What's Big Data Got to Do with It?

Advances in computing power and a wealth of digital information are changing scientific research.

By Kathleen McGarvey

In June—and in digital

culture, that's already a good while ago—the CEO of the social networking service Twitter, Dick Costolo, announced that users were posting 400 million tweets a day. And that was up 60 million tweets per day from the figure just three months before. It all adds up to a billion tweets every two and a half days.

As a microblogging service that allows people to post messages of no more than 140 characters, Twitter is an immense but transitory compendium of observations, insights, outbursts, and mundanities. What value could it have for scientific researchers?

A lot, as it happens. Henry Kautz, chair of the computer science department, and colleagues Adam Sadilek and Vincent Silenzio have shown that Twitter messages can be harnessed to predict the spread of infectious diseases, such as influenza. This year, they have published two papers explaining how, by using the geo-tags embedded in tweets, scientists can use social networking data to model the transmission of disease—and even to forecast when and if a specific individual will fall ill.

Kautz, Sadilek, a postdoctoral fellow in computer science, and Silenzio, associate professor of psychiatry and a member of the Department of Community and Preventive Medicine, have programmed computers to identify tweets in which people talk about feeling sick—disregarding messages where people use the term figuratively.

"Once you have that, you can start to map where people are sick," Kautz says, because GPS in cell phones indicate where a tweet was made. "And you can actually start to create a visualization of the spread of disease through cities and across time."

"These results provide a foundation for research on fundamental questions of public health," the team writes, "including the identification of non-cooperative disease carriers ('Typhoid Marys'), adaptive vaccine policies, and our understanding of the emergence of global epidemics from day-to-day interpersonal interactions."

And they note that the approach has applicability far beyond infectious diseases, for modeling and predicting political ideas, purchasing preferences, or nearly anything else rooted in behavior.

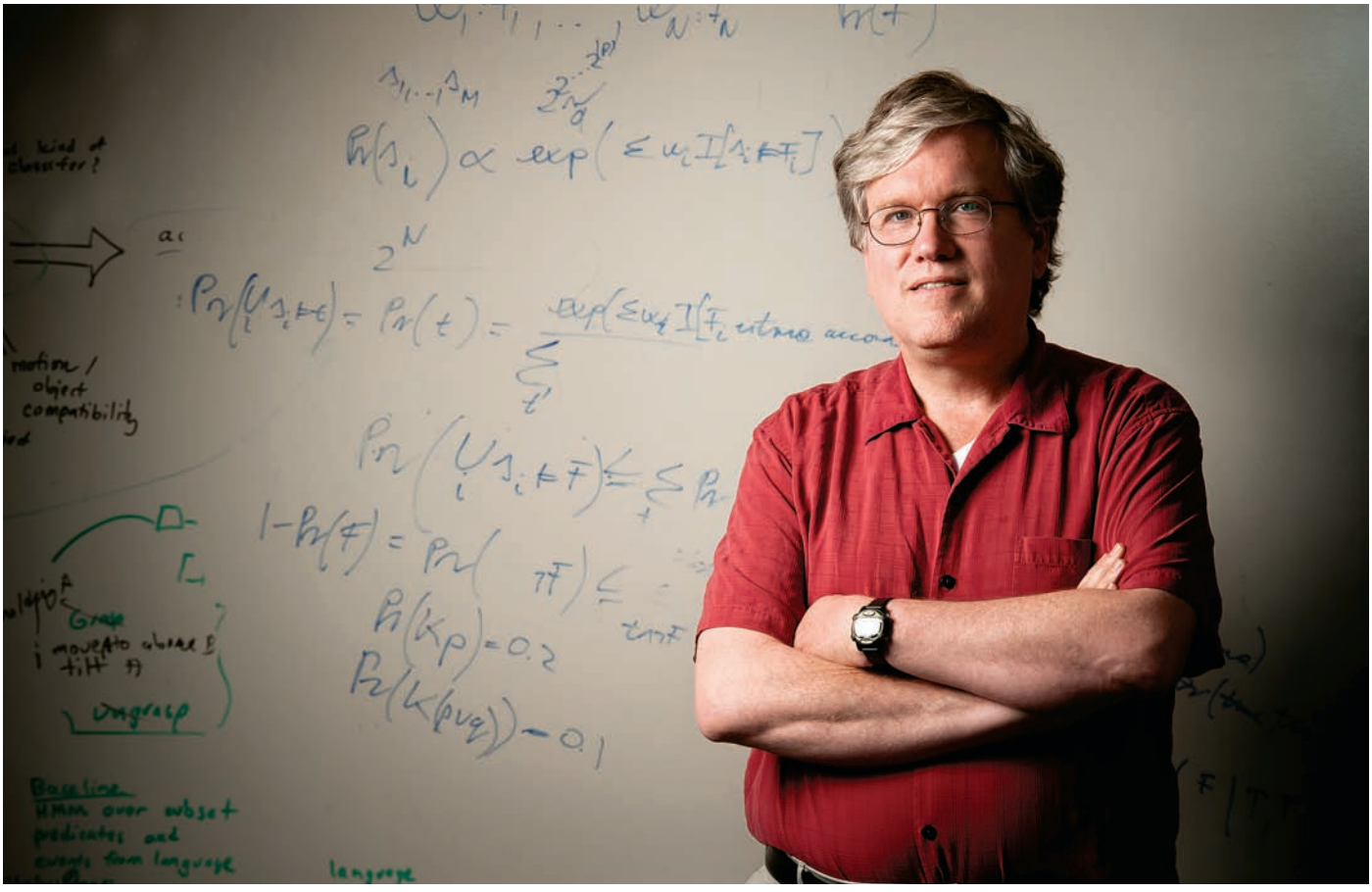
"It's actually pretty neat," Kautz says—so neat that they've formed a venture capital–funded start-up business, Corpora, that makes use of the technology for applications in areas such as health care, insurance, pharmaceuticals, government agencies, and public opinion tracking.

Such ingenuity, combined with vast quantities of information and high-performance computing, is changing the parameters of knowledge.

We call ours the "information age"—an era marked by an endless digital trail revealing what we do and where we do it, and much that's happening within us and without us.

Anyone who has used the Internet is already familiar with the ways businesses have seized on that trove of information to predict and guide the choices we make as we purchase books and shoes, vacations and music.

But the possibilities of "big data"—the fast-emerging shorthand term for the efficient analysis and problem-solving application of vast quantities of data—are profound for science, medicine, and other areas of research. Through high-performance computing, creative computer science, and new bonds of collaboration, researchers find themselves at the brink of what many predict to be a new age of investigation and



advances in knowledge—comparable, the *New York Times* has suggested, to the introduction of the microscope and the telescope.

Rochester is at the forefront, pairing teams of researchers and computational scientists with supercomputing technology to transform data into knowledge.

Applications range widely. Why do countries go to war? Curt Signorino, associate professor of political science, is using data mining tools drawn from genetics and finance to compare data on every combination of countries from the years 1900 to 2000, creating an explanatory model that fits the data more than three times better than standard techniques.

How can energy flow through the power grid to make sure that electricity is reliably delivered to people where they need it, when they need it? Mark Bocko, professor and chair of the Department of Electrical and Computer Engineering and director of the Center for Emerging and Innovative Sciences, is studying the dynamic behavior of the power grid and how to control it with the tactical use of data—what has become known as the "smart grid." He and his team are developing imaging, sound, and vibration sensors that will sort through information at the source, curbing the amount of transmitted data so only the most useful is passed along.

How can we better fight the flu, which claims the lives of 30,000 to 40,000 people each year in the United States? David Topham, vice provost and professor of microbiology and immunology, and colleagues are working to build a computer model of the immune system that will allow for simulations of infections and possible vaccines before the flu strikes—thereby speeding production of effective vaccines, and saving lives.

Pedro Domingos, associate professor of computer science at the University of Washington, who will be a featured speaker at a conference on big data to be held at Rochester in October, says there are few if any fields that will be untouched. "Science, in just about every area, without big data will grind to a halt. It will be a field of diminishing returns."

Kautz, who is director of an initiative for big data in Arts, Sciences & Engineering, says complex problems in science, mathematics, engineering, and the social sciences have traditionally been approached by breaking them into smaller pieces, understanding how each works, and then deducing solutions to the larger problems.

But systems science—a broad and interdisciplinary field underpinning big data that studies the behavior of complex physical, biological, artificial, and social systems—has upturned that approach, focusing on the whole instead of the parts and ushering in a new scale for problem solving. It provides a fresh capacity to see how things interrelate and influence each other, from the molecular level to entire populations.

"I'm an immunologist," says Topham. "I was trained in cell biology, so I like to study individual cells."

Formerly, he would collect a blood or tissue sample, isolate the cells, and from experiments on them, garner a few elements of data. Now, when he and his colleagues

CREATIVE SOLUTIONS: Henry Kautz, professor and chair of computer science, says "big data" often requires a new approach to problem-solving in science. "What I think we need are more people thinking of extremely creative ways to use these machines," he says.

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carry out clinical studies, they pursue many more dimensions of cellular investigation.

Computational approaches are going to "allow us to identify biological relationships between cells and proteins, microorganisms and the host, that we wouldn't otherwise have been able to detect, and then understand how these affect our ability to respond to vaccines or disease," he says. A computational take on science has inverted the relationship between experimentation and analysis. Carrying out experiments used to consume about 75 percent of researchers' time, and analysis the remaining 25 percent, but "I would say that's reversed now," he says. "You can do one experiment, and it will take weeks to analyze the data."

While computers, computational methods, and data collection are advancing rapidly, these are still early days for big data. When researchers talk about the data now available, they seem to reach almost instinctively for metaphors of water: a deluge, a flood, a relentless torrent of information to be channeled and controlled.

"It's not just more streams of data, but entirely new ones," says the *Times* about what it terms a "data flood." An influential report on big data issued last year by McKinsey Global Institute, the research arm of the global management consulting firm McKinsey & Company, invoked the idea of "large pools of data that can be captured, communicated, aggregated, stored, and analyzed" today.

"We don't know how to manage this information. It's like drinking from a fire hose—how do you control it so that you don't become overwhelmed?" says David Williams, dean for research for Arts, Sciences & Engineering and the William G. Allyn Professor of Medical Optics.

SCIENTIFIC VIEW: As part of work that explores the planet as a complex system, researchers are using large data sets to bring an interdisciplinary approach to earth science, says Carmala Garzione, associate professor and chair of earth and environmental sciences.

As critical as the

availability of data is the capacity to select from and organize it—to sort out the most useful elements, the most meaningful patterns, the formerly unrecognized connections—and transform the flood of data into something of practical value.

"It's a bit like prospecting in the old days of mining, because you're looking for nuggets of gold," says Rob Clark, dean of the Hajim School and interim senior vice president for research.

But it's not a passive search. "I think 'big data' is a term, like 'cloud,' that's getting thrown around so much that it's getting distorted," says David Lewis, vice president for information technology and CIO. "To us, 'big data' is doing something with the data—you're doing the analytics."

Such analysis has emerged as a national priority. In March, the White House's Office of Science and Technology Policy announced a "Big Data Research and Development Initiative" aimed at bringing together research universities, industry, and nonprofit organizations with the federal government to take advantage of the opportunities big data offers for science and innovation.

"The technology for generating new data is always far ahead of our ability to analyze it. It has become a major, global problem," says Topham. "The real data comes when you can relate different kinds of data, find the connections—and that's very difficult to do. It almost requires intuition."

Intuition is a tough thing to teach, but through courses in data mining, biostatistics, and algorithms, students are acquiring the skills needed to swim proficiently in a sea of data. Clark says the secret lies in teaching students the basics of how to manage information, big or small, "to extract kernels of useful information from data sets."

Such extraction is changing scientific research across the disciplines. In Arts, Sciences & Engineering, earth and environmental sciences and chemical engineering have to take a big data approach.

"We really view it as refining the tools for supporting the mechanics of research," says Carmala Garzione, associate professor and chair of the earth and environmental sciences department. "We're basically moving from a very discipline-oriented science, where you would have a group of researchers who'd look at some very specific aspect of the earth, to a much more interdisciplinary science, where groups of researchers are working across disciplinary boundaries to understand how the earth behaves as a complex system."

The kind of transition she describes is one taking place across disciplines, says Washington's Domingos. "I think a mental shift has to happen in how scientists think about doing science." Graduate students and researchers early in their careers have been professionally formed in an environment of computational approaches, but for more established scientists, he notes, big data requires an adjustment to a new way of pursuing research questions.

At the Medical Center, it's an approach that is swiftly becoming central. The University, New York State, and IBM have partnered to establish the Health Sciences Center for Computational Innovation. It's home to the IBM Blue Gene/Q supercomputer, making Rochester one of the five most powerful university-based supercomputing sites in the country.

"It's one of the most powerful supercomputers dedicated to health research in the world," says Topham, director of the HSCCI. "The Blue Gene/Q lets you run experiments that otherwise wouldn't be possible."

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POWERHOUSE: At peak performance, IBM's Blue Gene/Q supercomputer can make 209 trillion calculations a second.

A Super Supercomputer

Rochester is one of the first academic homes in the nation for IBM's next-generation supercomputer, designed to 'make knowledge out of data.'

A pivotal piece of big data research at Rochester is the Health Sciences Center for Computational Innovation (HSCCI), which in August became home to the next-generation supercomputer built by IBM—the Blue Gene/Q. It makes Rochester one of the five most powerful university-based supercomputing sites in the nation.

"It will be one of the most, if not the most, powerful supercomputers dedicated to health science research in the world," says David Topham, director of HSCCI. The University created the center in 2008, in partnership with IBM, and began work with what is now the previous generation of supercomputer, the Blue Gene/P. In collaboration, the University, New York State, and IBM have upgraded the center with the Blue Gene/Q. The Center for Governmental Research estimates that the project could create 900 jobs in the community and generate $205 million in new research funding over the next 10 years.

At peak performance, the BlueGene/Q can make 209 trillion calculations per second. It's 15 times more powerful than the previous generation supercomputer—and has the computing power of about 20,000 laptops. The supercomputer, which will enable scientists to sift through mountains of data and create complex models, has vast potential for applications in medicine, and Rochester scientists are applying high-performance computing to research programs in vaccine development, brain injury, and cardiac disease.

Topham calls it "truly a new domain" for research, as supercomputing technology allows researchers to ask fundamentally different questions about health, creating "knowledge out of data."

At universities around the country, just a decade ago, when researchers needed to summon more computing power than could be found in a conventional machine, they created what were known as "Beowulf clusters"—100 or 200 desktop computers linked together. It took a lot of space, produced a lot of heat, and consumed a lot of energy—and it was only sustainable for a day or two. Other researchers would cluster their own servers, requiring special air conditioning and running up electricity bills.

Faced with that insupportable situation, faculty at Rochester came together to find a solution.

"They had different research domains, but they had the same core issue: they needed a facility that could help them accelerate their research results," recalls David Lewis, vice president for information technology and CIO.

The solution they hit upon was a shared center—what is today the Center for Integrated Research Computing (CIRC), which advances research through high-performance computing. It supports 150 research groups across the University.

"We started with 16 pilot users. Now we have more than 500 researchers" from 35 University departments and centers, says Brendan Mort, director of CIRC.

"The results have been exponential," says Lewis. "We've built this as a community, and people have contributed hardware and people. They feel they can get bigger outcomes by being part of a shared resource rather than trying to build their own thing."

—Kathleen McGarvey

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For example, Jean-Philippe Couderc, associate professor of cardiology and assistant director of the Heart Research Follow-up Program Laboratory, and colleague Coeli Lopes, assistant professor at the Aab Cardiovascular Research Institute—along with Jeremy Rice of IBM's Watson Research Center—plan to use Blue Gene/Q in modeling the heart to test drugs' effects on the organ.

In 2004, the Food and Drug Administration launched an initiative designed to bring medical breakthroughs to patients more quickly while ensuring safety and reducing the costs of drug development. Key to that effort has been developing better ways to test the cardiac toxicity of drugs—a leading cause of drugs being removed from the market.

Together with the FDA, the University in 2008 established an electronic repository of electrocardiography data—the Telemetric and Holter ECG Warehouse, or THEW—to help foster research in the field. The database is part of the Center for Quantitative Electrocardiology and Cardiac Safety, funded by a $2.3 million grant from the National Institutes of Health and a part of the University's Heart Research Follow-up Program. It brings together an international network of academic researchers, pharmaceutical and medical device companies, and government regulators. Data from the center is provided to academic and private research organizations to help them design and validate new tools and methods to detect abnormal cardiac activity.

The repository makes Rochester the hub of a heart research wheel that spans the globe, from academic institutions and industry in Europe to Asia to South America. "We are the only academic group in the world that provides an open resource of ECG data for drug safety evaluation," says Couderc. Last year alone, 25 publications were produced from repository data. Together with Lopes and Rice, Couderc is using data from THEW to model effects of drugs on cardiac cells, using a computerized model of the heart system produced by the National Library of Medicine in cooperation with IBM.

From an anatomical point of view, the model's an excellent representation of the heart, he says. He and his team are being trained in using the Blue Gene/Q computer to evaluate the effects of drugs on a wedge of the heart—its inner and outer layers—and the millions of different cells that form them. They check the results of the model against the documented results shown in THEW's records.

"IBM brings a unique tool; the University brings unique data sets, enabling such tools to have a significant impact on drug-safety evaluation and medicine," he says.

But one of the most

important ingredients in that equation is the imagination and inventiveness of people engaged in research. "We lead with people, not with computing," says Lewis.

It's an emphasis that others echo.

"This is all about the people. In fact, the people are the far more valuable and important component of this partnership," says Topham. "Yes, you need hardware—but you can't use the hardware if you don't have the right people, and IBM has a very strong interest in disseminating the knowledge of how to use these tools to deal with important questions.

"Our health sciences researchers have the questions. We have the patient population. We have the ability to generate the data. We just need the tools to analyze it. And together, the University and IBM can do much more than either one of us can do on our own."

The collaboration doesn't extend only to IBM researchers; big data is strengthening ties between researchers all over campus. Big data allows "the creation of teams of investigators," says Williams. "I think we're going to see a lot more collaboration between investigators at different institutions" because of improved communications and the ability to transmit data.

The studies being carried out through HSCCI require many people, and a wide variety of expertise, says Topham. "I have pediatricians, infectious disease specialists, immunologists, neonatologists, researchers in genomics and microbiomics, computational people, data management—we have a huge data management core to deal with all that data."

Kautz's vision for big data at Rochester focuses not on supercomputing hardware—"we have that well in hand," he says—but on the people who use them.

"What I think we need are more people thinking of extremely creative ways to use these machines, as well as other resources."

With the rise of big data, computer scientists take on a pivotal role in the research of many fields.

"One aspect of providing computational support to a physical scientist is saying, we're programmers. You tell us what to do and we'll run that package. But there's this other role in terms of helping think more deeply about the problem, because that's the new way of solving the problem. And you need to do both."

Bringing big data to bear on the field of environmental sciences, for example, will "require a strong collaboration between computer scientists and earth scientists," say Garzione. "Ultimately, the department plans to hire "earth scientists with a strong computational bent"—Vasilii Petrenko, an atmospheric chemist, joined the faculty last year, and John Kessler, a chemical oceanographer, came on board for this academic year—"or computer scientists who are capable of tackling problems in other disciplines with a healthy dialogue that enables them to find a solution to computational problems."

And solutions found in one area can, at the computational level, provide keys to other areas, far afield.

Algorithms that Kautz's students are developing for mining social network data from Twitter, for example, might turn out to be relevant for doing computational biology. "That kind of thing happens all the time," says Kautz. "You look at a problem with the right level of abstraction and you realize, 'Gee, we can think of both of these things as a network, and we're trying to find certain patterns.' "

In his lab, Topham says, researchers are studying vaccines and immune responses, but the methodological advances they make "could apply to cancer, to development, to cognition. They could apply it to environmental questions."

The possibilities excite him.

"I'm hoping we get to do some really important research, that we solve some long-standing questions," he says. "Developing new vaccines. Imaging the brain better so that you can tailor treatment more effectively. Understanding individual cells' behavior, in the brain or in the immune system—these are the key questions that have just been lingering out there in the field.

"And we now have the technologies to study these things in ways we didn't before." R

The University will host a conference, The Rochester Big Data Forum 2012, *October 4–6. To learn more, visit www.rochester.edu/rocdata.*

‘A Great Gift to the City’

Dedicated in memory of a beloved son, the Memorial Art Gallery looks forward to its centennial celebration in October 2013 as a community landmark and resource for the arts.

By Marjorie Searl

MEMORIAL GIFT: Work began on the Memorial Art Gallery in 1912 after Emily Sibley Watson established the museum as a memorial to her son, J. G. (opposite).

As crews broke ground for what would be Rochester's new art museum in May 1912 on the University Avenue Campus, it's not difficult to imagine the profound mix of feelings—grief, civic charity, and simple personal gratification—that may have settled on Emily Sibley Averell Watson. With the construction site just around the corner from her mansion on nearby Prince Street, she could not have helped but reflect on the events that had led to the momentous project.

Her first marriage to Isaac Averell, the son of a prosperous Ogdensburg, N.Y., banker, had ended in divorce in less than a decade. Her two children from that marriage were gone. Her nine-year-old daughter, Elizabeth Louise, died in 1886; her 26-year-old son, James, known as J. G., in 1904. Both succumbed to infectious diseases that periodically ravaged pre-antibiotic America.

Her beloved mother, Elizabeth Maria Tinker Sibley, the wife of Western Union cofounder, Hiram Sibley, had died in 1903. Noted philanthropists, the elder Sibleys had bequeathed the mantle of civic leadership to their daughter, as well as the greatest wealth in Rochester.

In 1891, she had married James Sibley Watson, the son of her father's longtime business partner and himself an heir to the Western Union fortune. Together, they had a son, also named James.

And there was the art museum. For more than three decades, Rochester's civic and cultural leaders had discussed the need for a museum worthy of a bustling, growing, and industrious city like Rochester. Buffalo had opened a museum in 1905, as had Indianapolis in 1906. Toledo was preparing to open one in 1912.

Art museums, like most other institutions of the period, were founded and managed by men of means and influence.

Rochester's would not follow suit. A woman of means in her own right, Watson was one of the few women of her time to establish, singlehandedly, a major cultural institution. She not only fulfilled the hope of then University President Rush Rhees to include an art building on the University's campus, but in so doing she enshrined the memory of J. G., the son she had lost at such an early age.

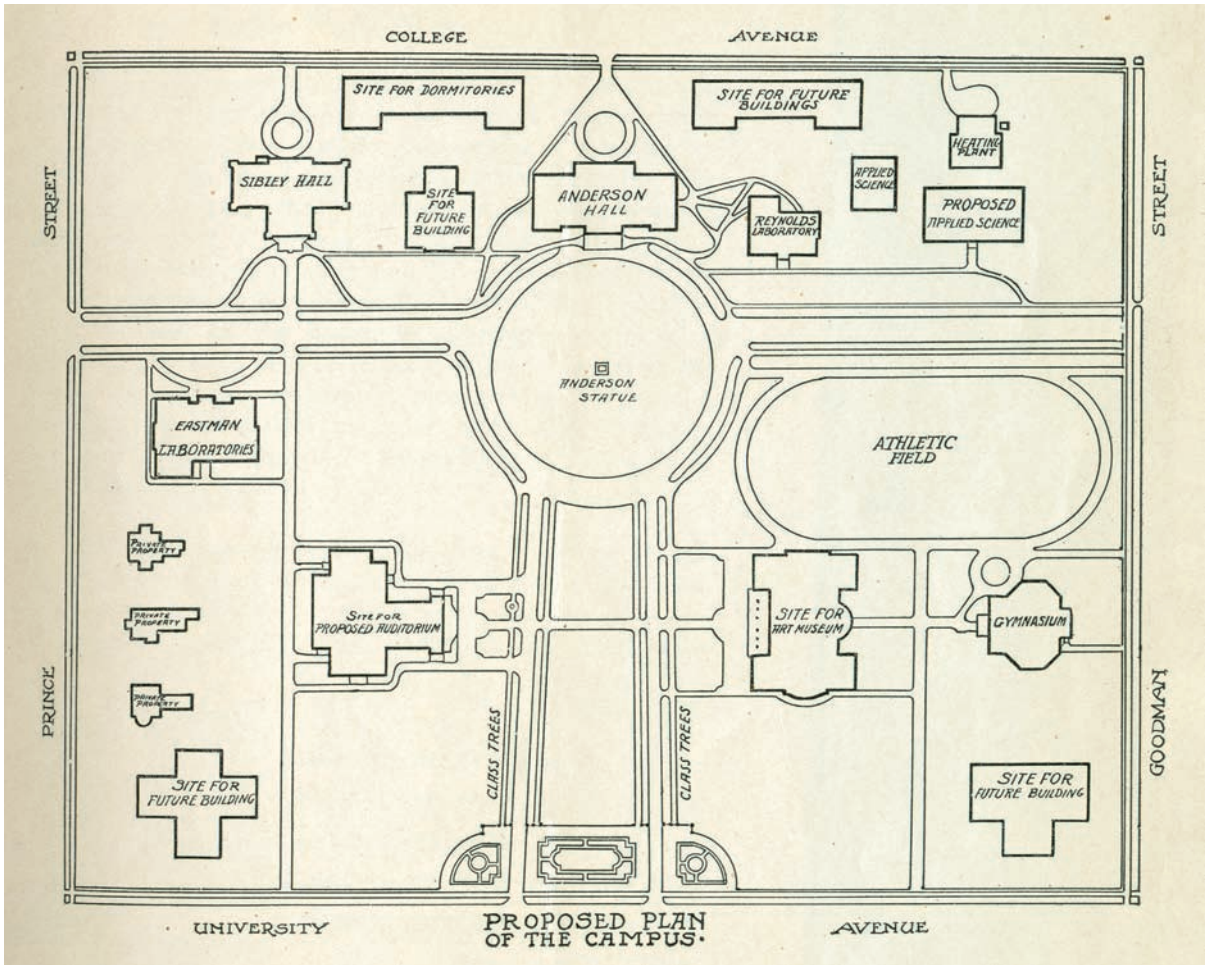
She had one important stipulation: that the museum be administered as a community treasure, open and available to all citizens of Rochester.

In 2012, that museum, the Memorial Art Gallery, has firmly established itself as one of the country's leading community art museums owned by a national research university. The museum's grounds even look a little similar to the construction site of 100 years ago as work continues on a new sculpture park that will be opened in time for the Memorial Art Gallery's centennial celebration in October 2013. As with the gallery itself, the Centennial Sculpture Park has been designed as a resource for the community to enjoy as well as a cultural expression of Rochester's leadership in the arts.

The first major expansion in 25 years, the park represents the latest chapter in the gallery's 100-year history of serving the community, a commitment that began with the expression of a mother's grief.

Emily Sibley Averell had grown up in a family that prized art and collecting. By the time construction began on the new gallery, she and her husband, James, were said to have one of the finest private collections of art in the country. In her 90 years of life, she traveled the world but remained loyal to her home of Rochester.

For more than three decades, the professional and cultural lives of the Watsons and the Sibleys had intertwined with that of the



City of Rochester. In 1877, Hiram Sibley built Sibley Library on the Prince Street campus, a year that also marked the birth of both of Watson's children—Elizabeth Louise in January and J. G. in December.

That year also marked the birth of the Rochester Art Club, an organization that gave structure and voice to a diverse but energetic group of painters, sculptors, and Rochesterians sympathetic to their cause. The club furthered its mission of "the cultivation and advancement of fine and industrial arts and promotion of social involvement of members" by offering studio classes. Its honorary membership included the upper crust of Rochester society, which was nearly identical with those who would, it might be hoped, support the organization financially.

PRINCELY PLACE: A 1905 plan for the Prince Street campus included a site for an art museum (above), but it remained on the drawing board until Emily Sibley Watson's efforts to build a museum in memory of her son, J. G. (opposite), were realized.

Among them was Emily Sibley Averell, who was elected to honorary membership in 1891 along with her future husband, James Sibley Watson.

Since founding the club, its members had searched for a permanent meeting and exhibition space, but efforts had proved futile. In other parts of the country, Greco-American edifices housing public art collections fast were becoming fixtures in cities that wanted to demonstrate the importance of culture and civic standing.

Why not Rochester? Rochester's civic leaders were conversant with the City Beautiful movement, a philosophy that emphasized grandeur in urban planning. Industries and businesses with an international reach were humming: Eastman Kodak, Bausch & Lomb, and, of course, Western Union.

At the same time, two institutes of higher education were growing within the city limits—the University of Rochester and Mechanics Institute, today known as the Rochester Institute of Technology.

Typically, the civic art museums of the day were founded and funded by wealthy citizens who were also collectors and connoisseurs. In Rochester, in the first decade of the 20th century, only two people could legitimately fill that role: Emily Sibley Watson and Eastman Kodak Co. founder George Eastman.

While both steadily built important art collections (the Watsons had art delivered to them on their yacht at least once), Emily Sibley Watson was also considering how best to commemorate J. G. As someone who regularly stepped in to fill needs of all kinds, whether giving food to the poor or providing tuition for an impoverished student, the need for an art building at the University must have been compelling to her, as not only did she prize art, but her son had also been a lover of the arts.

Watson had inculcated that lifelong interest. J. G. Averell lived a life that was in marked contrast to that of his grandfather, Hiram

Sibley, who came to Livingston County at the age of 16, and soon after opened a machine shop and a wool-carding business. At 16, J. G. was at boarding school preparing for a Harvard education and the life of an upper-class gentleman. Yachting and equestrian sports were shared family interests. At Harvard, he was on the golf team, and he was renowned as a polo player. In spring 1904, after enjoying a European tour, he joined the architectural firm of Herbert D. Hale in Boston.

By November, he had died of typhoid at his mother's Prince Street home. He was buried next to his sister, Louise, in Mt. Hope Cemetery. His grave was marked by a headstone designed by his mother's friend, the architect and designer Claude Bragdon. Like his grandfather and mother, J. G. had been a collector; on his final trip to Europe, he purchased a group of fine prints, which became the nucleus of the Memorial Art Gallery's collection of works on paper.

CIVIC LEADERS: Partners for several decades, Hiram Sibley (right) and Don Alonzo Watson cofounded Western Union in Rochester. They and their families became fixtures in Rochester's civic, cultural, commercial, and social circles of the 19th and 20th centuries.

As mourning was a largely private experience in those times, little remains to indicate how Watson coped, except to assume that her attention would have been directed even more fully toward her surviving child. But she was not inactive.

Following her mother's death in 1903, she commissioned a memorial painting by family friend George Haushalter to be installed at St. Andrew's Church. The subject: the biblical story of the gifts of the magi. She joined the Wednesday Club in 1908. She continued her philanthropic activities, contributing to the needs of St. Andrew's Church as well as helping young violinist David Hochstein advance in his musical studies.

Meanwhile, as Rhees steadily advanced his plans for expanding the University's campus on Prince Street, he followed in the footsteps of college presidents by trying to match up a willing donor with a campus need.

Whether strategically or not, the positioning of the need alongside the common good may have made the case more attractive to Watson. From the very beginning, the Memorial Art Gallery was aligned with the community.

In an undated article pasted on a page in the March 21, 1912, minutes of the University's Board of Trustees, the case was made clear:

"An abiding faith, held by all local lovers of the fine arts, that in due time some generous citizen would bestow upon us a permanent and beautiful home for paintings and sculpture, has been justified by the munificent gift of Mrs. James S. Watson to the University of Rochester, and through the university to the people of Rochester, in memory of her son, James G. Averell. . . .

"An art gallery has been badly needed in Rochester and will be the more appreciated because the lack of it has been felt for so long a time. In every work that has been attempted within recent years for the advancement of arts in Rochester, Mrs. Watson has upheld and assisted those who assumed active management, and her latest act of generosity lays the people of Rochester under another debt

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of gratitude to her for her practical methods of expressing civic patriotism. The plans for the gallery, which have already been made public, give assurance that the building will be a dignified, artistic, and enduring memorial."

On May 18, 1912, George Herdle, the president of the Rochester Art Club who would become the first director of the Memorial Art Gallery, extended the personal thanks of the club in a series of resolutions that underscored how widely Watson's gift to the community would be appreciated:

"Whereas, through the munificence and progressive spirit of Mrs. Jas. S. Watson, provision has been made for the erection of a museum and art gallery for Rochester be it resolved: That the Roch. Art Club realizes that the gift to the people is of the highest importance to the moral and aesthetic uplift of our citizens, gives dignity and high opportunity for the conservation of the Fine Arts, and places Rochester on a par with the leading art centers of the nation.

"Resolved: That the building shall be dedicated to the memory of a gifted and lamented lover of the Fine Arts and its kindred creative activities is felt by the club to be a most appropriate provision, which will act as an incentive to the youth of our city, to emulate the example of our departed co-laborer, who worked in the interest of all that was beautiful and progressive."

The New York firm of Foster and Gade, whose principal was architect John Gade, was hired to design the building. Gade's wife, Ruth Sibley, was Watson's niece and a favorite cousin of J. G. With the local assistance of Bragdon, Gade supervised the construction.

The gallery's first board, as noted in the agreement between the University and Watson, included Watson, her husband, her brother, her niece, Marie Atkinson Perkins Willard, sister-in-law and philanthropist Mrs. Granger A. Hollister, Rhees, and Eastman. Filling out the board was a group marked by overlapping interests in art, social welfare, and business.

At the formal dedication on October 8, Rhees prefaced his introduction of the speaker, Metropolitan Museum of Art president Robert DeForest, by tracing the history of art instruction at the University. That history included lectures for students and the public by art professor Elizabeth Denio, the first woman to teach at Rochester, whose salary originally had been funded by Watson.

Overlooking the dedication ceremonies was a plaster version of a life-sized sculpture commissioned by Watson from the prominent sculptor William Ordway Partridge, an artist known for his equestrian sculpture of General U. S. Grant (1896) in Brooklyn's Grant Square and the heroic *Pieta* (1906) at St. Patrick's Cathedral in New York.

Partridge had hoped to have the hooded figure of *Memory* finished in time for the dedication, but work on the marble sculpture had been delayed. In the following spring, the original was installed as a formal tribute to J. G. Averell, complete with a pedestal inscription: "He Loved Life and Beauty and Honour."

In the June 1914 issue of *The Common-Good,* arts advocate, artist, and Mechanics Institute instructor Anna Page Scott described the impact that the Memorial Art Gallery was already having on the community:

"The Memorial Gallery [*sic*], which stands in the spacious campus of the University, has proved within less than six months, that it is a center of aesthetic culture, and a source of true inspiration for all Rochester. The students, the workmen in the neighboring factories, the pedestrians who daily pass by, cannot help being affected by the silent influence of this gem of architecture; it is a great gift to the city, this Memorial to one who was himself a lover of the beautiful and a designer of fine buildings. The highly cultural effect of the exhibitions and lectures upon hosts of young people who will gather there for inspiration and study, will show itself in the higher aims of the citizens of the future, and will crystallize in various beautiful forms."

One hundred years have passed since the doors opened; millions of people—people of all ages, backgrounds, and abilities, have visited, studied, and created within its walls.

Much has changed: the University has expanded to include the Eastman School of Music, the Medical Center, and the River Campus on the banks of the Genesee River, the Mechanics Institute has become Rochester Institute of Technology in Henrietta, and the Memorial Art Gallery itself has expanded its footprint nearly to Goodman Street.

The common thread is a commitment to the common good, manifest most currently by the transformation of its grounds into Centennial Sculpture Park.

The creation of an urban park filled with sculpture and providing access to all is only the most recent fulfillment of Emily Sibley Watson's gracious, generous, and unprecedented intent to honor a son's memory by providing a center for the fine arts for the community. ®

Celebrating 100 Years

The dedication of a new, multi-acre sculpture park in October 2013 will mark the 100th anniversary of the Memorial Art Gallery's founding. Under way since 2010, the Centennial Sculpture Park, near the intersection of University Avenue and Goodman Street on the gallery's grounds, will feature work by sculptors Tom Otterness, Wendell Castle, Albert Paley, and Jackie Ferrara.

Representing the largest site-specific installation in the Memorial Art Gallery's history, the park is designed to carry on the gallery's tradition of serving as a public resource for the community while also emphasizing Rochester's contributions to the nation's cultural history.

For more information, visit http://mag.rochester.edu.

Marjorie Searl is chief curator at the Memorial Art Gallery and the editor of Seeing America: Painting and Sculpture from the Collection of the Memorial Art Gallery of the University of Rochester.

At Issue: Election 2012

As the 2012 election season hits full stride, we turn to Rochester experts for insight on some of the key issues.

Interviews by Karen McCally '02 (PhD)

FROM THE NATIONAL TO THE MUNICIPAL LEVEL, SEVERAL ISSUES are bound to grasp the attention of candidates and voters in November 2012.

Health care policy, the size and scope of the federal budget, and campaign finance are among the issues that continue to generate debate. Two more long-standing topics in American politics are likely to draw attention. One is negative advertising, which tends to arise from the mix of a divided electorate, a close contest, and well-known candidates. The second is the religious faith of the presidential candidates. President Obama's faith was a topic of discussion when he was a candidate in 2008, and this year, Mitt Romney became the first member of the Church of Jesus Christ of Latter Day Saints—or, less formally, Mormon—to win a major party presidential nomination. For faculty who follow such topics closely, this will be a busy season. Here's a sample of their perspectives going into the election.

Our Topics and Experts

- ★ **Health Care:** Ted Brown, Professor of History, Community and Preventive Medicine, and Medical Humanities
- ★ **Campaign Advertising:** Mitchell Lovett, Assistant Professor of Marketing, Simon School
- ★ **Money in Politics:** Lynda Powell, Professor of Political Science
- ★ **Federal Budget:** David Primo, Associate Professor of Political Science and Business Administration
- ★ **Religion & Politics:** Nora Rubel, Assistant Professor of Religion

ILLUSTRATION BY JOHN W. TOMAC FOR *ROCHESTER REVIEW*

Health Care

Ted Brown, *Professor of History, Community and Preventive Medicine, and Medical Humanities*

Brown is the editor or coauthor of several books, including a forthcoming history of health care reform in the United States as told through political cartoons. He teaches students in the College and the School of Medicine and Dentistry in courses including Introduction to the U.S. Health System; Health, Medicine, and Social Reform; American Health Policy and Politics; Changing Concepts of Health and Illness; and History of International and Global Health.

The health care overhaul, in the form of the Patient Protection and Affordable Care Act, is widely considered President Obama's signature achievement. How big a political victory is it? Will it solve the problem of access? Bring down costs?

The passage of the Patient Protection and Affordable Care Act ("ACA" or more commonly "Obamacare") in March 2010 was a considerable political achievement, in light of our history. Theodore Roosevelt supported the first national campaign for universal health coverage in the 1910s when, post-presidency, he ran again for president in 1912 on the Progressive Party ticket. President Franklin Roosevelt flirted with universal national health reform, coming out in support of a "right to adequate medical care" in his 1944

State of the Union address, and when Harry Truman was elected in 1948, he became the first sitting president to champion universal health reform, and pushed hard for it for several years. But Truman failed miserably, and under the pall of McCarthyism this country moved away from anything that could be politically labeled as "socialized medicine" and into the internationally unique and structurally bizarre system of employment-related health insurance we have today. Medicare and Medicaid, supported by President John F. Kennedy and passed under President Lyndon Johnson, were intended to cover those outside the employment-based system.

President Bill Clinton returned to the quest for universal health insurance, but he too failed—rather spectacularly. Universal health insurance emerged as a key priority of President Barack Obama's, and after a long and complicated political battle he succeeded, the first American president to do so after a century of struggle.

Nonetheless, the Affordable Care Act is highly flawed, and its structure and implementation clearly reflect the extraordinarily difficult and complex political process that produced it. Instead of creating one uniform, administratively efficient national system, the ACA primarily creates additional patches in an inefficient patchwork system. Even if the reforms survive this fall's elections and are fully implemented by 2014, the Congressional Budget Office estimates that some 25 to 30 million people will remain uninsured either because of numerous exceptions written into the law or because individuals will fail to obtain or employers will drop coverage, calculating that they would rather pay the penalty than pay for the insurance. Finally, those who will be covered will be covered to very different and unequal degrees.

From an ethical and social justice point of view we will fall far short of having a truly universal national system. In addition, there will be few effective cost control measures built in and the likelihood of continued, rapid, and unsustainable cost escalation is very high, which not long down the road will result in even more severe problems than we have now and which will keep the United States as the distant outlier in health care costs compared to all other countries.

In short, President Obama has handed us, at best, a half-full glass that's already leaking. Could any other president have done better? Perhaps not, but that assessment is more an indictment of our social values, political system, and national culture than an occasion for celebrating President Obama's triumph.

Campaign Advertising

Mitchell Lovett, *Assistant Professor of Marketing*

Lovett has coauthored numerous scholarly articles, including "The Seeds of Negativity: Knowledge and Money" in the journal *Marketing Science* (2011). He teaches Marketing Research, Advertising and Sales Promotion, and Consumer Behavior at the Simon School.

When and why do campaigns "go negative"?

Tightly contested elections generally attract negative television advertising. People always say they don't like negative advertising, but it's effective at influencing some of the key voters.

The voters who know the most about the candidates are usually partisan, and their choice of candidates isn't influenced much by advertising. Really the campaigns are going after the swing voters or the so-called "undecideds" that have been suggested to be a relatively small group in this presidential election.

Within this subset of voters, the effect of negative advertising depends on how much knowledge they have. If a voter has some knowledge of the candidates—and we're talking about pretty superficial knowledge—the effect is greater than if, for example, he or she looked upon the candidates as complete blank slates. If people know something about the candidates, negative advertising actually has something to build on. There's something already in their minds that the ads can trigger to generate a stronger response.

One reason negative advertising might build upon itself is that fear really has no end in the way people can imagine electoral

ILLUSTRATIONS BY JOHN W. TOMAC FOR *ROCHESTER REVIEW*

outcomes. Bad candidates can do really bad things. Good candidate can only do so much good—their hands are tied by Congress and other forces beyond any individual's control.

It's also the case that the candidate who's ahead gets a lot more negative attention, whereas the positive attention stays relatively stable for candidates. You saw this in the Republican primary earlier this year. As Herman Cain went up in the polls, as Rick Perry went up in the polls, you saw them getting more negative attention.

Money in Politics

Lynda Powell, *Professor of Political Science*

Powell is the coauthor of four books, including this year's *The Influence of Campaign Contributions in State Legislatures* (University of Michigan Press, 2012). She teaches undergraduate and graduate students in courses such as American Elections, Money in Politics, American Legislative Institutions, and Voting and Elections, and supervises undergraduates in a variety of political science internships.

What do we know about the relationship between big money and public policy?

Political scientists have had difficulty establishing a causal connection between campaign contributions and public policy, and some scholars have concluded that they have at best a marginal impact on legislative behavior. In my study of more than 3,000 state legislators in all 99 state legislative chambers, however, I found that contributions do indeed influence public policy, though more in some states than in others.

Previous studies that have looked for the influence of money have almost all studied the U.S. Congress, and have examined the linkage between the contributions to a member and the floor votes cast by that member on legislation of interest to donors. The problem with this approach is that looking at the votes that determine the final passage or failure of a bill ignores all the decisions that determine the details of its substantive content, as well as those that determine whether or not a bill is ever written or comes to a vote.

And it is in these less observable areas of legislative activity that legislators may most easily accommodate the interests of donors. Further, because this literature studies just the two Congressional chambers, little to no attention has been given to asking how variation in institutional design and electoral context might affect the degree to which campaign contributions influence the legislative process.

In surveying state legislators, I asked them how much time they devoted to fundraising for their own campaigns and for their caucuses. I also asked how much influence contributions had on the content and passage of legislation in the chamber. Asking about content, as well as influence, captures the range of legislative activities most likely to be affected by donations. I found fundraising was strongly related to influence—the more time members spent fundraising, the greater the influence of contributions.

Features of institutional design and electoral context explained much of the quite substantial chamber differences in fundraising time and influence. Members in the professionalized legislatures found in big states spend substantial time fundraising, and it is in these states with highly compensated members and leaders that donations are particularly influential.

Legislators with ambitions for higher office also spend considerable time fundraising. Chambers vary greatly in the fraction of these ambitious members; the more ambitious members, the greater the influence of donors. Chamber size also matters—the more members there are to fundraise, the greater the influence of contributions.

Term limits reduce the value of holding office, and should reduce the influence of contributions. However, members in these chambers are no less eager than other legislators to sustain political careers and a large fraction of them are ambitious for higher office. Ambition negates much, although not all, of the beneficial effect of term limits. The influence of contributions is also less in states with better educated constituents, who may be more able to monitor and sanction legislative shirking.

The Student Voter's Dilemma

You're an undergraduate at school in Rochester. You're from California. You're not registered to vote. What are you to do?

You might try calling your parents and asking. You might punch a few terms into Google and see where it leads you. Or you might be lucky enough to run into Andrew Cutillo '13, the senior coordinator for the student-led initiative in Arts, Sciences & Engineering that's come to be known as R' World, R' Vote.

This year the initiative gets a new name—the Committee for Political Engagement, or CPE—but the main mission is the same, says Cutillo, who's been involved in it since he was a freshman.

"The main thing we do is make sure everyone's registered, help people with absentee ballots, and for people registered on campus, make sure they can get to the polls."

A political science major from Clark's Summit, Pa., Cutillo says a student's rights are clear, even if the process of registering and voting doesn't initially seem to be.

"A student has a right to register to vote either in their hometown or wherever they're living to go to school, the idea being that they're in a transitional period in which they're part of two communities," he says. "So a student can register in Rochester and vote in person, or they can register to vote in their home state or district and vote absentee."

This fall, Cutillo and other members of the committee will be visible on the River Campus and each will carry a handbook of updated regulations for all 50 states—the regulations that spell out who can register absentee, when the deadlines are, and how to send in an absentee ballot.

"When we go up to a student and we say, 'Do you want to register to vote?,' and they say, 'Sure, but I'm from California, can I register there?' We'll say, 'Absolutely,'" Cutillo says. "We'll look it up, we'll work with them, we'll go online."

Cutillo says a resource students might find helpful is www.longdistancevoter.org. He adds that the committee will be launching an improved website of its own this month.

As it turns out, most states permit absentee residents to request a ballot on relatively short notice—a week or less. But that's not universal, and the laws are getting more complicated.

"A wave of new voting laws in several states adds to our workload and requires additional effort from student voters," says Cutillo. "Many of these are first-time voters, and are particularly affected."

—Karen McCally

Federal Budget

David Primo, *Associate Professor of Political Science and Business Administration*

Primo is the author or coauthor of three books, including *Rules and Restraint: Government Spending and the Design of Institutions* (University of Chicago Press, 2007). He teaches undergraduates and graduate students in courses such as Business and Politics, The Nature of Entrepreneurship, and Models in American Politics: Theory and Data.

Will the outcome of the presidential and congressional elections have any impact on our ability to reduce the long-term structural deficit?

Given that Congress does not have a strong track record in reducing the main drivers of the deficit—Medicare, Medicaid, and Social Security—the best hope for major reforms to the federal budget is presidential leadership.

Reelection-driven politicians fear that major changes to entitlement programs—especially Medicare and Social Security—will doom them to defeat. It certainly will make them targets. Politically, at least, charts and graphs cannot compete with ads like the one depicting House Budget Committee Chairman Paul Ryan pushing an elderly woman off a cliff after Rep. Ryan proposed Medicare reform.

This political calculus might change if public opinion radically shifts or if financial markets send signals that changes are needed. Neither seems likely. In public opinion polls, respondents view the deficit as a serious problem but oppose changes in programs such as Medicare that are critical to bringing spending under control. For instance, in a 2010 Bloomberg News poll, nearly half of respondents believed that the budget deficit

ILLUSTRATIONS BY JOHN W. TOMAC FOR *ROCHESTER REVIEW*

is "dangerously out of control and threatens our economic future," yet 82 percent were opposed to reductions in Medicare to deal with the problem.

Meanwhile, investors continue to buy up U.S. bonds, keeping our nation's borrowing costs low. It also doesn't help that when Standard & Poor's downgraded U.S. debt last year, the markets barely flinched. Paradoxically, the good times for U.S. bonds make reform less likely since it allows a run up of debt at virtually no interest cost (right now) and provides a justification for inaction—the markets aren't worried, so why should we be?

Strong presidential leadership might change political dynamics long enough to cement a fiscal reform agreement. The addition of Paul Ryan to Mitt Romney's presidential ticket is a welcome development, because Ryan is one of the few members of Congress who speaks out on long-term fiscal issues. At a minimum, then, we will hear more discussion of our perilous financial situation in the coming months. But even if a President Romney or a reelected President Obama is willing to use precious political capital to push for fiscal reform, he will still need to find members of Congress, generally not known for displaying political courage, who are willing to risk their seats for the sake of the country's fiscal future.

Religion & Politics

Nora Rubel, *Assistant Professor of Religion*

Rubel is the author of *Doubting the Devout: The Ultra-Orthodox in the Jewish American Imagination* (Columbia University Press, 2009) and teaches undergraduates in courses such as History of Judaism; Religion and American Foodways; and Religion and the American Presidency.

Why are Americans so interested in the religious faith of their presidential candidates?

Concern over our presidential candidates' religious affiliation is nothing new, but the nature of the concern has changed, reflecting at each point the anxieties of the time.

The 2008 presidential election highlighted contemporary concerns about religious identity that continue to reverberate in the ongoing 2012 campaign.

Who can forget the uproar over then candidate Barack Obama's supposedly hidden Muslim identity? The underlying message was that being a Muslim is a negative, and thus worthy of a smear campaign. The "secret Muslim" ruckus was immediately followed by a critique of his Christian pastor and the form of his Christian affiliation. Perhaps Obama wasn't a Muslim, but he wasn't exactly the right sort of Christian either.

Mitt Romney continues to be plagued by questions about his Mormon faith. A prominent pastor's statement last year that Mormonism is a "cult" only underscores the fact that many evangelicals don't consider it to be a true Christian religion. Among his critics, there doesn't seem to be a very specific interrogation of Mormon beliefs, just a dismissal of Mormon commitment to Christian principles (as the evangelicals see them).

Religion was an issue during presidential campaigns as early as the election of 1800, during Thomas Jefferson's bid for office. A widely distributed pamphlet by Dutch Reformed Minister William Linn declared opposition to Jefferson's candidacy on the basis of Jefferson's Deist affiliation and lack of appropriate Christian credentials. Linn believed that the law of the land, as well as its chief executive, should reflect the character of the nation—in his mind, a Christian one. Similar to the alarmist anti-Muslim rumors spread over the Internet about Obama, other opponents in 1800 spread rumors that Jefferson would force citizens to burn their Bibles.

And, of course, many Americans are aware of the hay that was made over John F. Kennedy's Catholicism during his 1960 presidential campaign.

The biggest religious question of the mid–20th century, which lacked the religious diversity that new immigration would bring in the late 1960s, was whether a Catholic or a Jew could be fully integrated. Kennedy chose to address the Protestant Greater Houston Ministerial Association in a speech that is now frequently cited as a watershed moment in American religious history. Rather than attempt to defend the tenets of his faith to an audience that was never going to embrace Catholicism as equivalent to their Protestant denominations, he instead challenged them to uphold the ecumenical spirit of America.

Almost 50 years later, Mitt Romney delivered his "Faith in America" speech, an address meant to allay fears about the foreignness of Mormonism (a concern that is ironic, given Mormonism's indigenous origins). Like Kennedy, Romney stated that "A person should not be elected because of his faith nor should he be rejected because of his faith." However, unlike Kennedy, he stressed that while church authorities would never interfere with presidential decisions, his Christian faith would nevertheless inform his presidency. ®