schools or through specific new programs.

Entrepreneurship and Economic Development

Job creation and economic development are state and local priorities. The University long has been among the nation’s leaders in patent royalties, regularly placing among the top 15 in the country. We have built on our success as an initial recipient of support from the Kauffman Foundation for campuswide entrepreneurial activity. In recent years we have created the position of vice provost for entrepreneurship, the Technology Development Fund, the Technical Entrepreneurship and Management (TEAM) Program, the Center for Medical Technology Innovation, UR Ventures, Excell Partners, our Entrepreneurs Network, the Center for Business Engagement, and most recently, formally established the Mark Ain Center for Entrepreneurship. Entrepreneurship and economic development are integral to our success as a University. Late in 2014, with support from the state, our affiliate, High Tech Rochester (HTR), opened offices that will serve as the cornerstone of the city’s new innovation zone. HTR will be housed in 68,000 square feet of the historic Sibley Building in downtown Rochester with new offices that will consist of coworking space, traditional office space, dry and wet labs, conference rooms, and a 100-seat auditorium. The Mark Ain Center for Entrepreneurship will provide more opportunities for students by connecting them to the community through internships, partnerships with community organizations such as the Hillside Work-Scholarship Connection, and helping provide a framework for community organizations to develop entrepreneurial ideas for their own students or organizations. Our student incubator at HTR and the Rush Rhees Library’s proposed iZone further will foster student innovation. 


- The Medical Center has taken a series of decisive steps toward a comprehensive Population Health Management strategy, including completion of a new regional affiliation with Strong West, substantial reorganization of the Medical Faculty Group, growth in membership of Accountable Health Partners to 1,700 Medical Center and other doctors, and refining its goals to include being the referral center of choice for the specialty care of the majority of patients in our region.
- We dedicated College Town in October 2014 and will dedicate the Golisano Children’s Hospital in May 2015.
- In 2015, the State Education Department approved the Educational Partnership Organization agreement that the University, led by the Warner School, has entered with the Rochester City School Board to serve as superintendent of East High School, the largest high school in Rochester. We assume responsibility for East High in July 2015.
- The River Campus Libraries have proposed a new Strategic and Master Plan and begun implementation of designated aspects of these plans, including the iZone and a proposal for a Center for Student Driven Learning that is intended to create a hub of expertise for the University in aspects of student-directed learning from program design to classroom engagement.
- We have begun work on improving infrastructure and renovating facilities, notably with key improvements to our dining facilities, Ronald Rettner’s gifts that have spurred renovation of Morey and Bausch & Lomb Halls, and upgrades to key aspects of our information technology.
- The School of Medicine and Dentistry and the School of Nursing, through the aegis of the Institute for Innovative Education, have begun planning creation of state-of-the-art simulation centers, potentially housed in a new facility.
- For our undergraduate and graduate students, we are enhancing efforts to strengthen career preparation and have continued to stress enhancements to quality of life at the University, including the Brian Prince Athletic Complex and plans for the renovation of Douglass Hall, which will include a new student activities space, language center, and the Paul J. Burgett Intercultural Center.

Our 2013–2018 University, Medical Center, and school strategic plans remain in full force. Full implementation will continue through June 2018. Our top priorities of the University for these years will include:

- Significant further steps at the Medical Center to implement its Population Health Management strategy, including further potential regional affiliations.
- Significant progress in improving the quality of life on the River Campus.
- Continued emphasis on fundraising to support student scholarships, faculty, and key programs.
- Development of new Advancement strategic and operational plans to provide a revised roadmap for our programs during the next five years.
- Continuing the transformation of University libraries to be leaders in our increasingly digital campus and initial implementation of the River Campus Libraries Strategic Plan.
- An unwavering commitment throughout the University to seek the greatest possible quality in our academic, clinical, and creative arts programs, consistent with cost efficiency.



Conclusion

We have progressed in the past 10 years because of the increasingly unified commitment of our board, volunteer leaders, alumni, friends, faculty, students, and staff. The success of *The Meliora Challenge* Campaign is a testament to the loyalty, generosity, and hard work of all in the Rochester family. As we enter the final 15 months of our Campaign, let us never forget that the human beings who support the University of Rochester are our most valuable resource. Let us always live in the spirit of Meliora and seek to be ever better. 





UNIVERSITY of
ROCHESTER

WE HAVE MORE THAN
100,000 ALUMNI
AROUND THE WORLD

RAX is your tool to find them.

Interact with alumni, update your contact information, register for alumni events in your city, and customize how the University contacts you.

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ROCHESTER ALUMNI
EXCHANGE

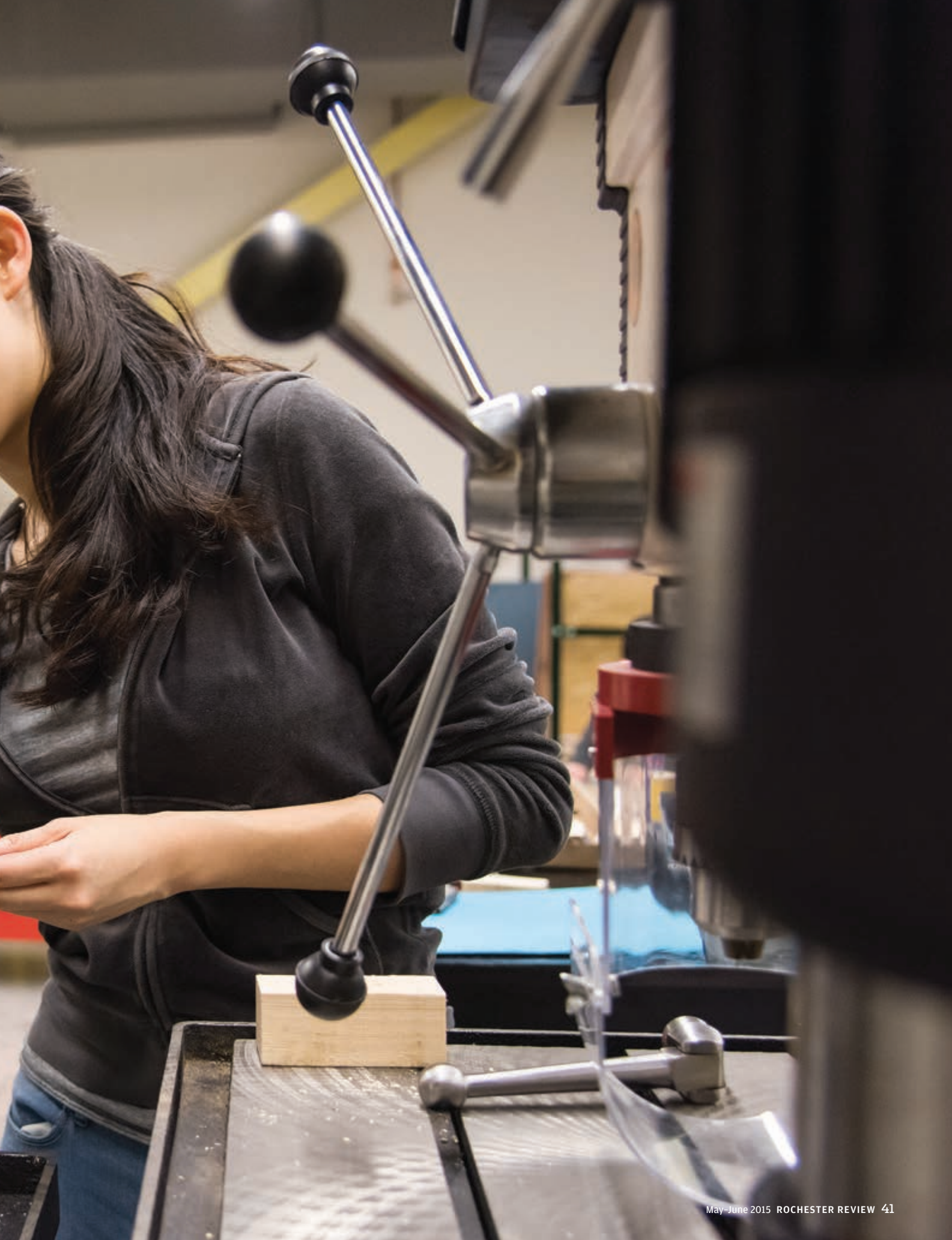
A young woman with dark hair, wearing safety glasses and a dark long-sleeved shirt, is focused on operating a drill press in a workshop. She is holding the handle of the drill bit, which is positioned over a workpiece held in a blue vise. The background shows various pieces of industrial equipment and a well-lit workshop environment.

FULL SPECTRUM *and* FULL THROTTLE

Enrollment is soaring at the Hajim School, as undergraduates embrace the chance to become multidimensional, “full spectrum” engineers.

By Karen McCally '02 (PhD)

TOOLS TO BUILD ON: Wen Zhou '18, an optics major from Beijing, China, operates a drill press in Basic Mechanical Fabrication, a course held in the Ronald Rettner Hall for Media Arts and Innovation, which opened in fall 2013.



Two years ago, when the Hajim School of Engineering & Applied Sciences introduced a new major in audio and music engineering, Mark Bocko, chair of the department of electrical and computer engineering, thought the department would probably have to accommodate about 16 students at a time in its sound design lab.

It turned out that he was well off the mark.

Twenty-five students declared the new major in its first year. “Just that number of students was more than we were anticipating,” Bocko says. “And we have more people from outside the major taking these courses than we have majors.”

He went from offering one section to offering four. And, he adds, “we still have a waiting list.”

Bocko’s experience is echoed across the Hajim School’s six departments. Faculty and staff have all been taking on an expanded work load. But as Bocko, Distinguished Professor in Electrical and Computer Engineering, says, when students are clamoring for what you’re offering, “it’s a good problem to have.”

The number of college students studying engineering has risen markedly across the country. According to data collected by the American Society for Engineering Education, American colleges and universities graduated 74,170 students at the bachelor’s level

2008 probably played a significant role in generating student interest. “Since the crash of 2008, and the realization that college is really expensive, they’re looking much more for a return on their investment,” says Richard Waugh, the chair of the biomedical engineering department, of students and parents. “Engineering is sort of the poster child for that.”

Matthew Yates, chair of the chemical engineering department, notes that interest in his field has tended to ebb and flow with the state of the oil and gas industries. But “a bad economy and job market,” he thinks, is “part of the reason” interest in engineering, including chemical engineering, has risen precipitously.

Nationally, it’s likely that more than one factor has contributed to growing interest in engineering. At the Hajim School, that’s almost certainly the case. The same month that Lehman Brothers collapsed—the event often cited, rightly or wrongly, as the beginning of the Great Recession—Dean Robert Clark arrived in Rochester armed with a plan to enhance the engineering school’s visibility and enrollment. Clark was fresh from Duke’s Pratt School of Engineering. When he took stock of Rochester, he saw strength among faculty and in research facilities, but too few undergraduates. At the time, there were just over 700 undergraduates who had either officially declared engineering majors or declared the intention to do so.

“For us to be at around 700 undergraduates for the kind of reputation Rochester enjoyed—that was just too small,” Clark says. There were drawbacks to the small size. For example, national recruiters make visits to schools based not only on the quality of graduates, but also on how many of them they are. “We didn’t have quite enough critical mass” to draw as many recruiters as the school should, Clark believed, based on its quality.

In addition, engineering schools are expensive to run, and Rochester’s was experiencing an unsustainable drain on its endowment. More students would mean more tuition revenue. As it turned out, the school received a tremendous boost in October 2008, when Edmund Hajim ’58, the chair of Rochester’s Board of Trustees and a graduate in chemical engineering, announced a landmark commitment of \$30 million dollars to the school for scholarships and endowment support.

“You cannot overemphasize the importance of Ed’s gift,” Clark says. In addition to providing much-needed financial support, “it conveyed to the students that they were part of something special. And we’ve just kept emphasizing that.”

It’s one thing to set a goal. Executing the goal has required the efforts of everyone from deans to the undergraduate coordinators, lab assistants, graduate teaching assistants and undergraduate mentors, and workshop leaders who make it possible for the growing school to maintain an approach to education that is team oriented and hands on. “Our students, faculty, and staff welcomed prospective students, made time to meet with parents, adapted programs, and took on massively increased advising roles,” Clark says. They even lent a hand to freshmen and their parents on a sweltering move-in day—and gave out ice cream.

It’s all part of what Waugh calls an “esprit de corps” that has developed at the school. The school lays out a long and durable welcoming mat, starting at the application process, where messaging has been chiefly in the hands of Assistant Dean Lisa Norwood ’86, ’95W (MS).

In 2008, Norwood, a Hajim School alumna with a degree in geomechanics, began working with the Office of Admissions and Financial



in 22 distinct categories of engineering in 2008. Five years later, in 2013, that number rose to 93,360, an increase of just over 25 percent.

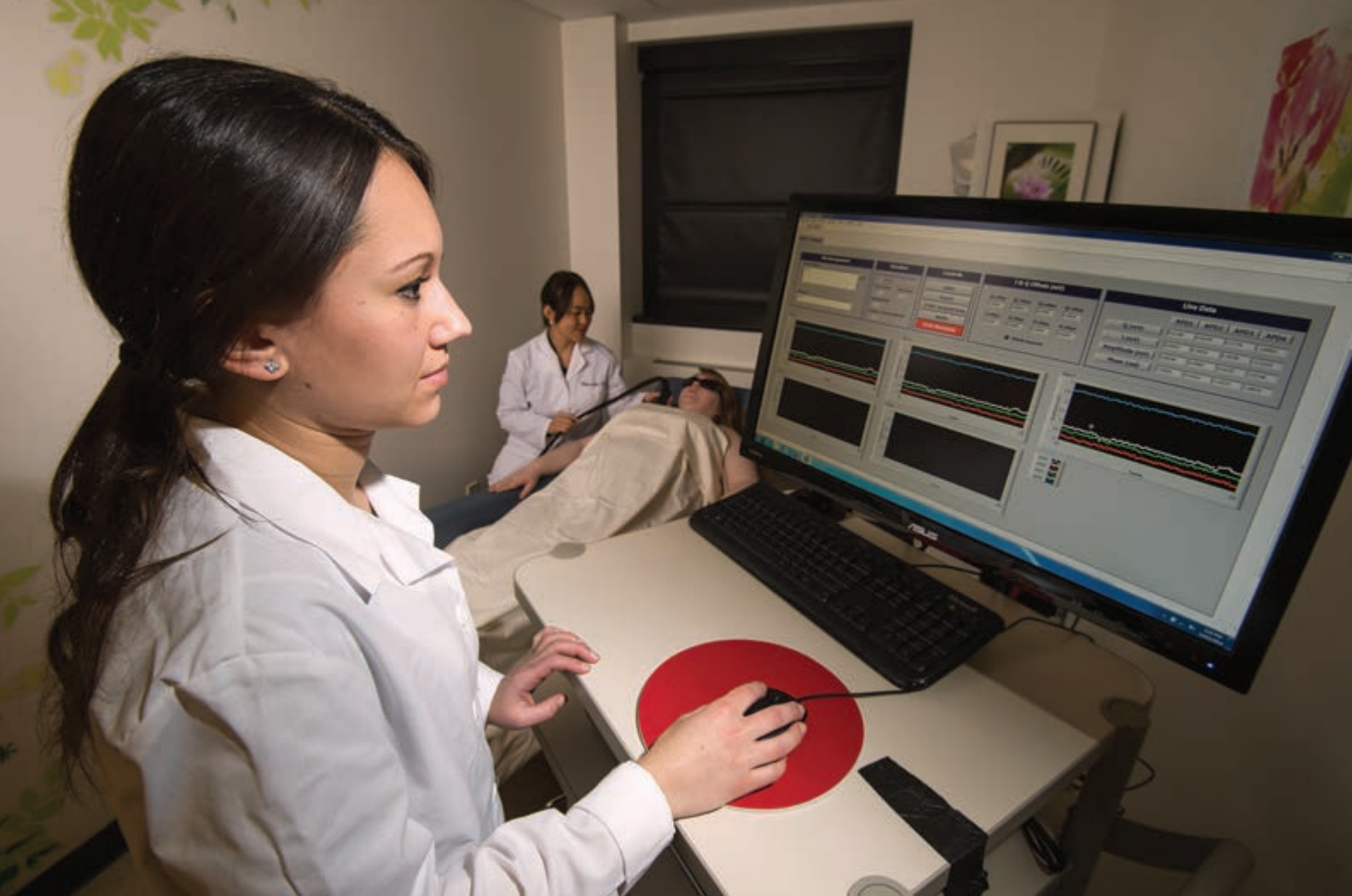
Conventional wisdom is that the financial crisis of 2008 marked a turning point in higher education. Economic uncertainty led to diminished interest in the humanities, for example, and rising interest in STEM—science, technology, engineering, and math—disciplines.

National figures certainly suggest a correlation. A highly publicized study by researchers at the University of California at Los Angeles and the University of Pennsylvania analyzed data on the intended majors of incoming freshmen at four-year institutions around the country. The most dramatic rise was in the number of freshmen studying an engineering discipline. That figure grew by 57 percent nationally from 2007 to 2011.

At the Hajim School, growth has been especially pronounced. During that same period, the number of freshmen rose by 42 percent, a remarkable rise to take place within any *single* institution. As of fall 2014, total undergraduate enrollment was double what it was in 2008.

That growth was spread across departments. Enrollment in all six departments grew substantially, and most departments saw their number of majors double from 2008 to 2014.

Hajim School leaders generally agree that the Great Recession of



LEADING EDGE: Clark (opposite page, left) and Norwood led a planned expansion of the Hajim School, starting in 2008; Stacie Zwolski '15 (above, foreground), a biomedical engineering major from Boston, works on a medical imaging project with Regine Choe (center), assistant professor, and technician Ashley Proctor, posing as a patient.

Aid to highlight engineering in ways the University hadn't before. For example, admissions began offering prospective students who indicated an interest in engineering a tour of the Hajim School facilities, in addition to the standard River Campus tour.

The school also produced a brochure titled "Take on the World: Be an Engineer." It showcased students taking part in a wide range of extracurricular activities, participating in study abroad, and pursuing multidisciplinary majors, such as archaeology, technology, and historical structures, that combine engineering and other fields.

Norwood believes the initiatives were major factors in attracting more students. "We thought our ideal freshman class size would be about 350 students. And the very first year, we got 350 freshmen," she says. "We unleashed the tide, and now that the word is out, it seems like there's no stemming it."

Given the expense of college and the uncertainty of the job market, it's not surprising that more students would look at engineering. But some Hajim School students question how much impact the financial crisis has actually had. They grew up with a knack for math and science, an urge to tinker and to build, and strong encouragement in a society that's embarked on both informal and formal campaigns to push STEM education.

They've also responded to the call for what Clark calls "full spectrum engineers"—engineers with multiple interests who pursue those interests with the same zeal they bring to their major.

Bill Green '16, a mechanical engineering major from Long Island, says financial security had little to do with his decision to pursue engineering, or the decisions of many of his friends.

"It comes up as something that I don't think I'll need to worry much about," Green says about job and financial security. "But I don't think that financial security is an end goal for many of the students here. In talking to friends, they don't have their minds on the end goal being the job; more on what their education allows them to do in a more general sense."

Green says his interest in engineering was a natural outgrowth of the hobby of building computers that he pursued in high school. When he visited campus, he was captivated by a serendipitous encounter with students on the Baja team. Each year, the team designs and builds an off-road vehicle. Then, the team takes their vehicle and races it in an intercollegiate competition. Green was taken past the Baja shop as part of his tour of the engineering facilities.

"There were students in there at four o'clock on a Saturday afternoon welding, putting parts together, and still willing to take time out to explain what they were doing," recalls Green, who went on to participate in Baja his first two years at Rochester.

Nancy Vargas '17, a first-generation college student from San Antonio, also says that the financial crisis played little role in her decision to study engineering.

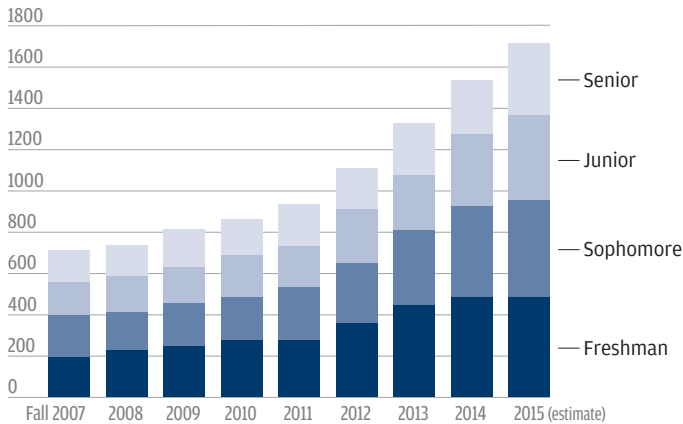
"I started taking classes at a college when I was 13," she says. Gifted in math and science, Vargas relished her advanced classes in math, science, and programming. But the electrical and computer engineering major also says she was exposed to many opportunities to pursue her talents. "There's more of a focus on math and science now," she says, recalling her secondary schooling. "And there are so many opportunities for female Hispanic engineers."

A Data Snapshot

The number of college students studying engineering has risen across the country in recent years. Nationally, the number of freshmen planning to study an engineering discipline has risen more than 50 percent since 2007. The Hajim School absorbed a 42 percent increase during the same period, a remarkable expansion for a single institution. Growing student interest, and markedly better retention, combined to double undergraduate enrollment at the Hajim School from 2008 to 2014.

ENROLLMENT

The number of incoming freshmen in the Hajim School has climbed steadily. The school surpassed its goal of 1,200 students in 2013. This fall, the number of incoming freshmen enrolling at the school is projected to remain the same as last year.

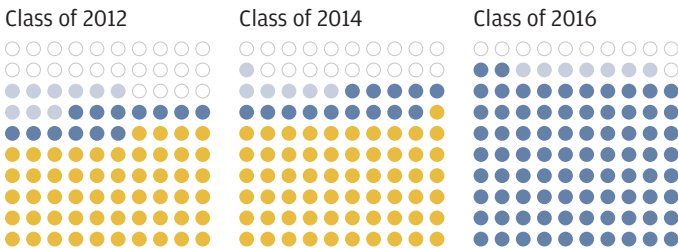


UNDERGRADUATE RETENTION

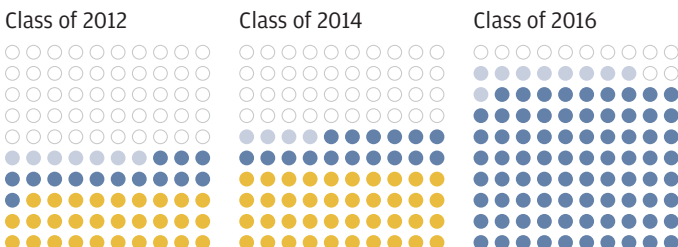
In the late 1990s, fewer than half the students who started out in an engineering discipline stuck with their programs and earned a bachelor's degree within four years. For underrepresented minorities, that figure was less than 10 percent. These figures began to rise dramatically in 2008. For the Class of 2010, the figures were roughly 60 percent and 40 percent respectively.

- For every 100 students enrolled, this number ...
- Remained at the end of the first year
- Remained at the end of the second year
- Graduated after four years

All Students



Underrepresented Minorities*



* Black, Hispanic, American Indian, Alaska Native, Native Hawaiian, or multi-race combination that includes at least one of these categories.

SOURCE: ARTS, SCIENCES & ENGINEERING

Green and Vargas have both taken advantage of another opportunity Rochester affords its engineers: the chance to explore other areas of interest to a greater degree than at many other institutions. The requirements to earn a bachelor of science degree in any engineering field are hefty, leaving engineering students less room to explore other fields than many of their counterparts in the School of Arts & Sciences. At Rochester, engineering students take clusters of courses in either the humanities or the social sciences. The cluster system gives students wide latitude. Green is pursuing a cluster in Roman history, and doing so through Rochester's study abroad program in Arezzo, Italy. Vargas was drawn to anthropology, and has developed a substantial interest in Latin American immigration to the United States. "I'm probably going to do a minor in anthropology," she says, reflecting the desire of many Hajim School students to go beyond the cluster requirement.

The Hajim School's full spectrum engineers are also sticking with their rigorous programs in larger numbers than in the past.

"We have a lot more students who can do engineering than we did 20 years ago," says Waugh, pointing to increasing strength of the overall undergraduate population at Rochester.

But there's also a cultural shift at play.

A generation or two ago, it was customary for engineering professors to put the fear of God in their incoming students. "Look to your left, look to your right," they would say—or so the story goes. "At least one of the people sitting next to you won't be here come graduation." Or come next year. Or by the end of the semester.

"There was a point in history where engineering schools took pride in flunking out half to two-thirds of their class," says Waugh. "I think that era has gone by the board."

Clark has turned the story on its head. "I've said that we need to say, 'Look to your left, look to your right. If you see someone struggling, let's see if we can help them out. Let's work as a team to get through this together.'"

Clark has a personal stake in that approach. He grew up in rural Virginia, in a tiny town outside Roanoke. He was the first person in his family to go to college. During his first semester at Virginia Tech, he was behind. "There were kids who already knew what was going on in the introductory engineering courses," he recalls. "I had no idea. I was playing catch up."

Clark knows that although he ended up thriving, he might have benefitted from the inclusive, team-oriented approach the Hajim School is fostering now. He also notes that it's a different scenario—and a harder one—for students who are not only first-generation college students, but also from underrepresented minority groups. While engineering is challenging for everyone, these students are especially vulnerable to feelings of self-doubt.

Norwood, who came to the Hajim School in the 1980s as an underrepresented minority herself, and who has been advising students in the school for more than 20 years, knows how pervasive these feelings can be.

"You can feel that sentiment just walking into a room. And if you feel it enough, you start second-guessing yourself. If you're not from this environment, this is a very hard place to navigate."

The Hajim School has boosted the retention of minority and low-income students through the STEM Gems program—a system of peer mentoring in which new students from underrepresented groups are guided, each step of the way, by a group peer who understands the unique challenges these students face and is an example of the success that perseverance can bring.

STEM Gems is part of a broader effort at the Hajim School to distinguish itself as a welcoming place for a diverse student body. The school has made two goals explicit: to increase the percentage of underrepresented minorities from 13 percent in 2014 to 20 percent by



TUBULAR! Senior chemical engineering majors (left to right) Stephan Tewksbury of Wyalusing, Pennsylvania; Garrett Meier of Caledonia, New York; Erik Laurin of Castleton, New York; and Sidney Royal of Dallas, work on their senior design project, a tubular reactor.

2018; and to become one of the first engineering schools in the nation to reach gender parity. The school's undergraduate student body is already nearly one-third female, well ahead of the national average of 18 percent as of 2014. And in many cases, diversity begets diversity. Vargas, for example, was accepted to multiple schools. But when she narrowed her decision, one factor stood out. At another school she visited, "the ratio of female to male was really off," she says. "I liked the diversity here."

But at liberal arts universities with growing engineering programs, the question is almost universally raised: what impact does their growth have on other disciplines? Both nationally and at Rochester, the percentage of students declaring majors in the humanities has declined markedly in recent years. And given the substantial requirements of engineering degrees—which leave students less room in their schedules for exploring various disciplines—how can colleges ensure robust programs across fields?


It's an especially important question at Rochester, given that the Hajim School attracts students on the promise that they'll be able to pursue multiple interests. And it's a question that weighs on Clark. "If we grew significantly more than we currently are, it would change the campus culture as a whole," he says. Having strong programs in the humanities and social sciences, he adds, is "an atmosphere that

enhances the education of the engineering student. We don't want to be a technical university."

Undergraduate enrollment in engineering is estimated to exceed 1,700 in fall 2015—well over the goal of 1,200 that Clark set in September 2008. Nonetheless, Richard Feldman, professor of philosophy and dean of the College, says the College is far from becoming a technical school. "The issue is not so much what percentage is here and what percentage is there, but do we have strong programs in each of the different areas," he says.

Enrollment in the College has been growing in general. Although the share of students majoring in the humanities has declined, in terms of pure numbers, students pursuing the humanities are well within the range of what they have long been. Just over 500 students were majoring in humanities disciplines in 2013–14, virtually smack in the middle of the high point (618 in 2008–09) and low point (353 in 1997–98) from 1996 onwards. Citing new faculty appointments in the humanities, Feldman adds that "the goal is to keep those programs strong."

Norwood emphasizes the Hajim School's integration into the College, offering students latitude to move easily in and out of engineering majors. To be sure, she and other Hajim School leaders want to retain students, and even welcome nonmajors to explore courses in engineering. But, she says, "Our philosophy in the College is for students to follow their passions and their interests.

"We don't want to lock students into a major. If they come in and say they want to study engineering, great. If they come in and think they'd like to study something else, or if they come in planning to study something else and want to move into engineering, we want them to have that flexibility." 



Sight Seekers

Students share their photos
in *Rochester Review's* seventh annual
Study Abroad Photo Contest.

For the seventh edition of our annual Study Abroad Photo Contest, we received more than 215 photos from more than 50 students who took part in academic programs sponsored by the College Center for Study Abroad during 2014.

Submitted in the categories of culture, people, and physical world, the photos were taken in more than three dozen countries, representing five continents.

We also invited international students to submit their photos of the United States.

Grand prize winners receive a gift certificate to the University bookstore. Category winners and other finalists also receive prizes. [📍](#)



Grand Prize: Study Abroad

FEZ, MOROCCO

The Chouara Tannery

Adam Rouhana '15 (T5), a brain and cognitive sciences major from Belmont, Massachusetts.
February 2014



People: Honorable Mention

RABAT, MOROCCO

Morocco's Amazigh People

Adam Rouhana '15 (T5), a brain and cognitive sciences major from Belmont, Massachusetts. February 2014



Culture: Honorable Mention

KYOTO, JAPAN

Kinkaku-ji

Brian Levine '15, an economics and political science double major from Morris Township, New Jersey. December 2014



▶ **Best Selfie**
SEGOVIA, SPAIN
Admiring the Aqueduct
Boubacar Diallo '15,
a mechanical engineering major from Bignona, Senegal. September 2014



▲
**People:
Category Winner**

VENICE, ITALY
Flooded St. Mark's Square
Andrew Mara-Williams '15,
an archaeology, technology,
and historical structures major
from Pittsfield, Massachusetts.
November 2014

◀ **International:
Category Winner**

ROCHESTER
Making Maple Sugar
Asma Khan, a graduate student
in the Warner School of Education
from Lahore, Pakistan. March 2014



▲
People: Honorable Mention

CAPE TOWN, SOUTH AFRICA
Coca-Cola
Sydney Simpson '15, a microbiology major
from Binghamton, New York. February 2014





Culture: Category Winner

DORSET, UNITED KINGDOM

The Locals

Margaret Dalton '15, an English and psychology double major from Canandaigua, New York. *April 2014*

**Culture:
Honorable Mention**

SANTIAGO, CHILE

*Torres del Paine
National Park*

Sarah Lamade '15, a linguistics and anthropology double major from Williamsport, Pennsylvania. *November 2014*





▲
Physical World: Category Winner

CAPPADOCIA, TURKEY

Hot Air Balloons Ascend

Aaron Schaffer '15, an international relations major from Rochester. *November 2014*

▲
**Physical World:
Honorable Mention**

FLORENCE, ITALY

A View of the Arno

Jessica Sands '15, an applied mathematics major from Jenkintown, Pennsylvania. *March 2014*

Thanks to Our Judges

Our panel of judges included Allen Topolski, professor of art and art history; Brandon Vick, digital assets manager for University Communications; and Maya Dukmasova '12 (T5), a former winner in the contest and now a journalist based in Chicago.

Jacqueline Levine '80, '84 (Mas), director of the Center for Study Abroad and Interdepartmental Programs, helped coordinate the contest.