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Join alumni around the world to tout your connection to the ‘Lute on Friday, Feb 7, 2014, for the third annual RPI Spirit Day.

Participating is easy—wear or display your Rensselaer gear wherever you may find yourself on Feb. 7, take a picture, and post it to social media with #RPISpiritDay.

Put on your Phalanx Pin! Line up your GM Week mug collection on your desk, or hang an RPI pennant on your office door.

Show your pride virtually by changing your profile pic or avatar to a Rensselaer-related icon. Visit alumni.rpi.edu/spirit for images to download.

Get Your RPI Gear

Don’t have any Rensselaer gear? Find it online at the Bookstore at bookstore.rpi.edu, or the Athletics Store, rpfanshop.com.

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FEATURES

16 The Rensselaer IDEA
Like electricity, nuclear power, or biotechnology before it, data will shape the next age of innovation and invention. With a bright new IDEA, Rensselaer is positioned at the forefront of this technological revolution.

24 Solving Problems
Rensselaer’s applied mathematicians are harnessing mathematics to support engineering and scientific pursuits for the good of our 21st-century world.

30 Hyperloop, Meet Tubeflight!
The recent proposal of a fantastical new mode of travel has brought back memories of a Rensselaer professor’s bold idea from a half-century ago.

DEPARTMENTS

4 President’s View
A lesson from the microbes.

5 Mail
Mastering manufacturing makes sense.

6 At Rensselaer
Technology Commercialization 12
Making a Difference 13
Milestones 15

38 Alumni Hall of Fame
Class of 2013 is inducted.

42 Staying Connected

44 Class Notes
In Memoriam 63

64 One Last Thing
The technologies of management.

The Jefferson Project at Lake George is conducting plane- and boat-based surveys. Page 7.
In October, Rensselaer unveiled a new petascale supercomputing system, the Advanced Multiprocessing Optimized System, or AMOS. With the ability to perform more than one quadrillion calculations per second, AMOS is the most powerful university-based supercomputer in New York state and the Northeast, and among the most powerful in the world.

AMOS is a five-rack IBM Blue Gene/Q supercomputer. In addition to massive computational power, AMOS has high-performance networking capabilities with a bandwidth of more than four terabytes per second. This combination of speed and networking is unique among the world’s university-based supercomputing systems, and will enable Rensselaer and its partners in academia and industry to better tackle highly complex, data-rich research challenges ranging from personalized health care, to smart grids, to economic modeling.

Rensselaer is also home to Watson at Rensselaer, a cognitive computing system provided by IBM to Rensselaer, making it the first university to receive such a system. Both AMOS and Watson at Rensselaer are housed in the Rensselaer supercomputing center—the Center for Computational Innovations. The combination of the balanced supercomputing power of AMOS and the ability of Watson at Rensselaer to understand the subtle nuances of human language and sift through vast amounts of data uniquely positions Rensselaer as a world leader in data-related research, innovation, and education.
A Lesson From Microbes
Collaborations are key to discovery and innovation

While microbiologists study the smallest forms of life on Earth, they currently are standing at a frontier so immense that they borrow from the language of astrophysics to describe it. They refer to the enormous number of yet-unclassified microbes as the “dark matter” of life. They point out that distant stars are better understood than the organisms in the soil underfoot.

The reason the full richness of the microbial world has been perceived only dimly until now is an interesting one: Only a miniscule percentage of microbial species can be cultured in a laboratory. Most of them live in communities of intricate interdependencies, and they cannot grow in isolation.

In addition, microbes are classified only poorly by their form or metabolic features. Beginning in the late 1960s, scientists were given a new kind of sight with the sequencing of the first bits of microbial genetic material—and a new trunk was added to the tree of life, the archaea.

The next great moment of illumination belongs to alumna and former trustee Dr. Claire Fraser ’77. In 1995, Dr. Fraser and her team published the first complete genome sequence of a free-living organism, the bacterium *Haemophilus influenza*. Dr. Fraser’s team rapidly sequenced other microbes from laboratory cultures, yielding significant insights into the evolution and nature of infections.

The science of microbiology advanced yet again with the advent of metagenomics—or the sequencing of genes from many microbial species, directly from an environmental sample without having to culture them. Metagenomic analyses offered new evidence of the breathtaking diversity of microbial life.

Metagenomic studies also revealed another fundamental truth: Plants, animals, and humans alike—we coexist with such rich microbial communities that we are viewed most accurately as consortia. In fact, the microbial cells in human bodies far outnumber the human cells. Microbes perform essential services for us, such as priming our immune systems and helping us digest food. Studies have found that different microbial communities, or microbiomes, correlate with different states of health.

Now, new technologies allow for single-cell genomics—or the ability to pluck a single unculturable microbe from the environment and to amplify its DNA a billion-fold so that it can be sequenced. Once again, information about heretofore undiscovered organisms is forcing the tree of life to be redrawn. Within its branches are new metabolic pathways, new proteins, potentially new medicines, and new ways to boost crop yields or improve industrial processes.

At Rensselaer, we excel at finding applications for such beautiful science. For example, our Vice President for Research Jonathan Dordick, Howard P. Isermann Professor of Chemical and Biological Engineering, has used genomic analysis to bypass the problem of antibiotic resistance in deadly bacteria such as *listeria* and *MRSA*. Using lytic enzymes—or enzymes that dissolve cell walls—specific to each bacterium, Dr. Dordick, Dr. Ravi Kane, the P.K. Lashmet Professor, and their team have developed antimicrobial coatings that are remarkably effective at eliminating pathogens. Since the bacterium uses this lytic enzyme in its own process of cell division for reproduction, it cannot develop resistance to it.

The work of Dr. Cynthia Collins, assistant professor of chemical and biological engineering, engages the social nature of microbes in order to turn them into efficient factories for the production of biofuels or pharmaceuticals. Bacteria have a facility called “quorum sensing” that allows them to coordinate their activities when they sense a certain population density of their own or another species. By genetically engineering new quorum-sensing systems in two different species of bacteria, Dr. Collins and her students are creating a community of microbes that can divide the labor of production for a new fuel or medicine.

The advances I have described would not be possible without computer scientists and sophisticated bioinformatics to assemble and analyze millions of pieces of fragmented DNA.

In fact, the data questions in the field of microbiology are enormous and growing larger by the minute. They include not just the “Who is there?” question, but also, an infinite number of “What do they do?” questions, such as the correlation between particular microbes within the human microbiome and the progression of a disease, or particular microbes in a farm field and drought tolerance in a crop. It was to enable just such investigations that we created the Rensselaer Institute for Data Exploration and Applications, or the Rensselaer IDEA, this spring, and brought together Rensselaer talents in every computational field with scientists and engineers addressing significant global challenges (see article, page 16).

The great lesson of microbiology is that none of us stands in isolation. We thrive only because of graceful symbioses. This is particularly true when the endeavor is discovery or innovation. At Rensselaer, we enable those interdisciplinary collaborations that help us to see new frontiers—and to use the insights discovered there to make the world a better place.
Mastering Manufacturing Makes Sense

My wife is an RPI grad (Susan Poleto, Class of ’84) and I recently read the article about the Manufacturing Innovation and Learning Lab (MILL) in the Rensselaer alumni magazine she received (“Mastering Manufacturing in the MILL,” Fall 2013). As another engineer, and one who has spent his entire career in manufacturing industries, I am very impressed with the work you are doing. It is relevant and it will definitely help a young RPI grad to hit the ground running when entering the workplace.

BOB PENICKA
Saratoga Springs, N.Y.

I read the article in the Fall 2013 alumni magazine about the MILL with interest. I was a part of the first class through the Advanced Manufacturing Lab (AML). Our “exciting” project was a simple bottle opener. (I am quite certain that I still have the balsa wood mock-up we made.) I am not sure that we ever finished it—as part of the inaugural team, much time was spent just bringing the equipment online. Also, back in those days (fall ’82-spring ’83), we did not have CAD systems, so all drawings were done by hand.

Back in those days, my interpersonal skills left a lot to be desired. Regardless, I was a class leader because: I had already been working with Professor Steve Derby for a year and knew how to program the robot; and, the previous summer (1982), I worked as a tool engineer at Kodak and knew more about injection molding than everyone else (which is more a testament to how little was known in the community).

It sounds like you have come a long way since then—congrats!

GERRY ROSTON ’83
Saline, Mich.

First, I’d like to say that the alumni magazine is really well done. I look forward to reading it each time it arrives in my mailbox. I was especially interested in the recent article “Mastering Manufacturing in the MILL.” I plan to post a link to it on our Pinterest board for RPI. I’m now a retired manufacturer and run a social media company promoting manufacturing, CTE, and STEM. I do this primarily with our website and social media platforms. Visit us online at manufacturingstories.com.

DAVID DEWITT ’68
Peterborough, N.H.

So, may I urge RPI to offer a course in union relations along with the manufacturing curriculum? It’s an integral part of manufacturing life.

GREAT issue! The article on Lake George, where we had a cabin for many years, and the amazing article on modern manufacturing, really hit me. After graduation in 1947 (after Navy graduation in ’45), I enjoyed many years running international industrial divisions.

But, my worst experience was at ALCO (American Locomotive Co.) in Schenectady in 1970. After two years of negotiations with the United Steelworkers Union trying to save it, then a long strike, I became the last president of ALCO, when the venture capital owner ordered me to shut it down and sell off the pieces.

So, may I urge RPI to offer a course in union relations along with the manufacturing curriculum? It’s an integral part of manufacturing life.

DICK ETTINGTON ’47
Palos Verdes, Calif.

Go Navy!

It was interesting to read that Navy officers are coming to Rensselaer (“Training Navy Officers”). It reminds me of the strength of materials course I took with eight or 10 Annapolis grads in 1947. The officers were enrolled in graduate studies and all of them were brilliant. I believe at least three of them graduated at the top of their class at the academy. There were about four regular RPI students in the class, including myself. Mr. Assini was our instructor. He was excellent.

I wouldn’t be surprised if the group that entered this August are extraordinary also. Their attendance is good for RPI and for our Navy.

JOSEPH BAUMAN ’48
Boca Raton, Fla.

Proud Parent

I was reading the Rensselaer magazine Fall 2013 issue and was thrilled to see the best picture of my daughter’s graduation (Christine Barbara Madsen, Class of 2012) on page 42. Is it possible to get a digital copy so I can replace the one on my mantel? Yours is fabulous!

She deserved that smile, and so does RPI—she is happily employed, continuing her education, and continues to dream big!

BARBARA MADSEN
Bloomfield, N.J.

We’d love to hear from you! To provide space for as many letters as possible, we often must edit them for length. Address correspondence to: Rensselaer Magazine, Strategic Communications and External Relations, Rensselaer Polytechnic Institute, Troy, NY 12180; email to alum.mag@rpi.edu; or call (518) 276-6531.
A view of layered rocks on the floor of McLaughlin Crater shows sedimentary rocks that contain spectroscopic evidence for minerals formed through interaction with water. A combination of clues suggests the 1.4-mile-deep crater once held a lake fed by groundwater.

**SCIENCE**

Mars Rover Finds Water on Planet Surface

The first scoop of soil examined by the analytical suite in the belly of NASA’s Curiosity rover reveals that fine materials on the surface of the planet contain several percent water by weight. The results were published in September in *Science* as one article in a five-paper special section on the Curiosity mission. Dean of Science Laurie Leshin is the study’s lead author.

“One of the most exciting results from this very first solid sample ingested by Curiosity is the high percentage of water in the soil,” says Leshin. “About 2 percent of the soil on the surface of Mars is made up of water, which is a great resource, and interesting scientifically.”

Curiosity landed in Gale Crater on the surface of Mars on August 6, 2012, charged with answering the question “Could Mars have once harbored life?” To do that, Curiosity is the first rover on Mars to carry equipment for gathering and processing samples of rock and soil. One of those instruments was employed in the current research: Sample Analysis at Mars includes a gas chromatograph, a mass spectrometer, and a tunable laser spectrometer enabling it to identify a wide range of chemical compounds and determine the ratios of different isotopes of key elements.

These results have implications for future Mars explorers. “We now know there should be abundant, easily accessible water on Mars,” says Leshin. “When we send people, they could scoop up the soil anywhere on the surface, heat it just a bit, and obtain water.”
JEFFERSON PROJECT

High-Tech Surveys Monitoring Health of Lake George

The Jefferson Project at Lake George is building one of the world’s most sophisticated environmental monitoring and prediction systems, which will provide scientists and the community with a real-time picture of the health of the lake. This fall, scientists used a combination of sophisticated plane- and boat-based surveying techniques to create a high-resolution contour map and images of the lakebed and surrounding mountains.

The survey is critical to the development of an accurate computer model of water circulation within the Lake George watershed, which is part of a suite of new technologies and techniques being developed in the three-year, multimillion-dollar collaboration between Rensselaer, IBM, and The FUND for Lake George.

The circulation model built from this survey information will expand our understanding of how water, nutrients, invasive species, and pollutants move through the watershed and within Lake George. The model is part of a series of advanced data analytics, computing and data visualization techniques, new scientific and experimental methods, 3-D computer modeling and simulation, and historical data expected to provide an unprecedented scientific understanding of Lake George.

The Jefferson Project has contracted Substructure Inc., a New Hampshire-based company with significant expertise in precision geophysical and hydrographic surveying to use highly specialized vessels to conduct the lakebed survey. The boats, which are equipped with multibeam SONAR, will cruise a repetitive pattern in deeper areas of the lake, beginning in the southern basin and continuing for the next several months as they map the lake. The boats cannot survey in the shallowest areas due to risk in damaging precision measurement equipment suspended from their hulls.

Shallower areas will be surveyed by Aerial Cartographics of America, with aircraft equipped with custom-designed bathymetric LiDAR (light detection and ranging) equipment. The initial aerial survey will take approximately three days, with each flying day chosen dependent on weather conditions. The planes will fly slowly at an altitude of approximately 500 meters above the lake in a repetitive pattern for the mapping. A second round of aerial surveys of the surrounding watershed will commence later in the project.

The Jefferson Project at Lake George, launched in June, aims to understand and manage multiple complex factors threatening one of the world’s most pristine natural ecosystems. The collaboration partners expect that the world-class scientific and technology facility at the Rensselaer Darrin Fresh Water Institute at Lake George will create a new model for predictive preservation and remediation of critical natural systems.

SCIENCE AND TECHNOLOGY STUDIES

Kinchy Book Offers Food for Thought

In her recent book, Seeds, Science, and Struggle: The Global Politics of Transgenic Crops (Food, Health, and the Environment), Abby Kinchy offers food for thought on challenging questions such as: What values should our agriculture system represent? How can we fairly distribute the benefits of our food system and minimize its negative impacts?

As society grapples with a changing climate, growing population, and degraded water and soil, confronting those and other complex questions is imperative, says Kinchy, an associate professor of science and technology studies. In the face of all that is changing, she says, one thing remains the same: “We must continue to feed ourselves.”

“Despite the increasing popularity of organic and local food, our regulatory and legal institutions are rigged against farmers who want an alternative to the dominant agribusiness model of food production,” Kinchy says. “I wanted to tell the stories of farmers who are pushing up against regulatory systems that have failed them, and to prompt serious discussion about changing the criteria we use to evaluate new technologies like genetically engineered seeds.”

In her new book, Kinchy navigates the intersections of science, politics, food, and farming as she delves into the debate and social movements surrounding the introduction of genetically modified seeds into the food supply.

Kinchy examines a theme common to conflicts over genetically engineered crops worldwide. “Many people seek to frame conflict about biotechnology as a struggle to maintain the purity of rational science against political interference,” she says.

Seeking to “challenge and complicate” a debate that is often boiled down to scientists vs. activists, Kinchy examines struggles over native maize in Mexico and canola grown in Canada. Her methods include interviews, observations, archival research, and analysis of documents like scientific papers, newspapers, and legal documents.
Unlike conventional horizontal skylights, light scoops balance out daily and seasonal fluctuations in light level and temperature.

The Lighting Research Center (LRC) recently released a guide for designing light scoops—an innovative type of skylight designed by the LRC with funding from the New York State Energy Research and Development Authority (NYSERDA). Light scoops provide optimal levels of daylight throughout the changing seasons and daily fluctuations in weather by capturing and strategically redirecting daylight into buildings.

Many conventional horizontal skylights provide too much sun on days that are warm and sunny, and too little sun on days that are cold and dark. The LRC’s new light scoops design balances out these daily and seasonal fluctuations in light level and temperature by providing less light in summer and more light in winter, while accounting for the natural pattern of the sun as it travels across the sky. In overcast conditions, a light scoop receives light from the brightest part of the sky, known as the zenith. Light scoops are most appropriate for spaces where direct sun is desirable such as lobbies, cafeterias, and hallways. They work very well in locations that are frequently cloudy and overcast such as Seattle, Portland, Detroit, and Buffalo.

Using light scoops and controls, electric lights can be turned off or dimmed when adequate daylight is available, thus saving energy and operating costs. Light scoops can also save heating and cooling energy.

Not only does this new design save energy and operating costs, but it provides occupants with a more pleasant environment. Light scoops provide “patches of sun” where occupants can enjoy the health benefits of sunlight. In 2012, 14 light scoops were installed on an expansion of the Welch Allyn corporate headquarters in Skaneateles, N.Y. Several months after the light scoops were installed, 48 occupants completed a survey with a very high rate of satisfaction—almost 90 percent “like” or “strongly like” the patches of sun in the atrium, with responses such as “sometimes I like to take a mental break, sitting in the sun,” “I just love to have sunlight,” and “it’s very relaxing.”

More details of the Welch Allyn installation and case study can be found in the light scoops design guide.

Light Scoops: A Design Guide demonstrates how to design light scoops to meet target light levels and includes a performance comparison of light scoops vs. conventional skylights.
MiSci, the Museum of Innovation and Science in Schenectady, N.Y., held an exhibit this fall featuring School of Architecture students’ design proposals for re-envisioning the museum campus.

The exhibit showcased the results of a design studio that second-year students took part in last fall semester. School of Architecture Dean Evan Douglis says the MiSci project is the third in a series, called the Capital Region Collaborative Initiative, which he launched upon his arrival at Rensselaer.

“We’ve worked with the Shaker Museum, the Hyde Collection, and now MiSci,” Douglis says. “This exhibit is the culmination of a full semester of study by the entire second-year student body. They were charged with examining the existing museum campus, learning the history and mission of the museum, and developing design options that will transform the museum into a contemporary cultural magnet.”

MiSci Executive Director William “Mac” Sudduth played an integral role in the students’ design process, giving his time to explain the museum’s mission and role in the community, and describing his vision for the future.

“As an informal educational institution, MiSci always loves working with students, and the RPI students were just delightful to work with,” Sudduth says. “What was really wonderful was that they learned something, but we learned some things, too.”

During the design studio, students were asked to consider limitations in the present facility including its lack of visibility—the museum sits on a hill overlooking downtown Schenectady and cannot be seen from the main road—as well as its distance from passing traffic and underutilized landscape, says Douglis.

“The second-year design studio is a pivotal moment in the education of an architect. This is their first experience designing a building, so it’s quite a monumental passage for our students. Speaking on behalf of the entire student body and faculty associated with this collaborative initiative, the opportunity to work with the leadership at MiSci was inspiring and offered an invaluable educational opportunity for everyone,” says Gustavo Crembil, assistant professor of architecture and the project coordinator.
Tracking the Disappearance of Ghostlike Neutrinos

The international Daya Bay Collaboration, which includes researchers from Rensselaer, has announced new results about the transformations of elusive, ghostlike neutrinos, particles that carry invaluable clues about the makeup of the early universe. The latest findings include their first data on how neutrino oscillation—in which neutrinos mix and change into other “flavors,” or types, as they travel—varies with neutrino energy, allowing scientists to measure a key difference in neutrino masses known as “mass splitting.”

The new results are based on four times the data, with twice the precision, of the first Daya Bay results released last year, which established the value of the third and final neutrino “mixing angle.” Mass splitting represents the frequency of neutrino oscillation. Mixing angles, another measure of oscillation, represent the amplitude. Both are crucial for understanding the nature of neutrinos. Understanding the subtle details of these neutrino oscillations and other properties of these shape-shifting particles may help answer some of the most mysterious questions about the universe.

Rensselaer researchers and students, led by Professor of Physics, Applied Physics, and Astronomy James Napolitano, have led the design, installation, and commissioning of the large-scale water purification system needed to shield the antineutrino detectors from cosmic ray and radioactive backgrounds.

“After more than a year of careful calibrations and detailed study, we are releasing results that show the antineutrino spectrum shape is completely consistent with the rate at which they transform,” Napolitano says. “Electron antineutrinos indeed ‘disappear’ with the appropriate dependence on distance and, separately, with energy, as predicted by the phenomenology known as ‘neutrino oscillations.’”

The Daya Bay Experiment is located close to the Daya Bay and Ling Ao nuclear power plants in China, 55 kilometers northeast of Hong Kong. The Daya Bay Collaboration includes more than 200 scientists from six regions and countries.

ENTREPRENEURSHIP

Vicarious Visions Co-Founders Named Entrepreneurs of the Year

Karthik Bala ’97 and his brother, Guha Bala—co-founders of the successful video game development company Vicarious Visions—were selected as the 2013 William F. Glaser ’53 Rensselaer Entrepreneurs of the Year. Established in 1990, the award brings the world of entrepreneurship into Rensselaer classrooms by recognizing successful entrepreneurs and role models who share their wisdom and experiences with students.

Vicarious Visions, based in Menands, N.Y., has earned nearly $3 billion in retail sales and sold more than 45 million software units worldwide. Located in a 40,000-square-foot state-of-the-art studio, the company employs more than 200 creative programmers, artists, and designers.

“I think that what Vicarious Visions has become is a wonderful reflection of what we try to foster in student entrepreneurs at Rensselaer, combining the technology, the creative process, and effective management.”

The two brothers co-founded the company in 1991 in their parents’ basement while in high school. They landed their first publishing deal when Karthik was a freshman at Rensselaer. In 2005, Vicarious Visions was acquired by Activision | Blizzard (NASDAQ: ATVI), a leading worldwide publisher of entertainment software. Vicarious Visions has since grown to become an industry-leading game developer. They have helped shape popular culture with hit video game titles including versions of Skylanders, Guitar Hero, Crash Bandicoot, Tony Hawk, Spider-Man, and Marvel Ultimate Alliance for various platforms. Vicarious Visions was rated in the top 20 of 100 of the World’s Most Successful Games Development Studios by Develop 100.

Karthik Bala currently serves as CEO of Vicarious Visions as well as chief technology officer of Activision Mobile, a division of Activision Publishing. Guha Bala serves as president of Vicarious Visions.

“It’s a privilege to be in such esteemed company of alums who have previously received this award,” says Karthik Bala. “It’s been 20 years exactly since I came to Rensselaer as an undergraduate and was inspired by the entrepreneurial alums who have made such a broad impact on the world. Guha and I are looking forward to coming back on campus to meet the next generation of Rensselaer entrepreneurs.”

“I think that what Vicarious Visions has become is a wonderful reflection of what we try to foster in student entrepreneurs at Rensselaer, combining the technology, the creative process, and effective management,” says Jason Kuruzovich, associate professor in the Lally School of Management and director of the Severino Center for Technological Entrepreneurship.
Off-Hour Truck Deliveries in Manhattan Reduce Traffic

A federal study led by Rensselaer is helping make Manhattan streets cleaner, less congested, and more profitable for businesses by shifting daytime delivery truck traffic to after normal business hours.

Jose Holguín-Veras, the William Howard Hart Professor, is leading this innovative program in conjunction with the New York City Department of Transportation (NYCDOT). Since launching in 2011, the program—called NYC deliverEASE—has enlisted nearly 150 restaurants, grocery stores, retailers, and other businesses in Manhattan to accept their freight deliveries between the off-hours of 10 p.m. and 6 a.m. instead of during normal business hours. The feedback from companies, which received a $2,000 cash incentive to participate in the program, has been overwhelmingly positive.

Holguín-Veras says this new model of unassisted off-hour deliveries—truck drivers use keys to drop off goods at the store or restaurant and lock up afterward—benefits participating businesses, the delivery companies, and the overall economic health and vibrancy of Manhattan. Participating companies range from small restaurants and delis to larger companies.

“Restaurant and grocery store owners can easily run out of products, because they don’t know if their food deliveries are going to arrive at 9 a.m. or 3 p.m. So, just in case, they often buy extra, which is inefficient and expensive,” Holguín-Veras says. “With unassisted off-hour deliveries, they know their fresh products are going to be there waiting for them every morning. This consistent, reliable delivery pattern improves the ability of business owners to manage their supply chain, which in turn allows them to be more efficient and better serve customers.”

The NYC deliverEASE program also benefits the delivery companies, Holguín-Veras says. During business hours, delivery trucks spend an average of two hours at each stop. With unassisted off-hour deliveries, drivers are able to park directly in front or back of the business, and the average time spent at each stop was only 30 minutes. Additionally, average travel speeds at night are twice as fast as during the daytime.

If just 6 percent of New York deliveries shifted to the off-hours, the difference to livability in the city would be substantial, with less congestion, visible display windows in retail establishments, and open street space during daytime hours, Holguín-Veras said. Such a 6 percent shift to off-hour deliveries also could result in a reduction of carbon monoxide emissions of more than 100 tons each year. All of these benefits add up to less daytime truck traffic on Manhattan’s busy streets, which makes it easier for tourists and local residents to visit and patronize downtown businesses.

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Water Glides Freely Across “Nanodrapes”

Engineering researchers at Rensselaer have developed a new drape made from graphene—the thinnest material known to science—which can enhance the water-resistant properties of materials with rough surfaces.

These “nanodrapes” are less than a nanometer thick, chemically inert, and provide a layer of protection without changing the properties of the underlying material. The team of researchers, led by Professor Nikhil Koratkar, demonstrated how droplets of water encounter significantly less friction when moving across a surface covered with a nanodrape.

This innovation holds the potential to benefit lab-on-chip devices, high-throughput assays, self-cleaning surfaces, and many other applications requiring the motion of liquid drops on solid surfaces.

“Graphene nanodrapes are the thinnest, most sheer drapes we can imagine. Other than providing a barrier against water, these drapes are optically transparent and cause minimal changes to the topology of the underlying surface,” says Koratkar, the John A. Clark and Edward T. Crossan Professor of Engineering. “We found this ultra sheer drape prevents the penetration of water into textured surfaces, which has interesting and potentially important technological implications for many applications in micro- and nanofluidics.”

Drops of water can get easily stuck or “pinned” to a material with a nanotextured rough surface. When the droplet falls onto the material, the energy from the fall pushes out or displaces the tiny amounts of air trapped in the textured surface.

Covering the surface with an impermeable graphene drape, however, prevents a droplet from getting pinned to the surface. The nanodrape creates a barrier that prevents the water drop from penetrating into and displacing the air from the textured surface. Instead, the droplet sits on top of the drape, with reduced friction between them, which in turn makes it easier to move the droplet around on the surface, Koratkar says.
Reinvigorating a Rensselaer Tradition

For nearly 40 years, the Hockey Line has been a long-standing tradition at Rensselaer. The annual rite of passage for avid Rensselaer hockey fans provides an opportunity for individuals to stake out a spot alongside the Rensselaer Union in order to purchase season tickets for upcoming hockey games.

In September, members of the campus lined up for a two-week stint, rotating individuals to ensure that someone was always present. On Sept. 10, the Hockey Line countdown officially ended, with much pomp and circumstance and a procession to the Houston Field House.

“The Hockey Line is one of my favorite traditions on campus,” says Grand Marshal Chuck Carletta ‘14. “The tradition originated with the design of the Houston Field House. Originally, there were large support columns throughout the building that held up its roof. Groups of students would camp outside the Union for months to get tickets in order to ensure unobstructed seats. In the ‘70s and ‘80s, the line formed in late July before the fall classes even began. The Psi Upsilon fraternity even beat the previous record of 33 days with 178 consecutive days in line when they camped out the day after the Engineers’ 1985 national championship.”

This year, following brief remarks from the Grand Marshal, activities included a cookout hosted by the Red Army, and performances by the Pep Band, Rensse-lyrics, and a new drumline group. The Rensselaer Society of Engineers also partnered with Greek life fraternities and sororities to offer a series of hockey-themed yard games for students.

More than 430 members of the campus community participated in the Hockey Line event. At the Houston Field House, attendees had the chance to meet members of the men’s and women’s varsity hockey teams, take part in free skating, take a behind-the-scenes tour of the locker rooms, and enjoy carnival-themed games.

“The Hockey Line event was exceptional and my hat is off to the entire team that made this possible,” says Jim Knowlton, director of athletics. “Every aspect of the evening was spectacular and I was excited to see the energy of our students and staff to make this a special event. I am looking forward to the season and excited that we will have even more students each night to help the Houston Field House rock!”

“I would like to thank everyone for the great team effort in putting together Hockey Line,” says Seth Appert, head coach for men’s hockey. “I feel very fortunate to be coaching at a school that has such passion for hockey and such an engaged student body.”

Recent Breakthroughs

Laser-Based Fabrication and Placement of Controlled-size Microbeads

Rensselaer researchers have created a laser-based method for fabrication and precise, planar placement of alginate microbeads and other cross-linkable materials in a single step, advancing tissue engineering and drug-delivery studies. Microbead diameter control ranging 50 and 500 micrometers has been demonstrated with beads remaining immobilized with micron-level spatial control. The method is compatible with cellular patterning by laser direct-write, enabling custom placement of cells in controlled proximity to beads for cellular studies or tissue construct fabrication.

“Green” Enzyme-based Pathogen Decontamination

A new environmentally friendly treatment capable of highly effective bacterial spore coat permeation for decontamination of bugs like Bacillus anthracis, responsible for anthrax, has been developed by researchers in the Center for Biotechnology and Interdisciplinary Studies. The new treatment offers milder and more environmentally friendly conditions for removing spore pathogens while acting rapidly to sanitize within 24 hours of application. This technology could be used against spore forming bacteria in hospitals, labs, and mail-handling facilities.

Non-Contact Scanning Electron Microscope Temperature Mapping

Detection of nanoscale temperature distribution is important for studies of heat generation and transfer in a wide range of nano-engineering systems; however, no current temperature mapping techniques adequately combine both nanoscale resolution and far-field, non-contact mapping capabilities. A Rensselaer-developed, sensitive, integrable scanning electron microscope-based technique capable of nanoscale resolution temperature mapping without temperature perturbations provides enhanced capabilities for investigating heat generation and transfer at the nanoscale level. This inexpensively commercializable system can address long-standing issues related to power consumption, heat dissipation, and energy conversion efficiency in many current and future generation nano-engineered systems.
Ensuring a Brotherhood Endures

When William Pomeroy ’66 committed $300,000 to kick-start the “Building the Bridge to Excellence” campaign undertaken by Sigma Chi, he did so to strengthen the fraternity’s future and to ensure incoming generations of Rensselaer students have the option to participate in the enriching experience Greek life offers.

“Without my fraternity, I wouldn’t have been good at being a student at RPI,” Pomeroy says. “In a tough environment, Sigma Chi became a family away from home. It was an anchor to help me get through the difficult schooling. I made my gift to ensure that future generations of RPI students have the option to participate in Sigma Chi and have a similar experience that I was fortunate enough to have.”

Pomeroy’s gift led the way in a successful, dedicated effort by the Rensselaer community and the members of Sigma Chi to raise more than $1.5 million to help pay for the $2.8 million cost to completely renovate and refurbish the Sigma Chi house. The house now meets the demands of modern-day fraternity life and provides the ideal environment for the Clustered Learning, Advocacy, and Support for Students (CLASS) initiative to thrive.

A dedicated alumnus, Pomeroy has been a longtime supporter of Sigma Chi and Rensselaer. Pomeroy was named the William F. Glaser ’53 Entrepreneur of the Year in 2008 to recognize his success as founder and CEO of CXtec, a multimillion-dollar global provider of new and certified pre-owned networking, cable, and voice technology equipment. Under Pomeroy’s leadership, CXtec has been integrally involved with Sigma Chi for a number of years by building a first-class infrastructure and fully supporting the computer network in the house. He also has been a loyal supporter of the Rensselaer Annual Fund for more than 20 years.

In recognition of his generosity, the fraternity house was dedicated during Reunion & Homecoming weekend in October as the Sigma Chi Fraternity Pomeroy Chapter House. Pomeroy joined with hundreds of Sigma Chi brothers, as well as President Jackson and many members of the Rensselaer community, to celebrate the house opening with a variety of events throughout the weekend.

“It was beyond exciting to come back to campus for the celebration, to have the opportunity to see the improved house for the first time, and to reconnect with my fellow brothers,” Pomeroy says. “I truly believe the RPI experience was fundamental for my success in starting and running a business. Fraternities provide core values and help to make their members successful not only as students, but later in life. This is good for the students and good for the Institute.”

William Pomeroy’s gift led the way to help Sigma Chi pay for the $2.8 million cost to completely renovate and refurbish the house.

**STEM Outreach**

**GE Girls @ Rensselaer**

In August, middle school girls from the Schenectady City School District took part in a summer camp on campus, designed to spur an interest in science, technology, engineering, and math (STEM) and initiate mentoring relationships with women in STEM careers. The weeklong learning program, called GE Girls @ Rensselaer, is sponsored by the GE Women’s Network in collaboration with Rensselaer.

Daily lessons focused on energy, construction, programming, electronics, and chemistry. During the program, the girls had the opportunity to design a computerized game, build a flashlight, learn the chemistry behind lip gloss, make ice cream, and more. Each student also got the chance to work with accomplished female mentors from the GE Women’s Network, primarily with engineering or technology backgrounds, and had the opportunity to tour the Rensselaer campus.

Since the central theme of the camp focused on turbines, students also worked in teams to build their own wind turbines and were able to measure the current generated, and they had the opportunity to visit the GE turbine facility in Schenectady.

“Over the last two years, the program has worked with area teachers, GE scientists and engineers who serve as mentors, and students and faculty from Rensselaer who have introduced and inspired the girls to have a lifelong love of discovery and innovation in the STEM fields,” says Cynthia Smith, assistant dean of students and director of pipeline initiatives and partnerships at Rensselaer.

Encouraging young women to take an interest in science and technology is a top priority for GE Chairman and CEO Jeffrey Immelt. He initiated the program in pilot form in 2011 through the GE Women’s Network at MIT. This year, the company again awarded a $25,000 grant to fund the program in the Capital Region, leveraging Rensselaer as the local university partner.
COMMUNIVERSITY

First Annual Collar City Ramble

In September, residents of the city of Troy and members of the Rensselaer campus carved out time to participate in the “Pre(R)amble” bike, skate, walk event to celebrate the launch of the Collar City Ramble—an all-access urban trail linking neighborhoods with historic, architectural, natural, and recreational sites in the city of Troy.

The Collar City Ramble and the Pre(R)amble are projects of Transport Troy, a Citizen’s Working Group appointed by Mayor Lou Rosamilia to study alternative transportation issues in Troy. “We are creating a linear park, sites strung like jewels on a necklace through the city, connecting to paths of neighboring communities,” says Jim Lewis, co-chair of Collar City Ramble and owner of Springwood Studios.

The word “ramble” is often described as “walking for pleasure, typically without a definite route especially in the countryside” or “to explore idly.”

“The Pre(R)amble was a fun opportunity to build excitement about the Collar City Ramble, a series of routes and paths to be mapped throughout Troy for urban hiking and recreation,” says Barbara Nelson ’80, manager of campus planning and facilities design. “The Collar City Ramble will be another way to explore Troy’s beautiful views, historic sites, and cultural venues. Dozens of RPI alums, faculty, students, and staff are involved in this grassroots effort to promote alternative transportation systems in Troy.”

The proposed project will serve as a trail that goes through various points within the city of Troy, including the Hudson River, parks, the Farmers Market, nature preserves, and neighboring bike paths, among others. According to the group organizers, “it’s an alternate transportation route, so no motors, but walking, cycling, rollerblades, handstands, hopping, skipping, and jumping are all great.”

The inaugural 10-mile-long event featured a tour and parade from the Farmers Market in downtown Troy to the Albany Bike Path connection.

GRADUATE EDUCATION

Graduate Student Housing Expands

The neighborhood at City Station has expanded with the recent completion of its East building. At full capacity, College Suites at City Station now has 151 apartment suites to accommodate up to 396 Rensselaer graduate students. With a total of three residential buildings (East, West, and South) now available within walking distance to the campus, City Station supports Rensselaer’s housing needs as the graduate program continues to grow.

Offering 24-hour group study areas to undertake team projects, a state-of-the-art fitness center, gaming areas, and a short walk to either class or downtown Troy, the neighborhood at City Station provides the convenience and quality of life that graduate students need to focus on balancing their academic and social life, according to the United Group of Companies.

“We are committed to providing Rensselaer with innovative housing solutions that offer a secure, quality living environment for their students,” says Michael Uccellini, MBA ’02, president and CEO of United Group of Companies, which owns and manages City Station. “Our College Suites at City Station incorporates state-of-the-art technology and amenities, allowing students to live, learn, and relax. The City Station community creates a competitive advantage for the graduate program at Rensselaer, helping to recruit the best and brightest.”

College Suites at City Station East opened its doors to Rensselaer graduate residents on Aug. 1. Across the street from the Phase 1 West building, the Phase 3 East building is along the east side of Sixth Avenue between Congress and Ferry streets. The East building has 157 student housing beds that, like West, are designated to Rensselaer graduate students. College Suites at City Station South, on the south side of Ferry Street, will remain Rensselaer graduate family housing.

“The Rensselaer graduate community at City Station is the keystone of our efforts to create an educationally supportive living environment for all graduate students,” says Stanley Dunn, vice provost and dean of graduate education at Rensselaer. “With over 100 graduate programs in more than 50 disciplines, Rensselaer attracts top students, researchers, and faculty to the city of Troy. We are grateful for our strong partnership with the United Group and for the shared commitment to our graduate students.”
SHIRLEY ANN JACKSON, president, has been named by President Obama as a member of the Advanced Manufacturing Partnership Steering Committee 2.0. Comprised of leaders from industry, academia, and labor, the committee is charged with developing and enacting strategies to help revitalize the national manufacturing sector, create high-quality manufacturing jobs, and enhance America’s global competitiveness. The AMP Steering Committee 2.0 will function as a working group of the President’s Council of Advisors on Science and Technology, of which President Jackson is a member.

JUERGEN HAHN has been named head of the Department of Biomedical Engineering. Prior to joining Rensselaer in 2012, Hahn served for nine years as a faculty member at Texas A&M University. His research interests include systems biology, as well as process modeling and control. His interdisciplinary work combines systems engineering, applied mathematics, and computer science to develop new ways of analyzing nonlinear systems found in biological or chemical processes. He is the author or co-author of more than 70 journal papers and book chapters. He is a fellow of the American Institute for Medical and Biological Engineering.

WILFREDO COLÓN, professor of chemistry and chemical biology, has been named associate dean for research in the School of Science. In this new position, Colón will oversee all Science-based research efforts, including the development of new interdisciplinary research programs. He also will direct the school’s accelerated B.S./Ph.D. program and its graduate programs in multidisciplinary science and applied science.

T. RAVICHANDRAN, an information systems expert, has been named the Irene and Robert Bozzone ’55 Distinguished Chair in the Lally School of Management. Ravichandran joined the faculty in 1996 as an assistant professor at the Lally School. He was promoted to full professor in 2009 and named associate dean for research at the Lally School in 2012. His research focuses on the strategic implications of information technology, supply chain management, business-to-business electronic markets, innovation diffusion, and assimilation and organizational renewal/growth through innovation.

LEO WAN, assistant professor of biomedical engineering, has been named a Pew Scholar in the Biomedical Sciences by the Pew Charitable Trusts. Additionally, Wan has won a prestigious Faculty Early Career Development Award from the National Science Foundation. The Pew Scholar in Biomedical Sciences program is highly competitive, awarding recipients $240,000 over four years to pursue their projects. Wan aims to uncover the rules that govern left-right asymmetry in tissues and organs during development, and use this information to better understand genetic diseases and birth defects associated with asymmetry.

GEOFFREY SEBER, associate advancement officer in the Division of Institute Advancement, has been named the 2013 Pillar of Rensselaer, the highest honor Rensselaer gives to a staff member. The Pillar Award is presented annually to a staff member who understands the Institute’s mission and history, has been a role model for other employees, has shown concern for students and their welfare, has added to the human dimension of the school, and who has played an active role in his or her home community.

NICHOLAS DeMAISON has joined the School of Humanities, Arts, and Social Sciences (HASS) as the conductor of the 50-student Rensselaer Orchestra and the university Concert Choir. An acclaimed conductor and composer, DeMaison is organizing a comprehensive chamber music program and students will now receive academic credit in arts for their participation. DeMaison has led dozens of premieres of new operatic, instrumental, choral, and multimedia works. His music has been performed by the New York Philharmonic, Ikuts Percussion, Sinopia Trio, PRISM Saxophone Quartet, and Ensemble Dal Niente, and he is a regular conductor with New York’s Ensemble Moto Perpetuo.

JOSEPH CHOW has been appointed administrative dean for the School of Engineering. He will serve in that position until a dean is named, overseeing all academic and administrative operations. Chow, a tenured full professor in the School of Engineering, joined Rensselaer in 1987, and served as acting chair of the Electrical, Computer, and Systems Engineering Department from 1999 to 2000, and as associate dean of research from 2003 to 2010. His research is in control of large-scale systems, modeling, and control of power systems. He is currently focused on synchrophasor applications in power systems, and he serves as director of the National Science Foundation/Department of Energy Engineering Research Center at Rensselaer.

FRANCINE Berman, professor of computer science and co-chair of the international Research Data Alliance, joined with Google Vice President Vint Cerf to discuss the future of public access to research data in a Science magazine op-ed in August. “Who Will Pay for Public Access to Research Data?” discusses the growing call for greater public access to data resulting from taxpayer-sponsored research.

GEORGE ANSELL ’54, former professor and dean of engineering, and his wife, MARJORIE ANSELL, died Aug. 30. George Ansell, who earned his B.S., M.S., and Ph.D. at Rensselaer, joined the faculty in 1960, rising to the Robert W. Hunt Professor in 1967. He was appointed dean in 1974 and served for 10 years, expanding the school’s focus on graduate education and research. He was published extensively, received several major national awards, and was thesis adviser for some 75 graduate students. He was a fellow of the American Society for Metals, the Metallurgical Society, and the American Institute of Mining, Metallurgical, and Petroleum Engineers. Marjorie Ansell was also a member of the Rensselaer family, working in Institute Advancement.
THE RENSSELAER IDEA
Like electricity, nuclear power, or biotechnology before it, data will shape the next age of innovation and invention. With a bright new IDEA, Rensselaer is positioned at the forefront of this technological revolution.

Our lives are overflowing with data. We leave behind a trail of digital breadcrumbs when we send emails, post photos to the Web, use credit cards, or play video games. Our homes are outfitted with sensors that measure room temperature and the use of gas, water, and electricity. Video cameras, card readers, and keypads adorn our businesses and workplaces. Satellites above us collect data on the weather, and sensors in the ground gather information about earthquakes. Industry and academia are also awash in data. On the Rensselaer campus, students and faculty in every department are generating vast libraries of digital information from their course work and research.

In recent months, many metaphors have been employed to convey the importance and value of data. It has been likened to a natural resource and called “the new oil,” while others declare data a currency and call it “the new gold.”

Professor James Hendler, a world leader in Web science research who advises the White House on Web and data policy, is resolute in insisting data is more than a fuel to be spent or a commodity to be traded. These views, he says, do not accurately celebrate the transformative power of data.

Hendler sees data instead as the stage upon which this century’s biggest technological and scientific innovations will play out. Chemists in the late 1700s started organizing their investigations, which led to a scientific revolution enabled by chemical forces. Similar disruptive periods occurred in the wake of the organization of thinking surrounding electrical forces, nuclear forces, and biological forces. Data, Hendler says, is the force that will enable the next great era of rapid, radical scientific and technological progress.

“Data, or more technically the information derived from data, is the force of the future. Our global society creates data, consumes data, and uses data on a daily basis. But we’re not even close to being able to deal with the sheer volume and variety of data being generated. Organizing this data in such a way that it can be found, accessed, and used more effectively by more people is the challenge that will dominate scientific and industrial progress for at least the next decades,” he says. “We need to learn how to harness the force of data, or we will be left behind as individuals, as academics, and as a nation.”

It is in response to this grand challenge that President Shirley Ann Jackson announced on June 13, 2013, the creation of the Rensselaer Institute for Data Exploration and Applications. Known as the Rensselaer IDEA, the new research institute connects and fortifies the wealth of data-related research taking place on campus—with a specific focus on high performance computing, cognitive computing, Web, network and data sciences, predictive analytics, and immersive technologies—and links this work to actionable applications at the interface of engineering and the physical, life, and social sciences.

“The goal of the Rensselaer IDEA is to access and aggregate a global storehouse of social, cultural, financial, scientific, and engineering information—and then to make it available in a form in which any person, anywhere on Earth, can ask important questions and contribute to emergent hypotheses,” President Jackson said.

The Rensselaer IDEA, led by Hendler, cuts across the university’s five schools and more than a dozen academic departments. The new research institute represents an investment of more than $60 million. It also represents an opportunity for Rensselaer to capitalize on its unique platforms and intellectual capital to bolster its sterling reputation as a global leader in data-related innovation and in moving research breakthroughs from the laboratory to the public sphere.  

BY MICHAEL MULLANEY
“Here at Rensselaer, we will address the hard problems, which we are uniquely qualified to address because of our strengths in engineering, science, design, management and entrepreneurship, and the humanities, arts and social sciences,” says President Jackson. “We will continue to leverage our interdisciplinary approaches to problem solving and educating students, using the new tools and technologies of this data-driven, Web-enabled, supercomputer-powered, globally interconnected world.”

“We are looking to fundamentally change the life cycle of scientific inquiry by infusing it and informing it with leading-edge data techniques,” Hendler says. “This holds the potential to touch every discipline across campus, and in a way that is unique and very special to Rensselaer.”

SEEKING THE TREE INSTEAD OF THE FOREST

Rensselaer faculty researchers and students, past and present, have never been afraid to tackle the biggest, most complex challenges of the day. This audacity, paired with the Institute’s culture of excellence and interdisciplinarity in education and research, is a key factor that enables a bold, strategic endeavor at the scale of the Rensselaer IDEA to take root and grow.

The new institute builds on key Rensselaer strengths: Faculty in all five schools are already pursuing data-driven research. Educational innovation is ensuring students start using data and analytics in introductory courses taken within their first few semesters on campus. Research centers and constellations are developing critical capabilities and intellectual leadership in the use of data in science and engineering. And most important, arguably, are the low walls between engineering and other disciplines on campus.

The situation has evolved, Hendler says, to the point where barriers to collaboration are no longer internal but external to Rensselaer. The university has no cultural or procedural impediments to transitioning scientific discoveries into the realm of engineering, where the breakthrough is refined, documented, and moved forward toward a product or an application.

The challenge, he says, is that very few governmental agencies or private foundations are willing or able to fund this type of long-term project that spans both basic and applied research across traditional disciplinary bounds.

This promotes what Hendler calls “the data forest.” He characterizes the situation as a forest of slender trees drawing upon a shared underground aquifer of data. Each tree represents an individual research project, with the green treetop symbolizing the data-driven end application. (Such an application could be a piece of novel software for modeling metal fatigue at the nanoscale, or a student-created app for wirelessly monitoring home water usage, or anything in between.)

The challenge is that not all researchers are data scientists or computer programmers, Hendler says, nor is it reasonable to expect them to be. This often results in custom-built applications that are valuable to the intended end users, but which are precarious balanced upon project-specific programming techniques that Hendler equates to thin, brittle tree trunks.

Even though the underlying data is good, and the program works, the nature of the solution results in an application that is expensive to maintain, difficult to validate, and oftentimes impossible to share with others. Eventually, Hendler says, these brittle data applications diminish and crumble under the weight of their own complexity and narrow focus.

The Rensselaer IDEA is in the process of reshaping this forest of delicate saplings into one formidable, spectacular redwood. Here’s how the scene changes: Instead of being separate tiny top-heavy trees, the data-driven applications would be branches upon the big tree. And the trunk of the tree would be strong, healthy, and robust enough to support its many branches indefinitely into the future.

Consider this: An astrophysicist’s data, on the surface, looks considerably different from a network scientist’s data, which in turn looks significantly different from air flow and friction data collected by a mechanical engineer. “But from a computer’s point of view,” Hendler says, “the data probably doesn’t look very different.” And while the tools used to collect this data—a telescope, Twitter, a wind tunnel—are remarkably dissimilar, researchers often seek to do very similar things with the information they capture.

This is the opportunity of the Rensselaer IDEA: to create infrastructure, processes, and common tools for manipulating, mining, and sharing data that can be used by faculty members or students from any discipline. This common “trunk” will greatly reduce the
“Just think of all the extra time our faculty and students will have to ponder and extract value from that data, instead of thinking about how to collect and manage it.” JAMES HENDLER
time researchers sink into developing one-off, dead-end applications, and they can instead spend their time on other aspects of the project. Data collected by these applications will no longer go into a dusty digital folder never to be seen again. Rather, this data will be accessible to other researchers and thus could help to spark unplanned, serendipitous collaborations and innovation.

“Think about a civil engineer who, before building a bridge, had to learn to forge metal, pour concrete, and cable suspension trusses. Most of the time is going to be spent creating tools, instead of doing what she’s actually really good at—designing the bridge,” Hendler says. “Researchers working with data today often face a similar situation. They are experts in biotechnology, supply-chain management, or sociology, but much of their students’ time is spent in front of a computer screen trying to use specialized programming techniques to construct a functional application.

“What we want to do is create common tools that are accessible and easier to use, whether you’re a chemist, a mechanical engineer, an architect, or an artist. Just think of all the extra time our faculty and students will have to ponder and extract value from that data, instead of thinking about how to collect and manage it. We will also make it easy for people to share their data, and have access to data sets from across campus, even if it was created in a different department, research center, or school.”

Simply put: The Rensselaer IDEA tends the aquifer and the tree trunk, leaving faculty researchers and students to do what they do best—grow their branches by applying leading-edge science, engineering, scholarship, and technology to the common purposes of life.

POWERFUL PLATFORMS

Along with the collaborative, low-walls thinking that pervades campus, the Rensselaer IDEA draws upon and would not be possible without three unique intellectual and physical platforms: the Center for Computational Innovations (CCI) supercomputing center, the Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC), and the Center for Biotechnology and Interdisciplinary Studies (CBIS).

Each platform was envisioned and realized by President Jackson, and each contributes critical capabilities to what she calls the “computational ecosystem” coalescing at Rensselaer, which ultimately culminated in the launch of the Rensselaer IDEA. The three platforms, Hendler says, largely make up the trunk of the tree.

Located across town in the Rensselaer Technology Park, CCI is the heart of the university’s high performance computing activities. CCI is home to two of the university’s most famous non-carbon residents: AMOS and Watson at Rensselaer.

The Advanced Multiprocessing Optimized System, or AMOS, is the new petascale supercomputing system at Rensselaer. With the ability to perform more than one quadrillion \((10^{15})\) calculations per second, the five-rack IBM Blue Gene/Q supercomputer is the most powerful university-based supercomputer in New York state and the Northeast, and among the most powerful in the world. In addition to massive computational power, AMOS has high-performance networking capabilities with a bandwidth of more than four terabytes per second—more than the combined bandwidth of 2 million home Internet subscribers.

AMOS’s CCI “roommate” is Watson at Rensselaer, a version of the IBM cognitive computing machine that became famous in 2011 for appearing on national television and besting the all-time champions of the game show Jeopardy. IBM provided the system to Rensselaer earlier this year, making Rensselaer the first university in the world to receive such a system. Watson at Rensselaer has a unique ability to understand the nuances of human language and sift through vast amounts of data.

The Rensselaer IDEA aims to leverage the computational horsepower and unprecedented networking capabilities of AMOS, along with Watson at Rensselaer’s unique language skills and capacity to sift through unstructured data, to develop new technologies that enable Rensselaer faculty and students to work with data, whether in traditional databases or in documents on the Internet, at larger scales and in exciting new ways.

One example of this is agent-based modeling—or computational models that can simulate the effects, on a system, of the decision-making of individuals. CCI Director Christopher Carothers says creating an agent-based model of the population of Manhattan, for example, could provide insight into the way human dynamics affect the evacuation of the borough following a disaster, and save many lives. Agent-based modeling would also inform the creation of a smart electric grid, he says, that takes into very detailed account the various individual human responses to price incentives.

CBIS

For nearly a decade, CBIS has been a national pacesetter for fundamental and applied research in biotechnology. Faculty and students within the center have made world-changing discoveries, developed applications, and launched commercial ventures related to a range of globally important topics including drug safety, Alzheimer’s disease, tissue engineering, and regenerative medicine.

Uncharted territory explored at CBIS is at the interface of the life sciences, physical sciences, computation, and engineering. And it is at this frontier where the Rensselaer IDEA will best help advance and elevate the mission of CBIS, says CBIS Director Deepak Vashishth.

The first target will be biologics, Vashishth says, an area of distinct strength within CBIS based on the data-driven understanding of proteomics, protein regulation, and gene regulation. Still an emerging field, biologics has yielded promising new advancements for treating different ailments. It involves using biocatalysis and synthetic biology tools to block or supplement the actions of specific cells or proteins in the immune system.

The use of data-driven approaches also stands to boost research taking place at Rensselaer related to drug repurposing, which looks at existing biologics or molecules already approved by the U.S. Food and Drug Administration or for use in studies, and seeks to identify new ways in which they can be used to treat
different diseases or conditions.

High-throughput screening—a data-intensive technique used to identify the unique protein “fingerprint” of an individual’s healthy or diseased tissue, which can help the process of diagnosing an illness or regenerating tissue—is another area that will benefit from the types of common data toolsets being created within the Rensselaer IDEA, Vashishth says.

These and other research challenges are milestones on the path to truly personalized medicine, where physicians and surgeons are able to make increasingly objective decisions based on each patient’s unique biology and informed by fast, accurate computer simulations.

“Personalized medicine is really the holy grail of biotechnology and other health-related research taking place at Rensselaer and around the world,” Vashishth says. “The importance of data in this endeavor cannot be overstated.”

Another important element undergirding the connection of CBIS and the Rensselaer IDEA is the recently announced partnership between Rensselaer and the Icahn School of Medicine at Mount Sinai. The two institutions announced a formal affiliation agreement in May to collaborate on educational programs, research, and the development of new diagnostic tools and treatments that promote human health. As part of the affiliation, Rensselaer and Mount Sinai will leverage their respective supercomputing systems, and the data technologies realized thereon, to quickly and efficiently produce sophisticated computer algorithms that analyze genomic data and develop predictive models of disease, which in turn can better help diagnose and treat patients.

EMPAC is the platform where the arts, research, science, and engineering meet under the same roof and breathe the same air, says center director Johannes Goebel. Unmatched in the world in terms of its combination of technical capabilities, building facilities, and programs spanning arts and the sciences, EMPAC is also the venue in which the Rensselaer IDEA can be most appreciated via sight, sound, and other senses.

Opened in 2008, EMPAC was designed and constructed specifically to allow groups of different sizes—from one to 1,200 people—to experience and collaborate in immersive environments that can be outfitted with an infinitely customizable modular array of displays, speakers, cameras, and sensor technology. This technology has a direct connection via underground optical fiber to the CCI supercomputers.

Visually representing data, particularly esoteric or large volumes of information, can be challenging for researchers, and can often present a stumbling block for students and faculty as they try to convey the impact and importance of their work to their peers, funding agencies, or the general public. EMPAC and the Rensselaer IDEA are developing next-generation visualization and analytical tools to help make displaying, exploring, and interacting with this data easier than ever before.

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beginning,” Goebel says. “Our research at EMPAC over the years has developed unique approaches and tools, which will benefit the Rensselaer IDEA and contribute to its broad mission in outstanding ways.”

**ETHICS, EDUCATING THE LEADERS OF TOMORROW, AND THE BIG IDEA**

Hendler describes the Rensselaer IDEA as the “integratory fabric” that weaves together CCI, CBIS, EMPAC, and other data-related research taking place across campus. Researchers and students who seek to harness the capabilities of these platforms—a social scientist who wants to run simulations on AMOS, or visualize data at EMPAC—but who may lack direction on how to make it happen, will know the Rensselaer IDEA should be their first destination.

“It doesn’t make sense for each individual to try and quickly become experts in high performance computing, data visualization, or cognitive computing, in order to use these world-class, unique research platforms at Rensselaer,” he says. “We want them to focus instead on the applications they’re building—those branches at the top of the tree—and use our infrastructure for the other stuff. Rensselaer is the only place in the world where these powerful platforms all exist together, and we want to make it easy for students and faculty to exploit the interconnections between CCI, CBIS, and EMPAC to spectacular, world-changing results.”

Rensselaer Vice President for Research Jonathan Dordick says the Rensselaer IDEA is important for strengthening the position of Institute researchers to win grants in the current environment of shrinking federal budgets and heightened competition for funding from government, industry, and foundations. It also helps differentiate Rensselaer as the university seeks to attract the best and brightest students, faculty, and researchers from across the world. Most importantly, he says, the Rensselaer IDEA provides a fundamental framework to use data science and data analytics to address some of society’s most difficult, yet important, problems.

The Rensselaer IDEA has a particular emphasis on helping elevate the leadership of Rensselaer in seven emerging areas of research, Dordick says: health-care analytics, business analytics and intelligence, built and natural environments, virtual and augmented environments, cybersecurity applications, basic research in physical and engineering sciences, and public policy.

The educational aspect of the Rensselaer IDEA is also critical, says Kristin Bennett, a professor in the Department of Mathematical Sciences, who recently received a $550,000 grant from the National Science Foundation to integrate data analytics throughout the undergraduate mathematics curricula and engage freshman and sophomore students in data analytics research. “Our goal is to create the next generation of deep analytical thinkers who can leverage data to solve the most pressing business and societal needs,” she says.

The experience of working on data-related course work and research at CCI, CBIS, and EMPAC—particularly for undergraduates—will be extremely valuable as they graduate from Rensselaer and enter the workforce. A recent study by Gartner Inc. estimates that 1.9 million so-called “Big Data” jobs will be created in the United States by 2015. This workforce—which is in high demand today—will require professionals who understand how to ask the right questions to find insights in data, harness data-exploration, data-crunching, and data visualization technologies, and effectively communicate information found as part of multidisciplinary teams, Bennett says.

In light of the increasing pervasiveness of data and highly publicized persistent widespread concerns over the security of data, Hendler says the Rensselaer IDEA is working with the School of Humanities, Arts, and Social Sciences to develop a framework for addressing digital ethics. The goal is to challenge students with ideas about balancing security and profit or progress, and to help them become acutely sensitive to the personal, professional, and policy-level implications of the privacy issues that arise when dealing with potentially sensitive data.

Overall, the Rensselaer IDEA is empowering students and faculty with the ability to make intelligent use of the best tools available to inform their decision-making and help produce a range of discoveries and applications to change the world for the better.

“Rensselaer has an innovation mindset that is unique to the very best universities in the world,” Hendler says. “With the Rensselaer IDEA, we now have a data-forward mindset that is also rare in academia. We are ahead of the curve, and in a very strong position to be a leading force in helping to shape the innovations of the data revolution.”
Rensselaer's applied mathematicians are harnessing mathematics to support engineering and scientific pursuits for the good of our 21st-century world.

One of Math Professor David Isaacson's biggest career triumphs came one day in the late 1990s as a young female auto accident victim struggled to survive in an Albany hospital. An experimental electrical sensing system developed by Isaacson and several Rensselaer colleagues proved its mettle by detecting a collapsed lung (although he didn’t know it at that moment) before other conventional diagnostic means discovered it.

BY MARK MARCHAND
As part of our ongoing tests, we had been monitoring her lung function with our latest system and we kept seeing a dark area where the right lung should have been. We weren’t sure what that meant. Maybe, we felt, there was something wrong with our system. A little later on that day, as doctors sought to learn why the patient was still struggling, X-rays showed a collapsed right lung, confirming that as we monitored lung function in real time, we were indeed detecting a major problem,” explains Isaacson, talking about some of the early breakthroughs he and others at Rensselaer achieved with a system called electrical impedance tomography (EIT).

The experimental system, based on computed solutions of sophisticated mathematical models involving partial differential equations, generates “live” images of heart or lung function by measuring electrical impedance, or resistance—without the use of more established techniques such as X-rays or MRIs. Sensing electrodes placed on a human body, similar to much more basic electrically based diagnostic tools such as EKGs (which only produce line tracings representing heartbeats), are connected to an EIT system to produce detailed images that have the potential to vastly enhance diagnostic efforts.

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“Applied mathematicians start with a different drive,” Kramer says. “Rather than pursuing an idea for the sake of innate beauty and harmony, they often start with a motivating problem from the sciences and other disciplines, and then apply mathematical techniques to help understand the problem, and eventually to help solve it. Applied mathematicians delve into phenomena and try to explain them by building detailed models and simulations that lead to a better understanding, in a more quantitative manner,” he says. “We can’t take into account every detail of how something works, but we keep what we believe are the important parts to build a model that helps us predict future behavior.”

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...I believe that by applying our expertise we can make a huge impact in an important new frontier of medical and health research.” — KRISTIN BENNETT
in response to hypothetical scenarios of future carbon emissions and other potential disturbances.

“As I moved from studying physics in college to focusing on math, part of the motivation was designing computational methods to simulate models for things that people care about, such as weather, and this path led me to applied math,” he says.

Kramer’s research explores problems related to cellular biology. One of three primary areas he studies involves how components of a living cell move from one area to another, known as intracellular transport. Partnering with researchers at Rensselaer and elsewhere, he seeks to help broaden the understanding of the movement of cell components along microscopic highways within cells, known as microtubules.

“This is especially critical within neurons, some of which are quite long,” Kramer says. “How are neurotransmitters produced in the cell body delivered in appropriate amounts to the synapses far away in the axons?”

This area of research is similar to another topic Kramer is exploring with math colleague Gregor Kovacic and external collaborators: developing mathematical models to analyze dynamical features of networks of neurons to better understand higher-level brain functions.

A third topic of active interest is the analysis of the collective behavior of systems of microorganisms—such as bacteria—in a fluid. This research could aid in understanding how to use bacteria as power sources for micromachines.

**Understanding a medical scourge most consider eradicated**

For Professor Kristin Bennett, her long-term pursuit of problems in mathematically based artificial intelligence techniques has established her as a leading mathematical expert helping to advance the medical and molecular epidemiology of tuberculosis (TB). Her particular area of focus is the extraction of meaningful trends from large amounts of data using mathematical models that help answer important questions. Her research efforts, which have received funding from the National Institutes of Health (NIH) and other agencies, have played a critical role in TB-related decision-making here in the U.S. and elsewhere.

“TB remains the seventh-leading cause of death in the world, but many here in the United States don’t think of TB much when it comes to communicable diseases,” she says. “TB is still a major problem in prisons here and in the general population in many other parts of the world … and now we’re seeing the emergence of more drug-resistant strains of TB … often linked to HIV cases.”

Using sophisticated mathematical models, Bennett and her colleagues build data visualizations of infection information and clusters that help other scientists understand the source and DNA fingerprint of certain strains of *Mycobacterium tuberculosis*—the bacteria that causes TB—and help make overall decisions on where to allocate resources to fight outbreaks. Similar to the manner in which certain flu strains are identified and tracked, many of the optimized data displays—generated from reams of previously difficult-to-understand data often from many different sources—built by her and her team are critical to battling the disease.

In a 2011 paper, for example, Bennett, Computer Science Professor Bulent Yener, and several graduate students explored a range of publicly available Web-based tools to help develop a better approach to effective tracking and control of TB. Through the overlaying and interpretation of TB data onto geographic images and other types of charts, their work has helped many in the field to better understand the genetic diversity of the disease, the source of outbreaks, the development of potential new vaccines, and the development of better surveillance and control programs.

While much of her research work has been related to TB, Bennett is also focusing on stem cell research. Working with Yener again, as well several graduate students and Biology Professor George Plopper, she crafted a 2007 paper on how advanced math and data analysis can be applied to better understand the mechanisms of how human mesenchymal stem cells (hMSC)—one of the most well-known types of human stem cells with the potential to differentiate into seven different cell types—accomplish their transition to other types of cells. The researchers utilized a technique known as three-mode tensor analysis to better understand and identify the cell mechanisms affiliated with the process of hMSC cell differentiation into new cells that could be used in tissue repair or, potentially, regeneration of nerve tissue.
“It is in this field where I believe that by applying some of our expertise we can make a huge impact in an important new frontier of medical and health research,” Bennett says.

**Finding inspiration for research at home**

As Isaacson continues his work today, he is often asked what inspired him to focus on research in health-related areas in the first place. He is quick to explain that the decision was based on two events that impacted his family: a heart attack suffered by his father and his wife’s breast cancer diagnosis. Those events fueled a desire to find new ways to monitor organ function in real time and to utilize the new techniques to branch into better diagnostics for cancer. He says he even encourages his own students to find new targets for research in this area.

His electrical impedance tomography (EIT) system—developed with now Emeritus Professor Jonathan Newell of Biomedical Engineering, and Electrical, Computer, and Systems Engineering Professor Gary Saulnier—was sparked by a desire to better monitor heart and lung function as they worked, instead of time-consuming X-rays and MRIs. In addition, patients could avoid overexposure to X-rays, which can be harmful over time.

What was needed, Isaacson explains, was a way of measuring electrical current and translating it into something useful after it passed through parts of the body. The answer began with a set of partial differential equations known as Maxwell’s equations. In existence since the mid-19th century, these equations have long been used to describe electrical currents. Isaacson and his teammates designed specific equations that could describe the electrical flow, and then produce a moving image on a computer screen. The electrical current is measured from sensors placed at various points on the body, in much the same way the simpler EKG has worked for years.

“We started out trying the EIT system on gelatin-based molds and graduated to more sophisticated second and third versions, which was where we were—after a lot of trial and error—when we had the breakthrough with the auto accident patient in Albany,” he says. Along the way, Isaacson’s group picked up funding from the National Science Foundation and National Institutes of Health.

Following his wife’s diagnosis, Isaacson and partners began to focus on designing and testing similar systems that could help better detect cancer cells. (She’s doing quite well these days.) He started by trying to find a way to better differentiate benign cysts or lumps from real cancer. Doctors and patients are often frustrated because some 70 percent of patients for whom an abnormality is detected during a mammogram go through the trauma of a biopsy, only to discover they don’t have cancer.

“Applying some of the same lessons we learned with organ monitoring via electrical impedance, we found our system could sometimes distinguish a benign lesion within a breast from one that was cancerous,” he says. “We’re still working on this now but we feel this has the potential to prevent a lot of unnecessary biopsies.”

**Math students and real-world challenges**

For students, the benefits of studying math with teachers like Bennett, Isaacson, and Kramer are self-evident. As they learn core math basics, they are exposed to the promise of how their math skills can solve real-world problems, says Math Department Head and Professor Donald Schwendeman.

Originally focused on aerospace engineering as an undergraduate at the University of Michigan, Schwendeman understood that aero and other engineering disciplines used a lot of math, so he expanded his studies there, eventually deciding to pursue graduate studies in applied math at the California Institute of Technology.

“In the 1960s and 1970s, a lot of the good applied mathematics programs, such as ours, actually grew out of engineering programs where the use of math to address problems in continuum mechanics was critical,” he says. “While studying at Michigan, I was exposed to several faculty from Caltech who opened my eyes to focusing on applied math.”

Beyond the classroom and involvement with faculty who actively pursue applied math research, Schwendeman points to two programs where graduate students and faculty work together to solve industry problems using math: the Mathematical Problems in Industry (MPI) Workshop and the Graduate Student Mathematical Modeling (GSMM) Camp.

The annual MPI Workshop was first held at Rensselaer in 1985 and has drawn interest from companies ranging from Corning to GE to IBM, which participate by presenting real problems from their businesses and then challenging faculty and students to collaboratively solve them. Since 1985, the MPI Workshop has grown from a relatively small Rensselaer event to a much larger one that now involves other hosting universities.

The GSMM Camp was added in 2004, enabling participation from graduate students. Schwendeman has been the driving force behind this effort, having served as organizer since 1993. Today, both programs receive support from NSF and are held annually during two successive weeks in the summer.

“The combined program involving the MPI Workshop and GSMM Camp is an excellent example of applied mathematicians solving real problems, and this program is unique among universities in the U.S.,” says Schwendeman.

An example of the problems tackled during the MPI Workshop is from 2011, when Corning presented a challenge related to the manufacturing of glass optical fibers. Scientists at the...
company were seeking more advanced mathematical models for the thermal properties of glass as it is drawn through a furnace. Faculty and students at the workshop formulated models and obtained solutions that provided valuable insights into the detailed thermal properties of the fibers.

The camp, which runs during the week before the workshop, focuses more on graduate student education and career development. Typically, 32 students attend the camp and work in groups of eight. Each team works on an interdisciplinary problem to develop problem-solving skills that can be used at MPI, with an emphasis on mathematical modeling and analysis. While the real-world problems presented at the camp are not as difficult as those at the workshop, students learn how problems are solved, with an eye toward gaining skills that could be used at the workshop and elsewhere. Among the problems students have been presented at the camp were challenges related to geothermal energy harvesting, drug-delivery systems, fuel cells, and curtain coating of ice cream bars.

Another strong feature of the Rensselaer applied math department, according to Schwendeman, is the Inverse Problems Center, directed by Ford Foundation Professor Joyce McLaughlin. The center brings together an interdisciplinary group of researchers from mathematics, geosciences, mechanical engineering, civil engineering, and electrical engineering. The center solves problems by essentially working backward from indirectly observed phenomena to find objects, materials, and/or biological properties that cannot be directly measured.

Examples of problems addressed at the center include finding properties of the Earth’s substructure by observing seismic measurements, finding tumors in biological materials by measuring electric current or by measuring how tissue displaces when pushed, and determining the integrity of dikes using both radar measurements and dike displacement measurements.

“At the core of this important center is tackling identification problems where it is either not possible or desirable to make direct measurements to make the identification,” Schwendeman says.

The department head’s own research involves developing numerical algorithms for the solution of mathematical models for a variety of problems, a branch of applied math known as computational mathematics. His recent work, in collaboration with researchers at Lawrence Livermore National Laboratory, has dealt with the design and study of new algorithms for accurately predicting the interaction of fluids and structures. This work has applications in a number of areas, including the flow of blood through veins and arteries, and the interaction of air and the blades of wind turbines. Schwendeman also works with Ashwani Kapila, a professor in the department, and collaborators at Los Alamos National Laboratory on mathematical models and numerical algorithms for the study of reactive materials.

“The materials we study are very heterogeneous and complex, and developing mathematical models that enable a predictive capability for dynamical behavior, such as shock waves and detonations, is a very difficult task,” says Schwendeman.

The department today

The Department of Mathematical Sciences has grown to 230 undergraduate students and nearly 60 graduate students, who study and conduct research with approximately 20 members of the faculty. The graduate students who help in teaching also have been recognized for their efforts. In particular, over the last few years the annual award for the best teaching assistants (TAs) in the School of Science has gone to TAs in mathematical sciences, Schwendeman says. “And, we have earned widespread international recognition as a leader in undergraduate education by emphasizing computing-enriched, student-centered interactive learning.”

“Students who graduate from Rensselaer with a degree in mathematical sciences are in great demand in industries from finance to aerospace to oceanography,” says Leshin. “Many of our graduates find immediate employment for their skills in mathematical modeling and problem-solving, while others choose to deepen their knowledge through graduate programs. Their success in worldwide competitions such as the Mathematical Contest in Modeling is just one demonstration of the quality of the education they are getting here, and I fully expect that these students will go out and change the world.”
The recent proposal for a fantastical new mode of travel has brought back memories of a Rensselaer professor’s bold idea from a half-century ago.

BY JANE GOTTLIEB
WHEN BILLIONAIRE AND INVENTOR ELON MUSK convened a press conference in August to announce his vision for an above-ground transit system capable of whooshing people through tubes from city to city at close to 800 mph, the world paid attention. Musk, a 42-year-old entrepreneur, had followed through on improbable ideas before, as founder of SpaceX, a company that hopes to prepare people to live on other planets, and co-founder of Tesla Motors, the profitable electric car maker. The concept this time, which Musk named Hyperloop, represented an entirely new way of moving people and goods, through solar-powered tubes mounted on columns 20 feet or so above ground.

Publications ranging from The New Yorker to The New York Post splashed words about Musk’s bold plans across their pages. Tech analysts marveled at Musk’s audacity, or questioned the likelihood of a Hyperloop ever, literally, getting off the ground. After Musk’s big announcement, emails also started flying among Rensselaer aeronautics alumni who had done more than read about the train-in-a-tube concept. Fifty years earlier, in a basement lab of the Ricketts Building, they had worked on a system eerily similar to Hyperloop, under a soft-spoken professor with a slight Italian accent and Ph.D.s in both mechanical and electrical engineering.

Professor Joseph Foa, who headed Rensselaer’s then-aeronautical engineering and astronautics department, was an authority on jet propulsion who had significant inventions under his belt and a commitment to applying engineering to civic life. Foa was confident his system, named Tubeflight (or Tube Flight), could greatly improve intercity transit.

And the recent news about something that looked and sounded so similar sparked vivid, if incomplete, recollections among his onetime students. The Rensselaer aero alumni, all men, and in their 70s, note that Foa’s and Musk’s systems were each premised on moving a vehicle through stationary air within a tube, at jet speed. They recalled experiments measuring the acceleration of an object shot through a tube. One aero graduate said he had been assigned to design a vehicle that could respond to emergencies in a tube. Another said he had helped construct a test track off-site.

“I certainly remember Foa’s Tubeflight ideas and thought the very same thing when the Elon Musk tubeflight stuff hit the news,” notes H. George Hausch ’63. “RPI had that idea back in the ’60s.”

“I remember Dr. Foa with a sense of deep respect, not just for his technical prowess, but also for his kindness and humanity. A great man,” says Francis Coleman ’63, who attached a photograph to the email of himself posing next to a great metal tube used in a Tubeflight experiment. “When I saw the proposal for the people-mover in California,” he said later in a telephone interview, “my first thought was, ‘Oh my God. It’s happening, at last.’”

Like Musk, Foa inspired headlines and fed the imaginations of a public captivated by the idea of a different, more streamlined, tomorrow. Five decades apart, the two men challenged the status quo, most notably what each considered the nation’s terribly inadequate rail system. They both dangled the carrot of traveling from Boston to Washington (or San Francisco to Los Angeles) in a lunch hour.


But today, there is no straight line between the inventions, if any connection can be documented. Musk did not respond to several emails asking whether he had studied the work of Dr. Joseph Foa at Rensselaer Polytechnic Institute, or any particular aeronautics research from the 1960s. Foa died in 1995, at 87, a celebrated figure with 75 technical papers, a widely used textbook, and seven patents to his credit. When he left Troy in 1970 to join the faculty at George Washington University, he told a local newspaper he was confident tube train research would continue at Rensselaer. And, that “there is little question that Tubeflight offers the best compromise” to mass transit problems.

But in spite of the PR, a patent, publications, and some high-profile government contacts, the research at Rensselaer ended as funding dried up. Its legacy remains elusive. While some of the...
The Tubeflight concept utilized a "bladeless propeller" technology; the conical nose of a scale model vehicle as it proceeds through a tube; Joseph Foa with an early Tubeflight prototype.
students and collaborators doubt that government or private industry picked up any of the concepts, others say the possibility cannot be ruled out.

Among them, Francis Coleman recalls a lengthy proposal for an underground system—bearing a striking resemblance to Foa’s proposal—being sent in 1965 from Grumman Aircraft (now Northrop Grumman) where he worked, to the federal Office of High-Speed Ground Transportation. “We submitted a large proposal to the federal government, which as I recall was based on Dr. Foa’s technology—using large manta-ray-like vehicles to whiz all over the USA in underground vacuum tubes,” says Coleman, who went on to become a lawyer working in technology.

At that time, Tubeflight was among numerous such concepts being eyed to thrust the U.S. into the future. Planners and politicians wondered why jets moved so rapidly while most Americans relied on transportation that plodded along. Proposals included torpedo-shaped carriages riding on air in place of wheels, and systems that sped passengers through tubes or pipelines, above ground, on the surface, or underground.

“There is considerable urgency about exploring such schemes because without some really radical solution, the day may not be far off when movement between cities in some densely populated regions will slow to the pace of a crosstown taxi ride in Manhattan,” The New York Times proclaimed in a 1966 story detailing the slate of radical new solutions.

In a field of contenders described as a “magic highway,” “dream train,” and “futuristic”—concepts even mentioned in science fiction—Foa’s tube system was often singled out, in part because unlike conventional rail, it could be constructed anywhere people needed to go. Also, Foa said that a New York to Washington, D.C., link was even possible six years or so after early tests were concluded.

But today, any driver stuck in a Beltway bottleneck might be

“TODAY IS MORE LIKE THE EARLY 1960S... WE NEED TO move FORWARD AND THERE IS A LOT OF CONCERN THAT INFRASTRUCTURE HAS TO MODERNIZE.”
surprised to learn of the momentum building for better alternatives back in the Johnson administration.

Historians who study technology note that the push for never-before-tried innovation is often followed by a lull brought on by changes in the economy or national priorities. Foa developed Tubeflight during one such peak time, when cities were growing congested and the U.S. was looking over its shoulder. Japan had just developed the world’s fastest Shinkansen, or bullet, train; and Russia had pushed ahead in space with Sputnik. President Lyndon Johnson signed the High-Speed Ground Transportation Act to spark research and development.

“In the early 1960s, there was a strong idea that technology could solve the world’s problems. People were thinking of all kinds of radical new things, a lot involving national systems,” notes Atsushi Aker, an associate professor in Rensselaer’s science and technology studies department. “But the priorities shifted when you had the angst of the Vietnam War. In the 1980s and ’90s the government chose not to invest in big public projects.”

And now, it appears Elon Musk has come along during another peak. “Today is more like the early 1960s,” Aker adds. “We have the United States saying we need to move forward and there is a lot of concern that infrastructure has to modernize. Now we are also thinking about energy issues. We’re talking about it again.”

MUSK, WHO STUDIED BOTH PHYSICS AND ECONOMICS AS AN UNDERGRADUATE, IS CUT FROM THE INTERNET MOGUL CLOTH. He quit a Stanford University Ph.D. program in energy physics to join the boom. At age 29, he launched Zip2 Corporation, which provided content for new websites, and, two years later, co-founded PayPal, the ubiquitous digital payment system, which was acquired by eBay. SpaceX and Tesla—ventures in space and here on Earth—followed.

Musk has become known for making brash predictions and inserting himself into the equation. With Hyperloop, he not only bashes the $70 billion California high-speed rail system in the works as archaic, but challenges investors to throw billions of dollars behind his own, untried alternative.

As for the inventor of Tubeflight? “My father wasn’t a salesman,” says Lelia Walker, the eldest of Joseph Foa’s four daughters. “He had so many patents and inventions, but he was a professor. He worked on his grants and contracts and presented his work to whoever wanted to use it, or not.”

Her father wasn’t even a tinkerer. Rather than work with tools in a garage, Walker pictures him seated at the big desk of his study at home on Point View Drive in Troy, surrounded by his books, lesson plans, and designs. She says he was also a scholar of music and art who made frequent visits to museums in New York and Washington (where some of his papers and photographs are now housed at the Smithsonian’s National Air and Space Museum archives).

Born in Italy to a prominent Jewish family, Foa earned doctorates from the Polytechnic Institute of Turin and the University of Rome. He launched a vigorous engineering career that included working with aerospace manufacturer Piaggio. Among other projects, he designed the Piaggio P23 R plane, which set a speed record in 1939.

That same year, at age 30, Foa fled Italy via steamship in order to escape the oppression and anti-Semitism under Mussolini. After arriving in the U.S., he worked for the Bellanca Aircraft Corp., Curtiss-Wright Corp., and the Cornell Aeronautical Laboratory, all in Buffalo. He moved his family to Troy in 1952 to teach at Rensselaer, becoming head of the department six years later.

Some of his students and colleagues surmise that Foa’s devotion to engineering was in part a response to democracy. “He fled for his personal safety and continued his research in order to use technology for the public good—to improve the lives of free citizens,” says Coleman. “I am quite certain he viewed travel in a tube as one such concept.”

FOA EXPLORED TUBE TRANSPORTATION AS FAR BACK AS 1947, conducting basic research in his spare time at the Cornell Aeronautical Laboratory. For more than a century, pneumatic tubes had been used to deliver mail and messages from offices to plants. They moved an object by pushing air through the tube, and could not work well at high speed or great distances.

But with Tubeflight, Foa planned to propel the vehicle by transferring air from ahead of the car to the rear. “The transfer is the process by which the motion of the vehicle is produced and maintained, not the consequence of a motion that is produced by other means,” he wrote in 1964 in the Rensselaer Review.

The tubes carrying passengers the farthest—and moving fastest—might be made of aluminum. Those making more frequent stops, say from Albany to New York, would be constructed of clear plastic with windows. An artist’s rendering of a city retrofitted with Tubeflight shows see-through tunnels lacing together the dark architecture familiar in the Northeast. And articles published at Rensselaer and elsewhere reflect the hopes pinned on these tubes.

Tubeflight would not just get people where they wanted to go nearly instantly—Albany to New York in half an hour—but perhaps be activated by rider need instead of a rigid schedule. The new transit system might also spark urban planning by organizing neighborhoods around tube stations. People in small towns, in turn, would gain access to more opportunities. The countryside would be preserved. The tubes could work around forests and farms.

The popular press sometimes characterized tube transit, with its “bullet-shaped vehicles” that “floated on a cushion of air,” as within reach in the near future. But people working on the project said Tubeflight was actually in its early stages, even as strides were made. “I’d say we were maybe 10 percent along,” says Professor Emeritus Robert Duffy ’51, who worked on the project with Foa, and after Foa left Rensselaer. “You can see in our reports that we showed it was possible, that it could be done. [But] we didn’t get far enough in the experimental stage.”

As work progressed, Tubeflight was clearly a centerpiece of Rensselaer research, with momentum that reached well beyond Troy. In 1965, Foa drew coverage in The New York Times when he was granted a patent for his methods of propelling torpedo-like cars through tubes. The research was supported by the Army.
and the Department of Commerce, under the high-speed ground transportation act.

Soon, the project grew beyond the lab at Ricketts. Using a $225,000 Department of Commerce grant, Rensselaer leased land from New York Central Railroad along the river in the city of Rensselaer to build a track where Tubeflight’s feasibility could be studied.

Duffy, among the surviving engineers on the project, recalls a 1,000-foot-long track. A test vehicle used model airplane motors with air pumps on them to keep the vehicle from touching the tube wall. Unlike the futuristic sketches circulated in newspapers and magazines, there was not much to see. The tube used in the scale model was not transparent. “It was a metal tube, an experiment,” Duffy says.

The Tubeflight concept was presented at conferences showcasing the top high-speed transportation proposals from around the world. Some analysts said it joined a short list of those capable of moving at more than 300 miles an hour.

Its prominence was also made clear in October 1968, when Senator Claiborne Pell, the Rhode Island Democrat who was a chief proponent of the federal high-speed transportation bill, visited the site. An internal Rensselaer memo cautioned that logistics could be complicated by the landscape, “a plain-like terrain makes it a windy, cold place.” Coffee and doughnuts were to be offered. A newswire story reported successful results. Pell witnessed Rensselaer engineers send a vehicle powered by a two-horsepower engine through a 200-foot tube.

Duffy says Tubeflight progressed further than many of the experimental transit ideas being tried at that time because of Foa. “The head of the program was the guy who had the idea and the patent and things of that nature,” he says. “It was slow, but we got the program working—a test site and research working before many of the others.”

He says the team was ultimately able to resolve how to suspend vehicles in a tube, by using air cushions. “We added three pads in the front and three in the rear, around the vehicle, and that suspended it, like a hovercraft,” Duffy explains.

Left unresolved was how the propulsion system would actually work with a full-scale vehicle. Also, “What we were working on was how to safely stop the vehicle,” recalls the professor, who was responsible for measuring the drag of the vehicle. “You could get it up and down the tube but you really didn’t have a good way of stopping it.”

**WHEN FOA’S DAUGHTERS** heard that Elon Musk planned to announce an idea reminiscent of Tubeflight, they decided to contact him. “We said, ‘Let’s write and ask if he would at least give my father credit,’” says Lelia Walker. They sent a letter and did not hear back. They are not sure their correspondence went to the correct office. “We have no doubt in our minds” that Hyperloop originated with Tubeflight, she says. “Our father had the patent and all the articles, but he gets none of the credit.”

How, they wonder, could Musk or his advisers not have read the articles and papers on Tubeflight and reviewed the patent? A long list of writers had the same question. Immediately following Musk’s announcement, many proclaimed that Hyperloop really was Tubeflight.

And the news prompted Foa’s former aero students to wonder about the details of the project they had taken part in in Ricketts Hall. Through email, they wondered if their professor’s system had used a disc at the end of the tube, which ruptured as it exited. They speculated on whether the system might have employed a bladeless propeller (a Foa invention) within the tube. They wondered whether Tubeflight was ever eyed as a boost system for missiles. And they wondered what features Hyperloop might employ.

“Hyperloop looks like Tubeflight. But there are numerous ideas out there at once,” says Robert Ormiston ’63, a rotorcraft researcher for the U.S. Army who read Musk’s technical notes for Hyperloop and saw both similarities and differences to Tubeflight. “I agree it would be hard to believe that Musk and his people were not aware of Foa’s history. He had studied the concept far, far deeper than anyone else had.”

Musk’s audacious new proposal has prompted Ormiston to delve into Foa’s work. He has reviewed the Tubeflight patent, U.S. 3,046,732, and another one, for Foa’s bladeless propeller. In them, Ormiston glimpsed the inventor’s precision and clarity.

“I could see his style and almost hear his voice,” he notes.

Rather than see their mentor short-changed by the resurrection of tube transit, he and others see the world circling back to the ideas that mattered to him. And Foa’s widely circulated papers and articles are likely to play a role, if they have not already done so. “The whole idea of getting a patent is getting information out of people’s heads—out of secrecy and into public domain,” says Coleman.

Duffy says that Tubeflight research at Rensselaer ended in the 1970s as the government curtailed funding high-speed transportation and folded its functions into other agencies. But packing it away was not seen as a failure. It was science. He notes that whoever picks it up next can benefit from electrical batteries and Internet data that were not available when he and Foa were working on Tubeflight.

“The ideas just keep going on around and around,” says Duffy, who retired from Rensselaer in 1990 after 37 years. “And if you have an idea and worked on it and it doesn’t come out the way you want, someone will take the same idea and work on it in 10 or 20 or 30 years.”
With a $225,000 Department of Commerce grant, Rensselaer leased land from New York Central Railroad in the city of Rensselaer to build a 1,000-foot-long track where Tubeflight’s feasibility could be studied. In October 1968, Foa and his team demonstrated the technology to Senator Claiborne Pell (above, second from right), the Rhode Island Democrat who was a chief proponent of the federal high-speed transportation bill.

PLANNERS AND POLITICIANS WONDERED WHY JETS MOVED SO RAPIDLY WHILE MOST AMERICANS RELIED ON TRANSPORTATION THAT PLODDED ALONG.
The Rensselaer Alumni Hall of Fame inducted its newest class at a ceremony held on campus Oct. 4. The four new members include a housing reform pioneer, the co-founder of the Seabees, a power electronics innovator, and an esteemed dean of humanities and social sciences.

B. Jayant Baliga, Ph.D. ’74, inventor of a revolutionary switching device, in his acceptance remarks recalled having written on his graduate application that his goal in life was to create a technology that would be beneficial to mankind. “The fact that this dream has actually come true is in no small measure due to the education and inspiration that I received here at RPI.”

Family members of Alfred Tredway White, Class of 1865, Lewis B. Combs, Class of 1916, and Thomas W. Phelan Jr. accepted the awards on behalf of their honored relatives, each sharing heartfelt, gracious remarks.

Sylvia Van Sinderen said that even though she never met her great-grandfather, housing reformer Alfred T. White, she shared his dreams of a better world. “His alma mater gave him essential tools to help improve the quality of life for many.”

Read about the newest members of the Alumni Hall of Fame on the following pages.
Alfred Tredway White (1846 -1921) was a leading American housing reformer and philanthropist in the late 19th century. An engineer by training and a businessman by practice, he became deeply concerned with the living conditions of the working poor through his work with Brooklyn’s First Unitarian Church. Appalled that the death rate in tenement districts exceeded the general rate of population growth, White proclaimed: “Well it is to build hospitals for the cure of disease, but better to build homes which will prevent it.”

In 1877 he constructed in Brooklyn the first model tenements in America, which set new standards for tenement housing in their attention to architectural beauty, open space, sunlight, ventilation, and fire safety. White’s lifelong work on behalf of the city’s poor population stemmed from a conviction that success, health, community, and the built environment were fundamentally interrelated, and that investing in the living conditions of the working poor could be both transformative and profitable. He advocated for a “philanthropy plus 5 percent” business model which turned a modest profit, and persuaded other landlords to enter the market for low-income housing. His financial success and public advocacy of his cause influenced passage of New York tenement reform legislation. White founded charities dedicated to children’s aid and medical care, greatly reducing infant mortality, and created the Brooklyn Botanic Garden, which brought green space, gardens, and community to the neighborhood’s poor. At his death, White was eulogized as “the great heart and mastermind of Brooklyn’s better self.”

Lewis B. Combs (1895 -1996) was co-creator and director of World War II’s legendary fighting Seabees, who rapidly built docks, landing strips, and other critical facilities, often under fire, in every theater of operation during the war. Combs served the Navy with distinction for 31 years, attaining the rank of rear admiral. A leader in the Navy’s Civil Engineer Corps (CEC), he oversaw an unprecedented construction program to provide the public works and utilities for Navy operations in the United States and for a far-flung network of bases overseas.

In 1942, this work included organization of the Naval Construction Battalions (CBs), known as the Seabees, an entirely new branch of the naval service that expanded to 250,000 by war’s end. “The Seabees can do the difficult immediately,” said Combs. “The impossible takes a little longer.” “Can Do” became a motto of the Seabees.

Combs played a major role in the development of floating dry docks, which enabled the quick return to battle of impaired ships and saved many American lives. In 1946 President Truman awarded him the Distinguished Service Medal, citing him as “a brilliant engineer and inspiring leader.”

Upon his retirement from active duty in 1947, Combs joined the faculty at Rensselaer, where he served as head of the civil engineering department for 15 years. Besides the regular undergraduate and graduate programs, he oversaw the CEC Qualification Program for Naval and Coast Guard Academy graduates, several of whom went on to become U.S. Navy chiefs of civil engineers.
B. Jayant Baliga

Power-saving device reduces energy consumption and consumer costs

B. Jayant Baliga is an internationally recognized expert on power semiconductor devices, best known for his invention of the insulated gate bipolar transistor (IGBT), a power-saving semiconductor device that has revolutionized the field of power electronics. With high efficiency and fast switching, the energy-saving device controls the flow of power from an electrical energy source to any application that needs energy, and is widely used in transportation, lighting, medicine, defense, and renewable energy generation systems.

The IGBT, which Baliga developed while working at General Electric in the 1970s, is used in appliance controls, robotics, medical systems, automotive ignition, electric and hybrid cars, and bullet trains. Consumers use his technology every time they turn on a TV, power up a computer, or switch on the air conditioning. The IGBT is used in compact fluorescent lamps and has enabled the development of compact, light-weight defibrillators used to resuscitate cardiac arrest victims.

“The improved efficiency that comes with using the IGBT has saved consumers 50,000 terawatt hours of electricity—that’s as much electricity as produced by 600 coal-fired plants—and it has reduced gasoline consumption by one trillion gallons,” said Baliga.

“This has translated to a cost savings of over $15 trillion and a reduction of carbon dioxide emissions of 78 trillion pounds.”

Among his many honors, Baliga was named one of “eight heroes of the semiconductor revolution” by Scientific American magazine in 1997. In 2010 President Obama awarded him the National Medal of Technology and Innovation.

Thomas W. Phelan

Beloved dean inspired love of history, culture, humanity

The Reverend Thomas W. Phelan (1925 - 2006) devoted more than four decades of his life to Rensselaer as chaplain and dean of humanities and social sciences. He was a professor, dean, historian, champion of the arts, and esteemed counselor.

Phelan began his long association with Rensselaer in 1959 when he was named the resident Catholic chaplain. His legacy to Rensselaer includes building the award-winning Chapel + Cultural Center, which was added to the National Register of Historic Places in 2011.

He was named dean of the School of Humanities and Social Sciences in 1972 and served an unprecedented 23 years as its leader. As dean he transformed a traditional liberal arts curriculum into a cross-disciplinary program focused on bridging the humanities and social sciences with science and technology. He created the Department of the Arts, a forerunner in electronic arts education, and the Department of Science and Technology Studies, the first in the country.

Phelan was a historian and scholar, who studied American material culture as it is reflected in the nation’s industrial heritage, and was a champion of preservation efforts. An advocate for the arts, he served as president of the Catholic Art Association, and was named a fellow of the Society for the Arts, Religion, and Contemporary Culture in 1972.

Countless individuals were touched by Phelan’s calling to connect with people. “He had a presence that was larger than life,” said his niece, Eileen Howe Bird. “He left an indelible impression on the Rensselaer campus and his spirit continues to live on.”
Theta Xi was founded at Rensselaer, making it the Alpha chapter of the fraternity. It is the only fraternity founded during the Civil War, and has been in continuous operation since then. Notable Theta Xi graduates include Rensselaer President Palmer C. Ricketts, Class of 1875, and three members of the 1954 NCAA national championship hockey team—Gordon Peterkin ’55, Martin Karch ’56, and C. Lloyd Bauer ’55. The chapter also boasts seven members of the Rensselaer Alumni Hall of Fame—Ricketts; television pioneer Allen B. DuMont ’24; “father of the Civil Engineering Corps” Mordecai T. Endicott, Class of 1868; a founder of American geology, noted paleontologist James Hall, Class of 1832; Rensselaer’s most prolific civil engineer of the 20th century, Emil Praeger ’15; William H. Wiley, Class of 1866, noted scientific and technical publisher; and titanium pioneer Matthew A. Hunter ’49 (Hon.).

Campus locations named for Theta Xi brothers include the Darrin Communications Center and the Darrin Fresh Water Institute, named for Margaret and David M. Darrin ’40, and the Folsom Library’s Fischbach Room, named for Jerome Fischbach ’38.

Theta Xi will celebrate the 150th anniversary of its founding on campus in April 2014. They will also host the Theta Xi National Convention in Troy in August 2014, and at that time a new memorial will be dedicated near the Ricketts Building.

Delta Phi was the 11th Delta Phi chapter to be established following the fraternity’s birth in 1827 at Union College. The chapter has produced three Rensselaer presidents: Livingston Houston ’13, George Low ’48, and Neal Barton ’58. Houston and Low are both members of the Rensselaer Alumni Hall of Fame, as is William Pitt Mason, Class of 1874. Other notable graduates include Rensselaer’s first Grand Marshal, Albert Metcalf Harper, Class of 1867, who interrupted his education to enlist in the Union Army in 1862. He returned to Rensselaer after the Civil War a hero, and in the fall of 1865 was elected to the position.

Buildings on campus named for Delta Phi brothers include the Houston Field House, named for Livingston Houston ’13; the Low Center for Industrial Innovation, named for George Low ’48; Barton Hall, named for Neal Barton ’58; Walker Laboratory, named for William Weightman Walker, Class of 1886; and all six Church Dorms in the Quad, named for Townsend Vail Church, Class of 1881.

Delta Phi will hold a 150th anniversary celebration in Troy in 2014 on their founding date, June 28. They are planning for the largest gathering of the Lambda Chapter of Delta Phi alumni in their history.
ALUMNI NEWS

Gmail Users: Don’t Miss Important Updates and Communications

M ost communications from the Alumni Office, including regional chapter programs, class information, and other updates, are sent via email. For Gmail users, new inbox settings may be moving your emails from Rensselaer to the “Promotions” tab. Be sure you don’t miss out on future communications from Rensselaer by adding our messages to your account’s “Primary” tab. To do so, follow the simple instructions above. If you receive email regularly from other campus organizations and departments, you may wish to do the same for them.

1. Click on the ‘Promotions’ tab.
2. Drag and drop an Office of Alumni Relations email into the “Primary” tab.
3. Click “Yes” to save this setting for future messages.

RENSSLEAER ALUMNI HALL OF FAME NOMINATIONS

Nominations are being sought for the 2015 class of inductees to the Rensselaer Alumni Hall of Fame. The guiding philosophy of the Rensselaer Alumni Hall of Fame is to recognize the “best of the best” as measured by discernible contributions by individual inductees, either of a sustained nature or of a one-time nature, to humanity as a whole; a specific field of endeavor as a whole; or a unique niche area. Past inductees have included Steven Sasson ’72, inventor of the digital camera; Raymond Tomlinson ’63, inventor of network email; and George Ferris, Class of 1881, designer of the Ferris wheel. To nominate a deserving individual, visit the Rensselaer Alumni Hall of Fame website at rpi.edu/rahof, or contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

RAA VISA CREDIT CARD

The RAA Visa card is offered through a partnership with U.S. Bank. The card features no annual fee and your choice of benefits and rewards, and a percentage of every purchase goes directly to support the RAA. Visit alumni.rpi.edu/service for details.

LIBERTY MUTUAL INSURANCE PROGRAM

Liberty Mutual now offers auto, home, condo, and renter’s insurance for Rensselaer alumni. Watch your mailbox for more information, or visit alumni.rpi.edu/service.

RAA WORLDWIDE TRAVEL PROGRAM

Visit exotic and exciting destinations with people who share your interests—fellow Rensselaer alumni. Trips for 2014 include the Galapagos Islands, Turkey, Normandy, and more. Visit alumni.rpi.edu/travel for a full schedule.

FEBRUARY

1 Alumnae Basketball Weekend. Women’s basketball alumnae are invited to return to campus for the traditional alumnae basketball game, women’s varsity game, and more. For more information, contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

3 Alumnae Hockey Weekend. Return to campus for the annual alumnae hockey weekend, women’s varsity game, and more. For more information, contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

7 Third Annual RPI Spirit Day. Wear or display your Rensselaer gear at work, school, or wherever you find yourself, and put your pride in your alma mater on display. For more on Spirit Day, visit alumni.rpi.edu/spirit.

7 Alumni Hockey Weekend. Men’s ice hockey alumni are invited to return to campus for the traditional alumni hockey game, men’s varsity hockey, and more. For more information, contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

7 1963-64 NCAA Final Four Hockey Team 50th Anniversary Celebration. Come back to Troy to celebrate the achievements of the 1963-64 men’s hockey team. For more information, contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

8 Big Red Freakout Ice House. This annual hockey tradition takes place at Heffner Alumni House, and includes a buffet dinner, face painting, and a post-game dessert reception. For more information, contact Peter Pedone at pedonp@rpi.edu or (518) 276-6061.

13 Reception at the Conference of the College Art Association. Chicago, Illinois. Mary Simoni, dean of the School of Humanities, Arts, and Social Sciences, will be the guest speaker. For more information, contact Kathy Kinsey at kinsek@rpi.edu or (518) 276-2832.

18 An Evening with Dean of Science Laurie Leshin. Austin, Texas. She will provide updates on Rensselaer and Curiosity Rover’s mission to Mars. For more information, contact Susan Haight at haighs@rpi.edu or (518) 276-6042.

19 An Evening with Dean of Science Laurie Leshin. Dallas, Texas. She will provide updates on Rensselaer and Curiosity Rover’s mission to Mars. Contact Susan Haight at haighs@rpi.edu or (518) 276-6042.

MARCH

12 An Evening with Lally School Dean Thomas Begley. New Jersey. Dean Thomas Begley of the Lally School of Management will provide an update on Rensselaer and the school. For more information, contact Kathy Kinsey at kinsek@rpi.edu or (518) 276-2832.
in 1987.

and New York, and finally Houston, where he retired

lingo) was his first and longest-lived publication. 

sent a nice letter from Bill Cloyes, Long Island, N.Y., who writes:

will be sorry but he just didn’t have any news to share. 

Dick Trepp, Philadelphia, Pa., and his family, write that Dick

and a walking cast for six months, which took him

out for an evening of fun and frolic on Long Island

Frank worked for Chance Vought doing design modifi-

tions on the F4U—the beautiful gull-winged fighter

was a potent weapon in the Pacific.

Standing.

Additionally, I am on watch for the

fellow LXA. After graduation Frank

and a new great-grandchild.

I did hear from 

the computer any more. At age 95 I feel blessed to be

apparently they are not well and are not regulars on

“Survivors” responded to my call for news. Usually

my “Survivors” column in the computer.

Standing. 

Am in Michigan for the beautiful summer

“Survivors” gone, my columns

for the current column it is very obvious as

with most of my “Survivors” gone, my columns

to contact him. Wonder if I will be the “Last one

classmate is in the hospital and I have been unable

of Ridgefield, Conn., high school, Class of ’35. There

was crew for Bill when he was racing Star boats on

of the Succotash dinner. For his fellow CEs, Frank’s address is: 9870

4th Ave. North, St. Petersburg, FL 33710 h: (410) 778-4853; 

any more. At age 95 I feel blessed to be

and a new great-grandchild.

members of the Class of ’63, celebrating their

have the usual questions about the other

Note I got from 

39

44

Rensselaer/Winter 2013-14
50th Reunion in October, led the crowd in singing the alma mater during halftime of the women's winning soccer game against Clarkson.
The Technologies of Management

Rensselaer Business School celebrates 50 years of developing savvy marketplace leaders

BY THOMAS BEGLEY

The business school at Rensselaer, today proudly known as the Lally School of Management, is 50 years old. Significant milestones give us pause to reflect on what has transpired previously and to look ahead to the future.

In 1963, the Management Engineering Department was separated from the Engineering School and set up as a stand-alone School of Management. From a department that injected managerial concerns into the life of the Engineering School, it was now asked to remove the “Engineering” from its title and expand on the “Management.” The new designation required its members to reorient themselves more toward the world of business, even if they originally taught only engineering students.

Eventually, the school began to admit its own management students and added faculty members with a more traditionally business school education and focus. The core of the old Management Engineering Department returned to the School of Engineering, and the more recently recruited colleagues started to build the management school.

Kenneth T. Lally, a Rensselaer trustee, entrepreneur, and philanthropist, and his wife, Thelma P. Lally, endowed the school in 1995 and it was renamed the Lally School in honor of their $15 million gift and lasting legacy in management education and the Rensselaer community.

Much has happened in the business world since 1963. Back then, General Motors dominated the U.S. car market and its management development programs were the envy of industry. IBM was a hardware company that was preparing to release its revolutionary System 360 mainframe. The majority of televisions were black-and-white. A stamp cost $0.05 and a gallon of gas was $0.30. Business education was trying to overcome its vocational image and seeking greater legitimacy in universities through increased rigor in research.

Since its early days, the school has been small by business school standards. Undergraduate programs at business schools in private technological universities seem to share this characteristic. For example, programs at Carnegie Mellon and Case Western are of similar size to Lally, and MIT’s is smaller. By contrast, at many comprehensive private and public universities, business schools have much larger enrollments.

In a technological university, the Lally School provides programs that complement those used in other parts of the university while still maintaining our own identity. Adopting the Rensselaer focus on technology, innovation, and quantitative skills enhances our competitiveness among business schools.

This complementarity also has helped shape our values and mission: “To bridge management and technology to create sophisticated global business leaders who are prepared to guide their organizations in the conversion of pioneering ideas and analytical insights into innovative products, processes, and businesses.”

For many years, Lally offered three degrees: a B.S. in Management, an MBA, and a Ph.D., and we still offer them. Over the last five years, we have grown the M.S. in Management and initiated two new M.S. degrees—Financial Engineering and Risk Analytics as well as Technology Commercialization and Entrepreneurship. Just this year, we added the M.S. in Business Analytics and the M.S. in Supply Chain Management. We are very enthusiastic about the value our degree programs deliver and their fit with Rensselaer.

I like to say that the Lally School features the management of technology and technologies of management. The management of technology has been a long-term strength of the school—some might claim its calling card—exemplified by the prominence of our Severino Center for Technological Entrepreneurship. Technologies of management offer tools to improve managerial decision-making. In our case, the Financial Engineering, Business Analytics, and Supply Chain Management degrees offer quantitative tools to better inform managers and make businesses more efficient and productive.

We see a bright future ahead in the next 50 years as part of this world-class, technological research university known as Rensselaer. We have excellent faculty members, dedicated professional staff, bright and motivated students, and alumni and alumnae who are eager to help. We will continue to shepherd our small-school customized environment, one where our faculty say hello to students by name. We will continue to make outsized contributions to the theory and practice of management. We will continue to produce graduates ready and able to address the business challenges of tomorrow.

Tom Begley, B.A., M.A., Ph.D., is dean of the Rensselaer Lally School of Management.
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EMPAC is Rensselaer's international hub for contemporary art, performance, science, and technology. This dynamic center offers adventurous public events and performances in dance, theater, music, and the visual arts throughout the year. EMPAC is also a space where artists and researchers engage in new creative practice through its residency program.

For information on these and other upcoming events, visit empac.rpi.edu.