HISTORIC TALK: Pulitzer Prize–winning historian Doris Kearns Goodwin talks with President Joel Seligman after her keynote address to an overflow audience at Kodak Hall at Eastman Theatre.

MELIORA AND EASTMAN WEEKENDS

Signature Celebrations

Alumni, family, and friends celebrate their connections during this fall's Meliora and Eastman Weekends.

OPENING NUMBERS: Student performance groups greeted alumni and guests as they arrived for Eastman Weekend, during an opening ceremony held in the newly named Lowry Hall.

ADAM FENSTER

PACKED PALESTRA: Actress Laverne Cox (top), star of the Netflix series *Orange Is the New Black*, gave a keynote address to a full house at the Palestra, which was also the site of the second annual MEL Talks, presented by members of the University community, including Elizabeth Schirmer '11S (MBA) (above), a vice president at Sweetwater Energy.

ADAM FENSTER (COX); BRANDON VICK (MEL TALKS); MATT YEOMAN (EASTMAN)

RIBBON CUTTING: Rochester Mayor Lovely Warren, Monroe County Executive Maggie Brooks, New York State Senator Joseph Robach, U.S. Senator Charles Schumer, President Joel Seligman, U.S. Representative Louise Slaughter, University CFO Ronald Paprocki, New York Assemblyman Mark Johns, University Board Chairman Ed Hajim '58, and New York Lieutenant Gov. Robert Duffy dedicate College Town.

ROCKIN' REVUE: Maddie Freeman '15 leads After Hours at the Rochester Dinner Revue, an annual showcase of performances by student artistic, musical, and cultural groups.

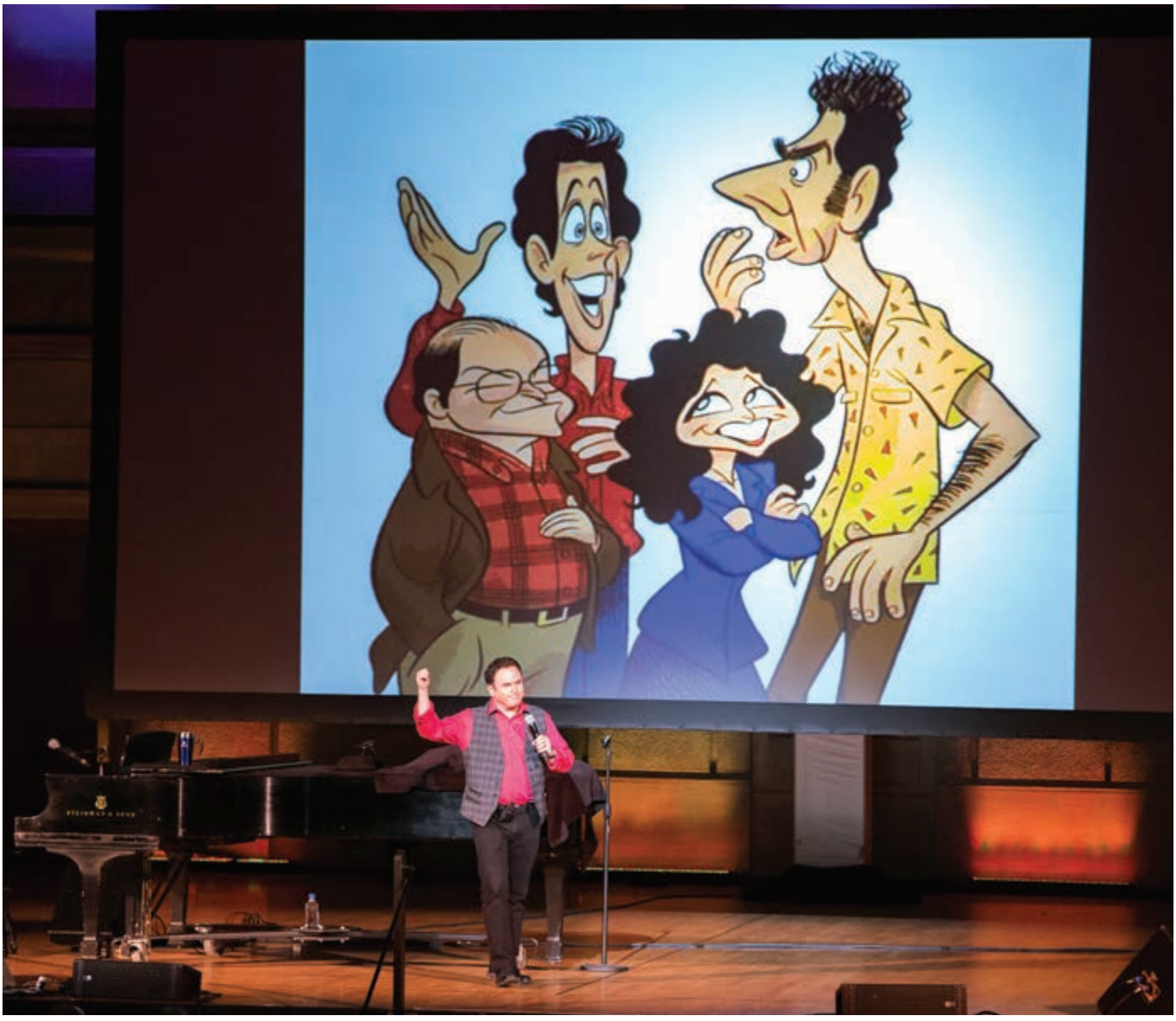
NETWORKING: Gaella Kabeya '18, Funmi Ogunbufunmi '18, Sailume Walo-Roberts '94, and her daughter, Dinsio Walo, were among the guests at the OMSA Networking Reception.

ADAM FENSTER

ADVANCEMENT ADVOCATES: University Trustee Larry Bloch '75 and his wife, Cindy (center), were joined by their children, Matt '13S (MBA) (left) and Reisa (right), during a ceremony to mark the dedication of the Larry and Cindy Bloch Alumni and Advancement Center.

MILLER'S COURT: Noted attorney Arthur Miller '56, '08 (Honorary) led a panel of experts in a discussion of privacy in the digital age. Joining him were Mark Leary, chief information security officer at Xerox; Linn Foster Freedman, chair of the Data Protection Group at Nixon Peabody; Bryan Hetherington, chief legal counsel at Empire Justice Center; Henry Kautz, professor of computer science; and David Cay Johnston, a Pulitzer Prize–winning investigative reporter.

ADAM FENSTER (MILLER'S COURT); UNIVERSITY ADVANCEMENT (BLOCH CENTER)



STAGE PRESENCE: Emmy and Tony Award–winning actor Jason Alexander had some fun with his life as a television, movie, and Broadway performer during his presentation at Kodak Hall at Eastman Theatre. He appeared as part of the "Eastman Presents" concert series.

NURSING NEWS: Patricia Tabloski '89N (PhD) discussed the opportunities and challenges facing nurses and educators as the number and diversity of older adults continues to grow. She was the guest for the 56th annual Claire Dennison Lecture.

MEDICAL GUEST: Former Surgeon General David Satcher '72M (Res), '95 (Honorary) pauses for a photo with medical students Rahul Shah, James Bates, and Michael Mattiucci. Satcher discussed the 50-year history of public health reports issued by the Office of the Surgeon General.

KURT BROWNELL (ALEXANDER); UNIVERSITY ADVANCEMENT (TABLOSKI AND SATCHER)

RUSH RHEES SELFIE: Ivy Kaplan Braun '90 (left) and Tracy Frommer Duberman '89 take pictures in front of Rush Rhees Library.

TOUCHDOWN: Max Berger '17 (No. 36) celebrates with Jacob Milberger '16 after catching a touchdown pass in the first half of the homecoming football game. The Yellowjackets beat Rensselaer Polytechnic Institute, 34–20.

ADAM FENSTER

When the 'New Normal' Is Not Enough

Neurorestoration is an infant field, with life-changing potential for people like Bradford Berk '81M (MD/PhD).

Now he's on a quest to make Rochester an early leader.

By Karen McCally '02 (PhD)
Photographs by Adam Fenster

REHAB: Berk undergoes physical therapy at the Medical Center's Department of Physical Medicine and Rehabilitation. He's aided by physical therapist Tim O'Connor (left) and his personal assistant, Harley Bowman.


DELL

Bradford Berk '81M (MD/PhD) grew up immersed in science fiction. "I read science fiction as a kid, just endlessly," he says sitting in his Medical Center office. "I loved the ability to imagine other ways of being and of thinking. I believe it expands your mind."

Berk reaches for a glass of water sitting on the conference table next to him. He raises it to take a sip. It seems hard to imagine, but for the physician-scientist with more than 200 papers to his name, widely praised upon his appointment as Medical Center CEO in 2006 as one of the finest leaders in academic medicine, that simple motion was a daunting achievement.

In a split second during Memorial Day weekend in 2009, Berk, an avid cyclist, rounded a tight curve and encountered a car in his path. Skidding to avoid it, his tire popped and he flew over the handlebars. He heard a snap in his neck. Moments later, he began to lose feeling in his limbs. He struggled to breathe.

Berk was airlifted to the University's Strong Memorial Hospital, where he underwent emergency surgery to stabilize his neck. Paralyzed from his neck down, he remained in intensive care for 12 days and then was transported to the Kessler Rehabilitation Institute in New Jersey for 100 days of treatment.

His helmet did its job. He emerged from the accident with his mind unscathed, his intellectual faculties intact. He returned to his role as Medical Center CEO in February 2010, and has followed a rigorous course of physical therapy at Strong's Department of Physical Medicine and Rehabilitation ever since. Between his treatment in New Jersey and at Strong, he's made great progress, regaining enough movement to feed himself, brush his own teeth, and navigate a host of digital devices such as tablets and smartphones. Yet he remains mostly paralyzed, a quadriplegic with limited sensation and movement in his legs, arms, and hands.

A WELL-EQUIPPED OFFICE: Berk stands for an hour a day in a standing frame, which he says aids his bone, cardiovascular, and gastrointestinal health.

No doubt, life in a wheelchair is not among the alternative ways of being that the sci-fi enthusiast imagined for himself as a youth growing up in the Rochester suburb of Brighton. But since this condition has been thrust upon him, it's given him reason to think back to the realm of science fiction. Sometimes it really does foreshadow the future. Just this past summer, for example, the Food and Drug Administration approved the first wearable robotic exoskeleton, allowing people who've been paralyzed to stand, walk, and even climb stairs. As Berk sees it, developments like this one, combined with recent advances in pharmaceuticals and stem cell medicine, herald a revolution.

"I am watching with great interest the start of a revolution as new drugs, devices, and cellular therapies promise to improve the quality of life for people like me," he said in a public announcement in September. "As a clinician, scientist, and patient, I want to be part of that."

On January 1, Berk will officially step down from his role as Medical Center CEO. Then, after a six-month sabbatical of planning and writing, he'll return to head a new institute dedicated to neurorestoration—the emerging science that promises to lead to treatments of spinal cord injuries and a host of nervous system disorders.

Broadly speaking, neurorestoration is a means to recover central and peripheral nervous system functions that have been lost as a result of injury or disease. It describes a process in which the brain rewires itself, to work around connections that have been damaged or severed. Neurorestorative interventions in the realm of physical therapies, pharmaceuticals, and stem cell transplants, now at varying levels of development and accessibility, all have the potential to improve the lives of people living with a wide array of conditions, including spinal cord and traumatic brain injuries, Parkinson's disease, stroke, cerebral palsy, and others. But as of yet, neurorestoration remains more a goal than an established practice. We know *that* the brain can restore itself. We are only beginning to learn *how*, or to what extent, it can.

At Rochester, one of the centers of that research is the Department of Brain and Cognitive Sciences on the River Campus. Greg DeAngelis, the George Eastman Professor and chair of the department, says that when it comes to clinical interventions in the brain, "I tell my students that it's a little bit like you're trying to fix an alien spacecraft that just landed. It has technologies in it that you don't fully understand. That's about where we're at. But as we learn more our ability to help heal the brain will increase dramatically."

Basic scientists now work directly, in some cases, with clinicians. And those are the types of relationships the institute is intended to foster. Brad Mahon is an assistant professor of brain and cognitive sciences with a secondary appointment in the Medical Center's neurosurgery department. His work is in understanding how the brain's networks function. He works with stroke patients, to understand how the brain recovers from a lesion, and with neurosurgeons to predict what functions could be compromised by surgery to remove tumors. After surgery, Mahon looks for patterns of damage and recovery. Although he's already enmeshed in intra-university collaborations, he sees the institute as an opportunity to build on those connections.

The value of an institute, he says, is that it "provides an infrastructure that's going to attract people from different fields who are interested in a common set of questions."

With research and clinical care in neurorestoration scattered across so many disciplines and subspecialties, it's not surprising that there are, at this point, few neurorestorative institutes as such. There are likely to be more in the future. But Rochester is making it a priority at an early stage, and a key reason Rochester can throw its hat into the ring is that neurorestoration draws on strengths the University already has.

Neuromedicine has been a strategic focus for several years, and in 2009, the late Ernest del Monte, then a life trustee, poured $10 million into the University's effort, expanding research and clinical care, and drawing both under the umbrella of what's now called the Ernest J. Del Monte Neuromedicine Institute. With a search under way for a new director, the institute will work closely, and share many resources, with Berk's neurorestoration initiative.

From a clinical standpoint, the Medical Center has already overhauled inpatient treatment of brain and spinal cord injury patients from admission to rehabilitation. The Kessler Trauma Center, serving Rochester, the Finger Lakes region, and western New York, received a Level One designation from the American College of Surgeons last spring, making it one of only two such trauma centers in the state.

Last summer, the Medical Center opened a brand new Neuromedicine Intensive Care Unit—long a goal of Webster Pilcher, the Ernest and Thelma Del Monte Distinguished Professor in Neuromedicine and chair of the neurosurgery department, and Robert Holloway, the Edward A. and Alma Vollertsen Rykenboer Chair in the Department of Neurology. They recruited two new directors to lead a specialized clinical team that operates 24/7. The unit is part of the Medical Center's Comprehensive Stroke Center, one of only three in the state. According to Berk, the unit, filled to capacity, is one of the Medical Center's major draws from regional hospitals. The unit will aid considerably in one of the most important aspects of treating traumatic injuries to the nervous system: working immediately to limit the damage of the injury.

On the research side, Rochester is a home to scientists of international distinction in stem cell biology, among the most promising


M300

avenues for treating brain and spinal cord injuries, as well as strokes, Parkinson's disease, and other nervous system conditions. They include Steven Goldman, the Dean Zutes Chair in Biology of the Aging Brain, and Maiken Nedergaard, the Frank P. Smith Professor of Neurological Surgery, both of whom hold joint appointments in the neurology and neurosurgery departments, and codirect Rochester's Center for Translational Neuromedicine; and Mark Noble, the Martha M. Freeman, M.D. Professor in Biomedical Genetics, and Margot Mayer-Proschel, and Christoph Proschel, also faculty members in the biomedical genetics department.

In short, distinguished clinical and research centers are rarely built from scratch. And with what's already been accomplished, the notion that Rochester can make a mark in the field of neurorestoration is well founded. That's even if the leader of the Rochester Neurorestoration Institute weren't a patient himself.

Riding in his motorized wheelchair, Berk is a regular presence in the corridors and atriums of the University's labyrinthine medical complex. With his personal assistant, Harley Bowman, always at his side, he works a busy schedule.

Berk is more visible, friends and colleagues say, than before his accident. There are reasons for that. Getting out and about, greeting staff and visitors as he makes his way through his workdays, is all the more important to him now.

"A lot of people who have these problems," Berk says, alluding to traumatic brain and spinal cord injuries, or even partial paralysis from stroke, "disappear from view. The saddest thing about the community I'm part of is that people tend to be homebound."

Yet they're a sizable group. An estimated 15,000 people sustain a spinal cord injury in the United States and Canada each year, and at any given time, hundreds of thousands of spinal cord patients live with considerable handicaps. There are nearly 800,000 strokes in the United States a year, according to the latest statistics of the Centers for Disease Control and Prevention, and strokes are an even larger source of long-term disability.

Berk sees a parallel with the time, back in the 1970s, when he entered the field of cardiology. "When I was a student, somebody would come in with a major heart attack, and we would give them some oxygen, some diuretics, and some morphine for the pain, and then they either lived through it or died," he says. "A lot of them died."

A POWERFUL ADVOCATE: Lieberman, a University trustee and senior partner at the New York City law firm Skadden Arps, was a leader in the effort to restore state funding for spinal cord injury research.

Of those who lived, many would never regain enough strength to go back to work. And then, in the early 1980s, came angioplasty, followed by stents. And then implantable defibrillators and pacemakers. "These devices transformed cardiology," says Berk. "It was just this sudden wave over about a decade or two that totally changed the practice."

Today, the state of treatment for people with diagnoses like his is similarly rudimentary. Often patients are prescribed a course of physical and occupational therapy and told that after six months to a year, whatever state they are in is where they'll likely remain. They're told that's the "new normal." And Berk, speaking from personal experience, calls the new normal "unacceptable."

Aside from Berk, few people know this better than Nancy Lieberman '77.

Lieberman is not a scientist, but an attorney. She's known Berk since 1998, the year he came to Rochester to lead the Medical Center's Cardiovascular Research Institute. As a trustee, she served on the board's health affairs committee. Possessed of the same driven personality as Berk, Lieberman entered the University at age 16, and graduated first in her class, in three years. By age 22, she had earned a JD degree, and in 1987, at age 30, she became the youngest partner ever—of either gender—at the prestigious New York City law firm Skadden Arps.

In December 2007, on a ski trip with her husband and son, Lieberman, an experienced skier, slipped and lost control of her skis. She careened into a grove of trees, and heard a snap in her neck. "I had this horrible accident and, sadly, a year and a half later, he had his accident," she says of Berk. "I visited him in the hospital. I told him the world doesn't come to an end."

Lieberman had been a patient at Mt. Sinai Hospital. Although she was at a top facility, her progress had been slow and difficult. In five months, she'd gained only limited movement in her upper arms. Her doctors told her that she was unlikely to make much more progress.

Through her connections to Rochester, Lieberman was introduced to Mark Noble.

NEW LEADER: Taubman, who led the Medical Center during Berk's recovery in 2009 and early 2010, will become Medical Center CEO in January.

LEADERSHIP

Dean Mark Taubman to Lead Medical Center

Mark Taubman, who has served as dean of the School of Medicine and Dentistry since 2010, will become senior vice president for health sciences and CEO of the Medical Center, beginning January 1, 2015.

Taubman will succeed Bradford Berk when Berk transitions from those roles at the end of the year to launch the new Rochester Neurorestorative Institute at the Medical Center.

In announcing the appointment, President Joel Seligman praised Taubman as an "unflappable straight shooter" and "a man of unquestioned honesty and integrity."

"In his recent five-year review, Mark was praised for his strategic ability with the School of Medicine and Dentistry, his hiring and promotion of outstanding leaders, his implementation of operational plans, his integrity, and his ability to engage Medical Center leaders during the post-2008 recession period of financial challenges," Seligman said.

A highly respected leader at the Medical Center, Taubman was appointed dean following a nine-month stint as acting CEO while Berk recovered from his 2009 spinal injury.

A board-certified cardiologist, Taubman came to the Medical Center as chief of the Cardiology Unit and Paul N. Yu Professor of Medicine in 2003. He became chair of the Department of Medicine and the Charles E. Dewey Professor of Medicine in 2007 and served in that role until being named as dean.

Before joining the Medical Center, he was director of cardiovascular research at Mt. Sinai School of Medicine in New York City.

BRANDON VICK

STATE-OF-THE-ART: Amrendra Singh Miranpuri, surgical codirector of the new Neuromedicine Intensive Care Unit, gives a tour of the unit to (left to right) Berk, John Markman, associate professor of neurosurgery and of neurology, David Carmel, cofounder of New Yorkers to Cure Paralysis, and Lieberman.

Noble enjoyed a close collaboration with colleagues at the Burke Medical Research Institute in White Plains. For five years, he and the Burke Institute's director, Rajiv Ratan, were the codirectors of the New York State Center for Research Excellence on Spinal Cord Injuries—a communications and research hub for scientists from more than a dozen laboratories.

Burke researchers were recruiting spinal cord injury candidates for an experimental treatment in what's called mass practice therapy. With researchers from the Massachusetts Institute of Technology, Burke scientists had developed a series of robots—armbots, handbots, wristbots, and anklebots—that guide stroke and spinal cord injury patients through thousands of repetitions. The aim of the therapy was to re-educate the brain, to restore function to limbs that were themselves undamaged, but that the brain had forgotten how to use.

With Noble's help, Lieberman enrolled in Burke's experimental program. The results were significant.

"My arms are 60 to 80 percent back," Lieberman says. "This all has to do with the robots."

Among the first priorities of the Rochester Neurorestoration Institute is the replication of Burke's program, now fully operational in its new Restorative Neurology Clinic. Rochester's goal is to offer patients in the region access to this state-of-the-art rehabilitative therapy, which is itself a prerequisite for making use of any significant advances in research. For even if stem cell therapy could fully repair the spinal cord—the holy grail of research—the connections between the brain and the limbs would still have to be reestablished through extensive physical rehabilitation therapy. Which explains in part why Noble, a research scientist, has worked hard for the purchase of physical therapy equipment.

The initial goal of obtaining the robots is now within reach. But it was no easy process getting there. The challenges to improving the lives of patients like Berk and Lieberman aren't only scientific and technological, but also political and financial.

The main source of funding for medical research in the United

States has been the National Institutes of Health. After rising steadily for several years, NIH funding began to decline, adjusted for inflation within the biomedical sector, precipitously so since the financial crisis of 2007.

In 2013, President Barack Obama announced the Brain Research through Advancing Innovative Neurotechnologies, or BRAIN, initiative. NIH recently awarded $46 million in grants as part of the initiative, a relatively small amount for a major initiative in biomedical research. However, funding for the initiative is spread across multiple federal agencies, and Berk has his eye in particular on the Defense Advanced Research Projects Agency, or DARPA, part of the Department of Defense that has funded research leading to some of the most consequential technological innovations of our time, including the Internet.

With the decline in federal support, states and foundations have started playing more prominent roles in funding medical research. The result has been competition among states for top research talent and facilities.

For several years, spinal cord injury research in New York was funded to the degree that it helped scientists in the state to remain competitive, and attracted new ones as well. The money came from traffic tickets. Because motor vehicle accidents are the largest single cause of spinal cord injuries, in 1998, the New York state legislature established the Spinal Cord Injury Research Trust Fund, in which up to $8.5 million per year, collected from ticket surcharges, was to be deposited.

Those funds supported groundbreaking discoveries by researchers across the state, especially concentrated at the Burke Institute and at Rochester. In 2004, it helped support a groundbreaking study by Nedergaard. While many researchers were attempting to regenerate injured spinal cords, she took an alternate path, discovering how it might be possible to interrupt a series of molecular events that cause considerable damage in the immediate aftermath of an injury.

Mayer-Proschel used the funds to build on nearly 10 years of research she'd conducted in stem cells with partners Noble and Proschel. At the University of Utah, where she, her husband, Proschel, and Noble worked together before coming to Rochester, she discovered a new central nervous system precursor cell—that is, a cell that lies on the path of embryonic development between undifferentiated stem cells and fully developed spinal cells. She began to cultivate the precursor cell population in vitro, turning the cells into a very specific kind of astrocyte—the major support cells of the brain and spinal cord that perform many functions, among them, tissue repair. In 2011, she, Proschel, and Noble completed a study in which the cultivated astrocytes were implanted into injured spinal cords of adult rats. Their results showed significant healing in those rats, compared with the control.

The Spinal Cord Injury Research Trust Fund dispersed approximately $70 million. But in 2010, the research funds were diverted when the state faced a $7.5 billion budget gap. Among those who mobilized to restore the funding was Lieberman. She cofounded New Yorkers to Cure Paralysis, a lobbying coalition bringing together most of the state's centers for medical research, as well as several foundations, and at least one pharmaceutical company.

Last May, Berk, Lieberman, her cofounder, New York investor David Carmel, and Noble traveled to Albany to press their cause. "They had a pretty hard time saying no," Berk says. The funding was restored at $7 million. When the board doled out multiple grants in the aftermath of the new budget, Rochester's Medical Center received the state's largest, at more than $1 million. An equipment grant, it will go toward the purchase of multiple tools for research and treatment, including the robotics rehabilitation devices pioneered at Burke.

Noble sees it as a good omen. And in August came further good news, as Gov. Andrew Cuomo announced the release of $14 million to support stem cell research.

New York still has a way to go. California is the national leader in state funding on stem cell research, including research on brain and spinal cord injuries. Scientists under pressure to find grant money to support themselves, their labs, and the graduate students and postdoctoral fellows on which research relies tend to go where the funds are.

Noble, a member of the team that reviews stem cell grants for the California Institute for Regenerative Medicine, says New York will have to continue its leadership, lest it end up becoming "a farm team."

Philanthropy will also play a role.

And Berk's leadership will be key.

"There's an aspect to Brad that I can point out, but Brad wouldn't," says Noble. "This field needs articulate advocates. And there are far too few of them."

Lieberman, who has also become an articulate advocate, agrees. "Most people with these injuries aren't the head of a major medical center, or like me, a senior partner in a law firm. They can't go to Albany and talk the talk." Spinal patients are often young—the victims of car crashes, sporting accidents, gunshots, and increasingly, blasts from military combat. The late actor Christopher Reeve, who was paralyzed in a horseback riding accident in 1995, raised the profile of spinal cord injury patients considerably. But although the Christopher Reeve Foundation remains an important force for publicity and fundraising for research, since Reeve's death in 2004, there have been few compelling spokespeople.

Berk is not a movie actor. But he's a distinguished medical leader, clinician, and scientist. Personable, photogenic, and at home before an audience, he's ready to write, speak, and travel to educate the public and raise money—for the Rochester Neurorestoration Institute, and for the cause of patients more broadly.

Lieberman will continue to be an important partner. "I have felt for myself—and I think Brad probably feels this way—that's it's incumbent on us. Incumbent on the people who have had accidents later in their lives to do for all the others who can't do for themselves."

To her, it really is a matter of saving lives. "We warehouse—and I use that word deliberately—warehouse human beings in nursing homes and institutions." But even small advances can make a big difference to people like her. Her goal is to walk again. Nearly six-and-a-half years after she was expected to make no progress, she continues to work on her arms. Whether you consider her progress modest or significant can depend on what chair you're sitting in.

"Every notch that you're able to get back makes a huge difference," she says. "If I were simply a paraplegic, meaning I couldn't walk, but I had my arms, that would be transformative for me." R

Models of History

How is digital technology helping scholars interested in cultural history understand the past? And will you one day 'visit' long-lost places?

By Scott Hauser

How do you bring the past to life?

For historians and other scholars who analyze cultural, architectural, and physical history, the answer may be as close as the latest software update.

Faculty at Rochester are turning to increasingly available imaging, 3-D visualization, and immersive world technology to imagine virtual spaces—projects designed to use the facts and details of history to inform new ways of understanding and analyzing the past.

The projects range from an exploration of ancient Roman monuments to a 400-year history of Bermuda, as Rochester scholars turn to technology—and to one another—to think of new ways to share their scholarship.

"The opportunities for interdisciplinary collaborations in this field are phenomenal," says Renato Perucchio, a professor of mechanical engineering and director of the College's Program in Archaeology, Technology, and Historical Structures who has been using computer technology to analyze ancient structures over the last 10 years. "By their very nature, these are multidisciplinary projects."

And while the final piece of scholarship may live online, the academic work undergirding them does not change, says Joan Saab, an associate professor of art and art history who is helping to lead a project to build a 3-D model of an architecturally significant train station in Rochester that was torn down in the 1960s.

"For me, this is a chance to do the work and model a type of rigorous, scholarly practice," she says. "We want it to have the scholarly rigor that an article or a book would have."

Such technologically rich projects are designed to provide visual, interactive ways to better engage and inform students, other scholars, and the public. They also allow researchers to simulate experiences and conduct experiments that would not otherwise be possible, and may offer insights into ways to preserve ancient objects and structures.

Michael Jarvis, associate professor of history who has been working to create a virtual version of Bermuda, says the technology has opened new doors to re-imagine the past.

"The act of reconstructing—either restoring modern places to

ISLAND VIEWS: Using software that captures and collates geographic and spatial data, Jarvis and his team are recreating a multi-layer map of Bermuda (inset, above) while students are using common 3-D visualization software to model historically correct houses and other buildings (inset, below), based on property records and other information.


Mappa
ÆSTIVARUM
Insularum alias Bermudas
A Mapp of the
SOMMER
Hands once called the
Hammilton
Haring
toni Fretum
Harington
Sound
Smiths Tribe
Tribe
Part of
the General Land
Southampton Harbour
SOUTHAMTONIÆ PORTUS
St David
Hland
Burnt point
St GEORGES
Devonshire
Pagets
Abbots bay
Garnets head, Hyrcus, promont.

historical appearances or reconstructing lost buildings—forces you to think in a level of detail that you normally wouldn't," he says. "We know what happened but we don't 'get it' in the way that visualization brings to bear."

Here are a few examples of projects currently under way.

Virtual St. George's

Imagine yourself on the shore of 17th-century Bermuda. Your ship has anchored just beyond the reef, and from the railing you can see a few small, timber houses that make up the settlement of St. George's. Beyond those few buildings, the 20 square miles of the island are dense with lush, green wilderness. Beyond that is 600 miles of open Atlantic ocean and the New World with its lonely outpost of struggling Jamestown, Virginia.

Fast forward to 2014 and St. George's is a vacation island destination. While the footprints of those first few buildings remain, the history of Bermuda has gone on unabated as generations of settlers, sailors, shipbuilders, and slaves made their homes on the tiny archipelago.

What if you could "see" that history as it unfolded? Better yet, what if you could put yourself on the streets of the original capital of St. George's, interacting with fellow Bermudians in day-to-day life and commerce?

While Michael Jarvis, associate professor of history, can't travel with students back in time, he's envisioning the next best thing to a time machine. Using digital technology, he's working on a virtual version of Bermuda that will allow students and others to explore, experience, and understand the 400-year history of the longest permanently inhabited settlement in English America.

"I want to let people stand there and walk the streets and look at the buildings as they stood in 1620, in 1680, in 1750, and probably 1775 at the start of the American Revolution," says Jarvis, who has been studying the history of Bermuda for more than a quarter century.

As part of his research, he has collected nearly four centuries of detailed data, a trove of information captured in deeds, wills, baptismal records, tax rolls, and the other facts that power the bureaucratic life of every society. Jarvis can follow the ownership of a particular piece of property over lifetimes, much like a storyteller following a multigenerational epic.

By matching that information with building records and analyzing it with imaging, mapping, and 3-D visualization software, Jarvis is slowly recreating a Bermuda that has disappeared from view. He envisions taking that recreated island one step further, using some of the common software behind video games to make an immersive world where Bermudian society comes to life.

Claude Bragdon

"We can put historically accurate people in historically accurate contexts," Jarvis says. "For example, almost like in a video game, you could walk up to a house in a particular year and knock on the door and Widow Tucker will answer the door. We know that Widow Tucker was 45 years old and she had three children and five slaves. We can restore everybody in the town to their houses in a particular target year."

To create the original prototypes for the project, Jarvis has led undergraduates and graduate students in a project to integrate historical data into databases, conduct independent research on specific buildings and property owners using digital newspaper archives, and "build" individual houses using software such as Google's SketchUp, a free rendering software used to model 3-D objects, and more advanced computer-aided design software. Using archaeological records, property rolls, and other information, the students can not only recreate the buildings, but they can also "furnish" them with objects that property owners listed in deeds and wills.

Jarvis says that by doing such work, he and the students are able to understand Bermudian society at a level that isn't possible by simply poring over records. When you see the layout of a house, for example, and you know who lived there and how they lived, you start to ask new questions, he says.

"You know that there were eight slaves in the house. Where did they live? How did people interact on a daily basis? Where would white and black members of the household have slept each night?" he says. "What was the social space inside the physical space? The act of visually reconstructing these spaces raises these new questions."

And as he brings more interactivity to his virtual version of Bermudian society, he expects those questions to become more compelling.

"There's a level of historical accuracy that's possible now with the new technology," he says. "Everybody who lived there—be they adult, children; black, white; slave, free—everybody is equally worthy of study, and by putting this together, I can see how 17th-century life was different from 18th-century life and how 18th-century life was different from 19th-century life in a very real way."

Rochester's Third New York Central Train Station

During its heyday in the first half of the 20th century, many thousands of travelers, soldiers, college students, and commuters passed through the landmark Third New York Central Train Station in downtown Rochester.

Few of them probably were aware that the monumental building—with its cathedral-like waiting room, geometrically patterned tiles, and other seemingly decorative embellishments—was meant to embody many of the artistic, architectural, philosophic, and spiritual ideas of its designer, Claude Bragdon. A figure straddling the 19th century's ideas about urban architecture and the 20th century's emerging modernism, Bragdon thought of the station as an "architectural performance." He hoped it would be a space where his notions of transcendence and the possibilities of higher orders of human experience could be on display, say Joan Saab, associate professor of art and art history, and Joan Rubin, the Dexter Perkins Professor in History.

When the building was torn down in the 1960s, scholars of cultural history lost not only the physical structure, but also the experience of what it was like to stand in the space itself. What if they could virtually capture the feeling of being in the building? Would that open a window on Bragdon, his artistic ideas about public spaces, and his influence on the cultural arts of the early 20th century?

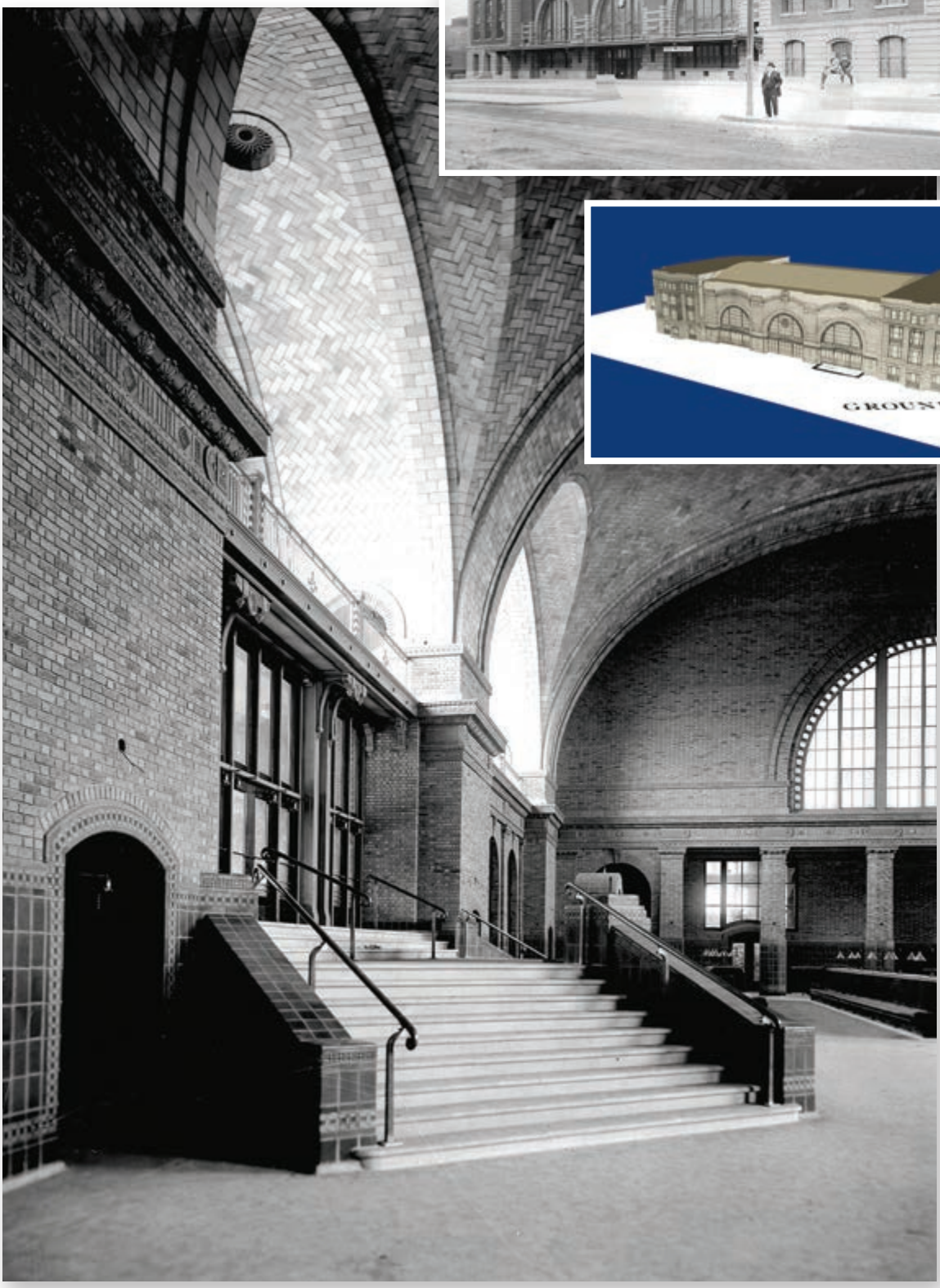
Working with archivists and technologists at Rush Rhees Library, home to the leading collection of Bragdon's papers and other materials, the two are leading an effort to bring the station back to life as a virtual, 3-D model.

"For me, this really came out of a teaching dilemma," says Saab. "When you teach architectural history, particularly buildings that no longer exist, it's difficult to get a sense of what the spaces were like. And with Bragdon, there's that extra richness because he had so many ideas about architecture that you can't get from black-and-white photographs. But once you can colorize the tiles and put them in a space, you can say, 'Oh, I get what he's talking about.' Whether or not it works is up to the person viewing the space. But that's one of the things we're trying to do. It's moving Bragdon from 2-D to 3-D."

Among the materials housed in Rush Rhees are blueprints, working designs, and correspondence about the train station, as well as

FROM THE COLLECTION OF THE ROCHESTER PUBLIC LIBRARY LOCAL HISTORY DIVISION

HISTORIC STATION: Drawing on blueprints, papers, and artifacts housed in Rush Rhees Library, Rubin and Saab are leading a project to create a 3-D model of an iconic former Rochester train station, considered one of designer Claude Bragdon's architectural masterworks. The result would be a multi-layered historical analysis of Bragdon's ideas about art, architecture, and public space.



Station Memories?

As part of the project to create a virtual version of the Bragdon train station, the research group is interested in hearing from people who visited the building while it was still in use. Contact the team at Bragdon.UR@gmail.com.

FROM THE ALBERT R. STONE NEGATIVE COLLECTION, ROCHESTER MUSEUM & SCIENCE CENTER, ROCHESTER, N.Y. (EXTERIOR AND INTERIOR); COURTESY OF JOAN SAAB (MODEL)

artifacts from the building that were salvaged when the building was razed. The project aims to recreate an architecturally accurate version of the station—down to the detail of light fixtures, water fountains, and tiles—that viewers will eventually be able to interact with almost as they would an electronic game.

As technologically impressive as they hope the project will be, the two are making sure not only that the details are historically accurate, but that they also are put in their proper historical and cultural context, an approach that Rubin calls layering.

"Image if you could 'go' into the building, and you click on a cornice. You can learn what a cornice is; you can also see Bragdon's comment about the cornice, or his letter to his sister about the cornice. There will be layers of information and context and analysis."

While the project is using the train station as a focal point, the goal is to get a broader understanding of Bragdon and his place in American cultural history.

"It's really Bragdon through the train station," say Saab. "You could do this for any building, but Bragdon is an interesting enough character that he can carry a project on his own.

"He wrote quite a bit about his ideas—of the spiritual properties of the space and architecture as 'frozen music' and the relationship between colors and material and between form and bodies—that's compelling to me as somebody who studies and teaches architectural history."

The designer behind several prominent buildings in Rochester, Bragdon eventually had a falling out with George Eastman, and he left for New York, where he became a nationally recognized designer for theater and stage productions, as well as for producing "Song and Light" festivals in Central Park, an idea that he first tried out in Rochester's Highland Park.

"As a cultural historian, I'm interested in the relationship between Bragdon's spiritual ideas and modernism, which is the style that we see emerging in the period right when Bragdon is working," says Rubin. "I'm interested in how to place him culturally. He had a cult following, and he was nationally known, but one of the things that intrigues me is that he is himself multifaceted."

Eternal Rome

If anyone has come across the civil engineering code for Imperial Rome, circa 200 CE, Renato Perucchio would like to borrow it.

Barring the likelihood that such a historic codex will emerge any time soon from a long-lost archive, the professor of mechanical engineering is using technology to recreate and understand the evolution of engineering in ancient Rome.

Since 2005, he has led a team that's analyzing a series of monuments built in Imperial Rome from the eras of Trajan to Constantine. Using 3-D solid modeling and engineering structural analysis software, he's analyzing a series of well-preserved concrete vaulted buildings, including some of the largest structures built in antiquity. The goal, Perucchio says, is to understand the evolution of structural thinking and the technological evolution of ancient engineers.

"Civil engineering embodies the technology of the time and at the same time, the willingness of builders to take risks," says Perucchio. "Clearly we don't have the civil engineering code of Imperial Rome, but the complexity of these monuments make it such that you cannot build them based on an oral tradition."

By analyzing how the structures were built and comparing earlier buildings to later monuments, Perucchio and his team can see how techniques evolved to help make sure the buildings could withstand damage.

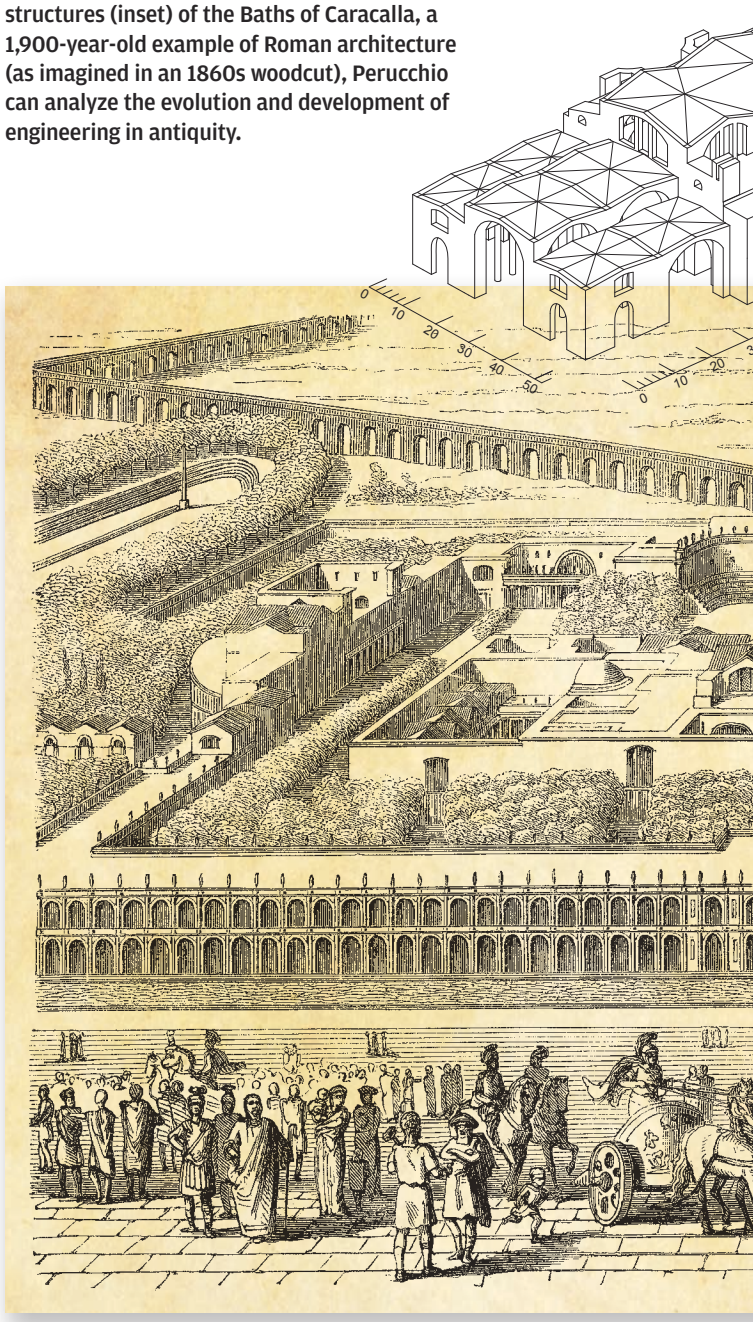
"As an engineer you can study the factors that produced problems—often critical—in a building," Perucchio says. "And then if you look at other buildings, you discover that specific items have been changed. What you infer is that, 'Well, these people looked at what was going on, understood the mechanism of a possible collapse, and modified their design so that the collapse was avoided in subsequent structures.'

"It's very much what we do today. Engineering proceeds this way—either doing it numerically or experimentally or combining the two."

And today that analysis relies on massive computing power and sophisticated imaging, rendering, and 3-D simulation software. Using a technique called nonlinear finite element modeling, Perucchio and his students can not only model the structures, but they can also analyze damage to unreinforced concrete structures, the kind that might occur, for example, during an earthquake.

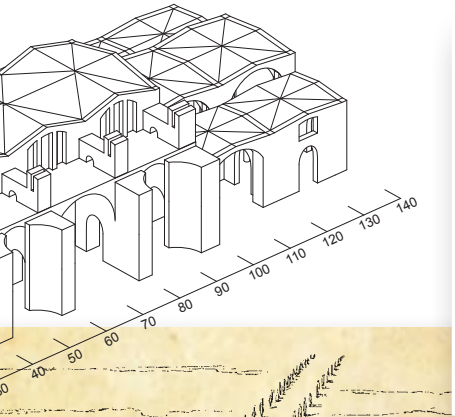
In order to do that, though, Perucchio's team faces an added challenge. Modern engineering analysis tools are designed to analyze modern buildings built with steel, reinforced concrete, and other materials. The Roman engineers working in imperial times had none of those available.

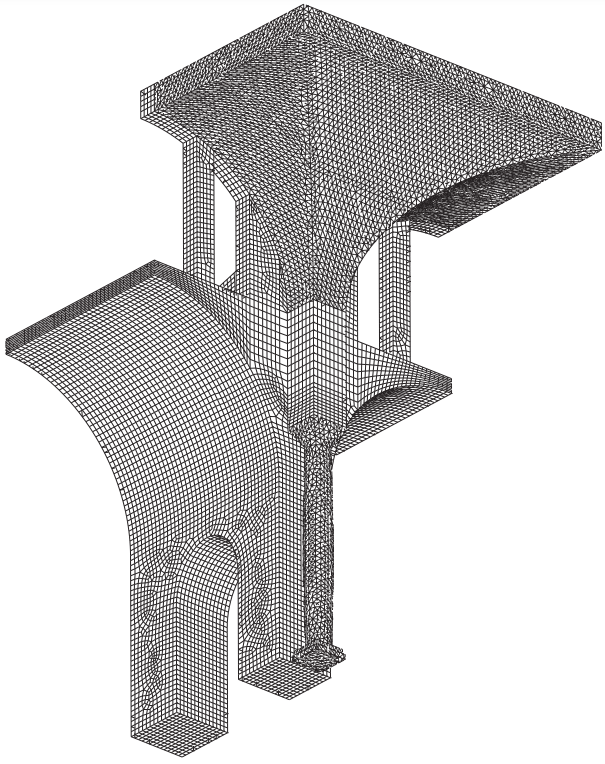
"Paradoxically, materials that were used extensively in antiquity



VAULTS OF ANTIQUITY: By modeling the vaulted structures (inset) of the Baths of Caracalla, a 1,900-year-old example of Roman architecture (as imagined in an 1860s woodcut), Perucchio can analyze the evolution and development of engineering in antiquity.

ISTOCKPHOTO (WOODCUT)





DETAIL VIEW: A detail of a finite element model created by Perucchio and his team shows the vaulted structure of the *frigidarium*, an area of the Baths of Caracalla with the highest vaulted structure.

are very, very difficult to model with modern tools," he says. "In order to understand the engineering of ancient peoples, we need to develop very sophisticated approaches that are much more complicated than modeling steel or modeling reinforced concrete."

Working with small blocks from the monuments, the team adjusted their analytical tools to understand how ancient concrete reacted to the stressing and crushing and bending that every structure faces in its lifetime.

"The best way to think of these structures is that these are live entities that adjust themselves over time," he says. "And in order to understand how they do that you need to have the physical properties of the material. That requires some very sophisticated experiments."

In recent years, Perucchio begun analyzing other ancient structures, such as an enormous adobe pyramid in modern-day Peru that was built by the Moche people of South America, a civilization that thrived from 100 CE to about 800 CE. The work is conducted jointly with a multidisciplinary team including colleagues from Rochester and the Pontificia Universidad Católica del Perú in Lima.

"The approaches that we have developed are really very powerful and can be applied to a fairly large number of structures," Perucchio says. "The common feature is that these types of structures usually cannot be analyzed with modern tools. You have to develop your own data as well as your engineering analysis tools."

And while Perucchio says his projects typically don't address how ancient structures can be preserved or protected, the research can help guide such efforts by understanding how the structures were designed and where they are most vulnerable.

"For me, it's a simple point: you learn through mistakes. That something was going to stand up, but instead it fails. These were very sophisticated people, and they understood that. They were able to conduct a critical analysis of their errors and develop new structural solutions. This is pretty much what engineers do even today."

ISTOCKPHOTO (BATHS OF CARACALLA); COURTESY OF RENATO PERUCCHIO (MODELS)