



AN EVER BETTER TOMORROW: Singing “The Genesee” are Ed Hajim '58, University trustee and board chairman emeritus; Cathy Minehan '68, cochair of *The Meliora Challenge*; Joel Seligman, University president and CEO; Delores Conway, professor at the Simon Business School; Brenda Tremblay, WXXI-FM radio host and emcee for the event; Bob Witmer '59, University trustee and board chair emeritus; Tom Farrell '88, '90W (MS), senior vice president for University advancement; Danny Wegman, chairman of the Board of Trustees; and Crystal Colon '17, an English major and student leader from Perth Amboy, New Jersey.



Momentous Meliora!

Meliora Weekend brings alumni, faculty, students, and family together to celebrate their connections to Rochester.

FIRE PLACE: Steven Broida '18, a member of Strong Jugglers, demonstrates his skills during the group's annual show.



CONVERSATIONS ON RACE: (left) Vice President and University Dean Paul Burgett '68E, '76E (PhD) talks to filmmaker Ken Burns about race in America at the Presidential Symposium. Burns's grandfather, Robert Kyle Burns Jr., was a member of the University faculty from 1928 to 1939. Burns and Burgett also spoke with WXXI-FM public radio's Evan Dawson. To listen, visit wxxinews.org/post/connections-filmmaker-ken-burns-race-america.

Meliora Weekend



EVER BETTER SELFIE: (above) Twin sisters Mary '19 (left) and Sarah Ogunji '19, from the Bronx, were among the many students and visitors who paused to admire, pose against, and even climb upon the temporary installation of the University motto that graced the Eastman Quadrangle for the duration of Meliora Weekend.

MORNING JOE: MSNBC hosts Joe Scarborough (immediate right) and Mika Brzezinski deliver a morning keynote address—a lively discussion about electoral politics, the rise in political vitriol, and the decline of bipartisanship.





STAR ENTERTAINERS: *Daily Show* host Trevor Noah (top) entertains a packed Palestra; multiplatinum singer and songwriter Ben Folds (above), whose past collaborations include work with the University's own *Midnight Ramblers* and the *YellowJackets*, performs a free outdoor concert.

MEL TALKS: Benjamin Meyerhoff '96 (left), celebrating his 20th reunion, presents "Please Forgive Me If I Don't Stand Up," his perspectives on trauma recovery, perseverance, and augmented life with paralysis. MEL Talks is an annual series of presentations exploring research, ideas, and culture.

Meliora Weekend



RAISING THEIR VOICES: Kimberly Rouse '17 (center), an audio and music engineering major from Philadelphia, and the other members of the coed a cappella group After Hours perform at the A Cappella Jam, held at the Palestra.

MILLER'S COURT: Arthur Miller '56 moderates the annual Miller's Court panel, this year focusing on "The Next President, the Supreme Court, and You." Panelists included (left to right) Jason Altabet '17, the first student to ever participate in a Miller's Court panel and the current president of the Rochester chapter of Mock Trial; Lew Kaplan '66, U.S. district judge for the Southern District of New York; David Primo, the Ani and Mark Gabrellian Professor and an associate professor of political science and business administration; Robert McNamara, senior attorney with the Institute for Justice; Jennifer Farmer '99, managing director of communications for the PICO National Network; and University President and CEO Joel Seligman.





MUSICAL MOMENTS: Provost and Senior Vice President for Research Rob Clark (top) performs with his band, Don't Know Jack, at the dedication of the Edmund A. Hajim Science & Engineering Quadrangle; students in the Eastman Saxophone Project (above) were among the performers at the *The Meliora Challenge* celebration dinner.

UNIVERSITY ICON: University Trustee and Board Chairman Emeritus Ed Hajim '58, his wife, Barbara, and their children and grandchildren pose with a new statue of Hajim on the Edmund A. Hajim Science & Engineering Quadrangle. The statue, by sculptor Marc Mellon, was dedicated during Meliora Weekend.

Connecting a Community

A fundraising campaign is about forging connections as much as it is about raising money.

Interview by Kathleen McGarvey

When *The Meliora Challenge* comprehensive campaign ended in June, five years after its public launch, the University had raised more than \$1.373 billion, exceeding the \$1.2 billion goal.

More than 200,000 donors and 7,300 volunteers took part. The campaign has brought more than 100 new endowed professorships, more than 400 new scholarships and fellowships, and more than \$129 million for new and improved facilities and infrastructure.

The Medical Center led a nearly \$700 million campaign for *The Meliora Challenge*, a major portion of which provided for the new Golisano Children's Hospital, an eight-story space dedicated to healing the 74,000 children across the region who rely on the University for care each year.

Tom Farrell '88, '90W (MS), senior vice president for University advancement, says that he's grateful for the outpouring of generosity—and that the funds the campaign raised are crucial for the Uni-

One of the great things that came out of this campaign is our memorable mission statement: Learn, Discover, Heal, Create—and Make the World Ever Better. It's a pretty remarkable distillation of what great American research universities are all about.

versity to carry out its many functions. But he calls the role that the campaign has played in rallying people to reconnect with Rochester and its mission even more essential. Those relationships are the real key to making the University “ever better,” he says.

From his base in the Larry and Cindy Bloch Alumni and Advancement Center, Farrell has led the advancement program since 2014. A Rochester native, he was vice president for alumni relations and development at the University of Chicago before becoming chief development officer for the University of Illinois and president and CEO of the University of Illinois Foundation. He also served in leadership roles at the University of Pennsylvania and Dartmouth. His more than 25 years of advancement experience began in 1990, when he worked in the reunion and regional development program at Rochester.

What's the value of campaigns?

They're very effective tools for forming a vision and a set of priorities for an institution's future. They bring the people who care about a place together around objectives and ideas that they connect with and want to participate in.

So campaigns are also an exercise in clarification?

Absolutely. One of the great things that came out of this campaign is our memorable mission statement: Learn, Discover, Heal, Create—and Make the World Ever Better. It's a pretty remarkable distillation of what great American research universities like Rochester are all about.

What does it mean to “support” a university? Is that fundamentally about money?

No, it's not at all. We want to build a much stronger culture of ownership around the future of the University. And that ownership might be giving a gift, but it might also be advocacy, or volunteering, or giving career support to our students, or providing feedback, or participating in an event. And it involves all our stakeholders—not just alumni, but also students, faculty, staff, and friends.

Here's what I mean by ownership: if I look up at the ceiling in my house and I see a leak, I'll be agitated and concerned. I'll call a contractor. I'll get it fixed right away. But if I'm in a hotel room and I see a leak in the ceiling, I'll think, wow, they've got a leak in their ceiling. I might tell the manager, but probably wouldn't.

We're trying to develop the same culture of ownership for people who are connected to the University, and to do it in a way that's based in our mission and that will help support our mission as we go forward.

What encourages that sense of connection for people?

Communication. Expectation setting. Shared values. I think people significantly misinterpret any university's interest in contributions, in this sense: are we interested in people participating and continuing to be active members of this community? Yes, we are. Are we interested in people—alumni and others—making large donations to support our mission, donations without which we can't carry out the mission? Yes, we are. Should people who can't give \$1,000 or \$10,000 or \$1 million or \$10 million feel like their \$50 gift doesn't mean anything? Absolutely not.

Giving a \$50 gift to your university, in my view, is saying, yes, I still believe. I'm making a vote that indicates that I'm still connected to you. The University made a difference in my life, and I'm willing to make a tangible statement in recognition of that by giving you \$50, or \$10. It's not about the money. It's about raising your hand and saying, I still believe in the University and I'm willing to participate in this way.

It's not the only way of participating. We're hoping that people will be advocates, go to events, read *Rochester Review*, stay in touch with their friends, give information, and say good things about the U of R when they're asked about it.

The opposite of love isn't hate—it's indifference. We don't want an indifferent community. We want a connected community, and we want to make the connections we have already even stronger.

Has that been happening?

I think it has. We hit all of our major goals. We raised a much greater amount of money than we had previously. We were able to develop our volunteer culture. We were able to revamp our communications and regional and geographic event activity. We were able to connect



with our faculty and staff in ways that we never had before.

A lot of this has to be considered in the context of Joel Seligman's presidency. It's important for people to remember that the campaign has coincided with Joel's presidency, and with a dramatic growth and improvement in so many different aspects of the University's activities.

You can see the effect of that vision if you look at the physical infrastructure, at the quality of our faculty and students, at the improvement in our financial position, at the growth of our endowment, and at the growth in many program areas—including, very importantly, the Medical Center.

Everyone came together around a mission-based vision to make the place better. And through the campaign, we sought all the revenue sources we could to drive that. We persevered through the recession. And it came together.

ONGOING MISSION: The fundraising campaign that concluded in June was “a means, not an end. It was always about the mission, not the money,” says Tom Farrell '88, '90W (MS), senior vice president for University advancement.

research grants and other funding, and limited but critically important support from the state. And it includes philanthropy.

But philanthropy can't happen outside of a genuine commitment to engaging, over long periods of time, with our external communities. Without that commitment, it just doesn't work. And the U of R in the past wasn't always deeply committed to seeking those connections. That's an idea that has been banished from this institution's mind-set.

Joel's been the chief communicator of that message, but it's also something that everybody here is committed to—not just the Advancement office, but also the deans, the provost, the faculty, the board, our volunteer leaders, our donors, and our supporters. We hope all our alumni, parents, and friends will feel that, too. **R**

How far does the money raised go toward meeting the University's expenses?

It's a heck of a lot of money. But it's important to compare those dollars to the size of the institution—29,000 total employees, a \$3.2 billion total budget, annual outlays of over \$100 million a year in financial aid to undergraduates, and \$900 million-plus in capital project improvements over the same time period. If you look at total institutional expenditures over the life of the campaign, it's over \$32 billion—and the campaign raised \$1.37 billion.

We've benefited from tremendous generosity. Philanthropy is a defining aspect of American higher education, but philanthropy and the endowment, on an annual basis, generate less than 10 percent of our revenues. If you look at our peer institutions, it would be more like a third. So we still have a ways to go. And if you look at the fact that Stanford University last year raised over \$1.2 billion dollars in cash in one year, you start to recognize that, from a competitive point of view, we're just beginning.

Now what?

We're spending the year going around the country and the globe to thank people for what they've done. We owe special thanks to our Rochester community. The Greater Rochester area donated 41 percent of the campaign total. That's truly significant and it speaks, in part, to the vital role of our Medical Center in this community.

At the same time, we're also grateful to the people around the globe who've participated. The University is important nationally and internationally, and the gifts that made up 59 percent of our campaign total are a demonstration of that. We want to protect against the campaign being viewed as episodic. A campaign is a means, not an end. It was always about the mission, not the money.

Even as we're expressing our gratitude, we're also continuing to try to raise funds to support the mission and the priorities of the University. That's how American higher education works. There's a partnership that finances American higher education, and it includes many different resource streams—including students and families, the endowment and institutional support, federal

Poet Jennifer Grotz reflects on place, inspiration, and the ‘vocabulary’ she found in a baroque French monastery.

Opening a Window

By Kathleen McGarvey

After finishing her second book, *The Needle* (Houghton Mifflin, 2011), poet and literary translator Jennifer Grotz went to the Monastère de Saorge in the French Alps. Completing the book had given her a “clean slate,” she says. “My idea was just to see if poems came. But I was going to work on translations. I wasn’t putting pressure on myself.”

The poems came.

Grotz’s newest book, *Window Left Open* (Graywolf Press, 2016), draws on her visits to the monastery over several summers. “I was so inspired by it, and that’s partly why I kept going back,” she says. “It was like the monastery became a kind of vocabulary for me.”

Franciscans occupied the 17th-century baroque monastery, located between Nice and Turin, until 1988, when it became a writers’ retreat. “They’d thought about making it into a hotel, but it was too spare,” says Grotz, a professor of English. “These were tiny monks’ cells. It’s a mattress on a wooden plank, a desk, a window.”

But for Grotz, that sparseness was liberating—even, she says, “ecstatic.”

Being at the monastery is like stepping out of the modern world: there’s no access to the Internet or



MOUNTAIN TIME: Tucked into the French Alps, the Monastère de Saorge is now a writers’ retreat. Grotz says its sparseness was liberating: “my days were long and free, and my attention span was so intensified by that freedom.”





cell phones. There's hardly electricity, or even much in the way of plumbing. Although there's enough space to house about 20 people, Grotz was never there with more than a handful of others, if even that.

"When I'd first arrive, I'd go through withdrawal, dying to check my email or get a cell phone. But after a day or two, that edge wears off. And then I felt this incredible freedom—the days were so long and free, and my attention span was so intensified by that freedom." A single day at the monastery was as productive as three days of her life back home, she says.

And the poems she wrote were unusual for her.

"When I first came back and showed drafts to my friends, they kept calling them my 'psychedelic' poems, because they're so steeped in the sensory world. There's actually nothing psychedelic about them at all. What I did was describe what was literally outside my window or in the garden."

Her book is about that openness to experience. She writes in her title piece, "Window Left Open":

*All you have to do is open the window
to let the night in: then moths
effervesce in a stream
toward the lamp ...*

The book is divided into two parts. The darker first half is urban, quotidian, and wintry.

But the second is suffused with life in a "perpetual summer," she says, like her experience of the monastery, which is available to writers only in the warm months.

"Initially, I thought I was writing two books. I didn't see how the two went together at all," she says.

But she began to see parallels to William Blake's *Songs of Innocence and of Experience*. She realized that her two sets of poems were "complementary, and the 'songs of innocence'—the monastery poems—were much more powerful if they were juxtaposed with the 'songs of experience.' But I flipped the order.

"It's more honest to my experience. You enter the middle time of your life, and you see the radical imperfections of society, and of modern life—that's the first half of the book. And then somehow going to the monastery soothed that and opened up a kind of optimism and beauty. It was restorative.


"There's something approaching wisdom or acceptance that being in the monastery—that pared-down existence—allowed. And that became very interesting to me, the sense of being able to convert experience back into a sort of innocence."

Grotz says her time in France has changed her as a writer. She's always been interested in imagery, in painting the physical world with words and "not just living in my head," she says. "But there I was taught such a lesson in looking, and it has made my poems more sense-drenched. I have an appetite for that now in all my poems. It developed some impulse in me."

It's an impulse she tries to pass on to her students. She asks them to describe the things they see.

"It sounds so obvious, but you'd be surprised how difficult that is. Our students are so brilliant, but they don't really give themselves permission to just describe the world.

"They think they're supposed to be philosophizing or doing something much more heady. They intellectualize even when they're supposed to be seeing. And so that's something I teach them about—looking, without your brain filtering it."

You could say she's helping them to open a window. 

All poems are reprinted with permission from Window Left Open, by Jennifer Grotz; Graywolf Press, 2016.





Apricots

I judged them very carefully, as though I'd been given the charge to determine which are good or bad, and they were all good, even the slightly overripe ones with bruises had a bitter ferment that only brightened the scent. And the too-young ones, firm and slightly sour, not yet softened by the sun. And the ripe ones, that felt like biting into my own flesh, slightly carnivorous.

They had been elegant in the tree, tiny coquettes blushing more and more until I picked them, then they were minimalist and matte-colored in wooden bowls, so barely furred one couldn't help but clothe them, enclose them with your hand, caress each one thoroughly before taking a bite, exploring the handsome freckles left from some minor blight.

Now I stand under the tree and pluck them one after the other. Each one tastes different, like a mind having erratic thoughts. Going into the trance halfway between eating and thinking, the thought of an apricot, the apricot of a thought, whose goodness occurs over time, so that some had been better earlier, others soon would become correct, I mean ripe.



Sundials

They do not make a shape themselves, which is why they look like marks left from something sliced, but the sun doesn't slice, and that is what they measure, these lines, on every wall of the courtyard so that the Franciscans

could know as precisely as possible the time to ring the bells. Humans invented time, and this morning, watching the sun's shadow slice across the walls, I think they did so as a form of praise. Nature made the flowers

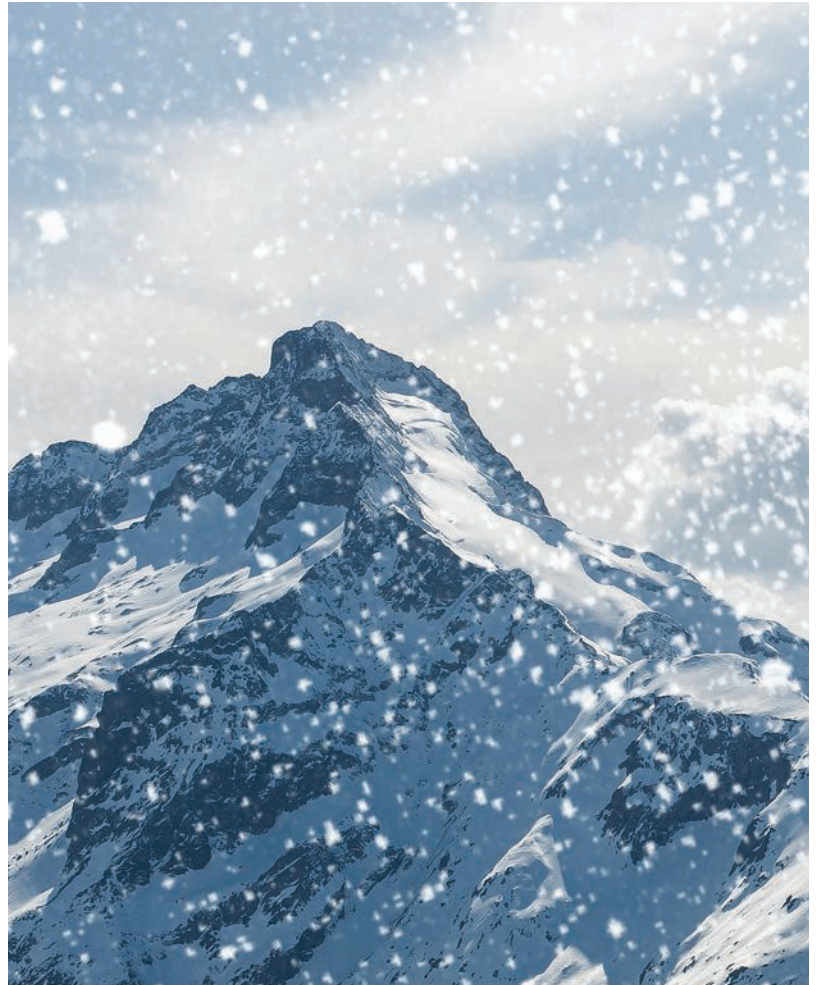
smell beautiful to attract the creatures that pollinate them. Except for the dandelions, too many to count, left for the wind to pollinate instead. What sparrows are to birds, little wisps, half-bald now after the rain, past the days they lit entire fields a solar yellow.

Little lampposts of the field, little clocks. That's what happens after staring at the sundials frescoed on the monastery walls. Everything becomes one: the lizards in the morning heat flicker like second hands all over the walls, little gray lightning bolts.

The roses measure the amount of time we can bear their beauty, and the candelabra measures the length of dinner on the grass. The trees are clocks for the wind, and the cherries are clocks for the birds, and the pupils are clocks that measure one's affection

but can be read only by the other, the *affected*. Vaster: the mountains measure the clouds and the dandelions in the field measure how far the wind travels, how far it carries the seeds, while the spider in the corner of my room is the second hand to stillness.

And the poem is a clock that measures the time and the time it takes me to comprehend this, the time and the weather.



Snowflakes

Yesterday they were denticulate as dandelion greens, they
locked together in spokes and fell so weightlessly

I thought of best friends holding hands.
And then of mating hawks that soar into the air to link their claws

and somersault down, separating just before they touch the ground.
Sometimes the snowflakes glitter, it's more like tinkling

than snow, it never strikes, and I want to be struck, that is
I want to know what to do. I begin enthusiastically,

I go in a hurry, I fall pell-mell down a hill, like a ball of yarn's
unraveling trajectory—down and away but also surprising ricochets

that only after seem foretold. Yesterday I took a walk because
I wanted to be struck, and what happened was

an accident: a downy clump floated precisely in my eye.
The lashes clutched it close, melting it against the eye's hot surface.

And like the woman talking to herself in an empty church
eventually realizes she is praying, I walked home with eyes that melted snow.

Lake Effect

Sailing on the Great Lakes, environmental science students take part in a first-of-its-kind study on a potent greenhouse gas.

By Karen McCally '02 (PhD)

Early last spring, John Kessler invited five undergraduate students and a master's degree candidate on a research venture of the type usually conducted by advanced scientists.

An associate professor of earth and environmental sciences, Kessler introduced the students in his course Research in Biogeochemistry to some intriguing questions about methane. It's long been known that methane is a potent greenhouse gas. It's also generally accepted as fact among oceanographers and limnologists (the scientists who study inland waters) that freshwater bodies are significant natural sources of methane to the atmosphere. Yet, Kessler notes, there's a paucity of data on the Great Lakes, collectively the largest liquid freshwater environment on the planet.

The questions Kessler has are many, and the answers have implications for the global effort to understand climate change. How much methane is being emitted from the Great Lakes? Where is it coming from? How much of it gets transferred to the atmosphere? And how does climate change itself influence the dynamics of further methane production, release, and emission?

Over the summer, the team embarked on explorations of Lake Ontario and Lake Superior. Kessler, whose lab has also collected data on Lake Michigan, plans his study to encompass all five Great Lakes. The team has already unearthed some surprises. "We're already really excited by the data that we see," he says. "What has surprised us is how variable methane emissions are."

Early in September, the group traveled on Lake Ontario, up and back from a marina in Hamlin, New York, north to within sight of the Canadian shoreline. The group members made consistent measurements of methane concentrations all along the route. They expected levels to be high, and they were. In fact, says Kessler, "about a third to a half of the transect across the lake was much higher in methane concentration than I would have ever expected."



UNDERCURRENTS: Freshwater bodies such as Lake Ontario are major natural sources of methane. Last summer, a professor and six students set out onto the lake to take some measurements. They conducted similar research on Lake Superior in October, as part of a study they hope will encompass all five Great Lakes.

The Great Lakes—A Methane Storehouse?

It's generally accepted that freshwater bodies are significant natural sources of methane to the atmosphere. Yet documentary evidence is surprisingly scant for the Great Lakes, which are the largest liquid freshwater environment on the planet. A much more efficient heat trapper than carbon dioxide, methane is widely considered the second most important greenhouse gas among those who study global climate change. It "accounts for a substantial fraction of the man-made warming in the atmosphere that we're experiencing right now," says John Kessler, an associate professor of earth and environmental sciences. Kessler is leading an effort to map and measure methane in the Great Lakes.

LAKE SUPERIOR

Surface elevation: 600 feet

Area: 31,700 square miles

Average/maximum depth: 483/1,333 feet

Volume: 2,900 cubic miles

Kessler and his students spent a week in October aboard a National Science Foundation research vessel collecting data on Lake Superior, the largest and deepest of the Great Lakes.

LAKE MICHIGAN

Surface elevation: 577 feet

Area: 22,300 square miles

Average/maximum depth: 279/925 feet

Volume: 1,180 cubic miles

LAKE HURON

Surface elevation: 577 feet

Area: 23,000 square miles

Average/maximum depth: 195/748 feet

Volume: 850 cubic miles

Duluth

Milwaukee

Chicago

Why study methane in the Great Lakes?

Oceans, which have been studied extensively, are relatively minor sources of methane in the atmosphere. Fresh water environments are significant sources, and, according to Kessler, there's been surprisingly little research on the Great Lakes, which collectively form the largest body of liquid fresh water on the planet—an estimated six quadrillion gallons.

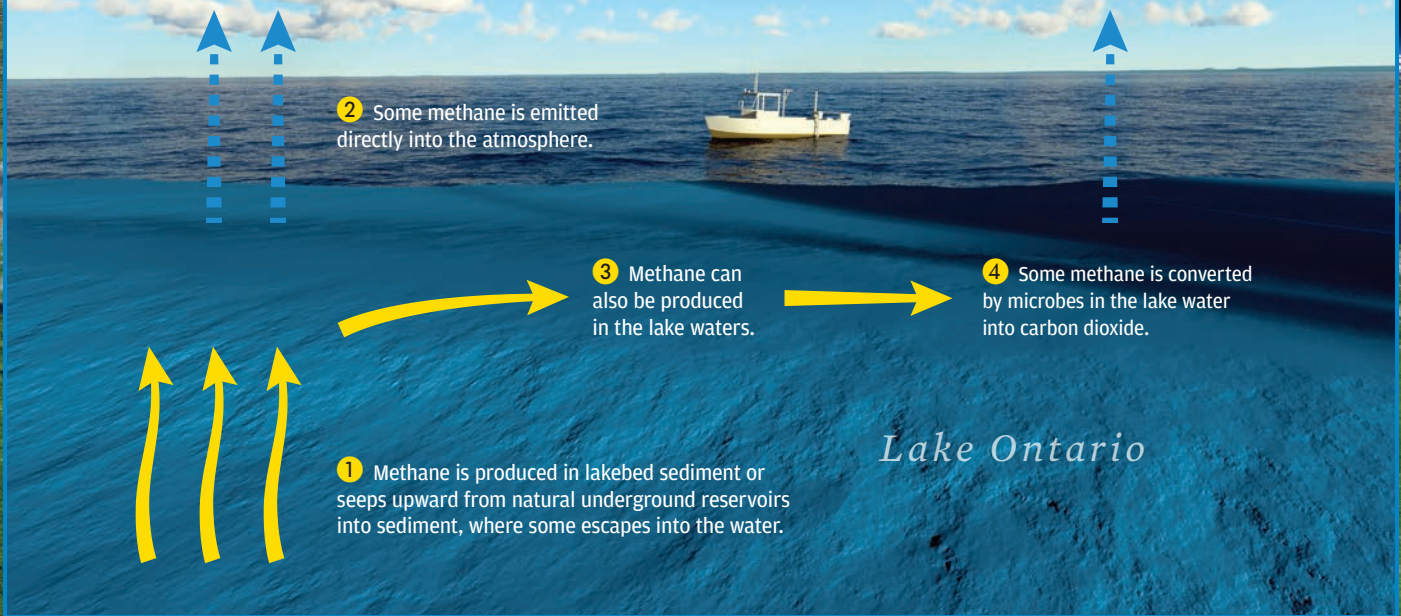
What do we want to know about methane?

Says Kessler: "Number one: we want to be able to map how much methane is out there. What are its fluxes, its emission rates to the atmosphere? What's the distribution across all of the Great Lakes?"

The second goal is to understand its sources. Kessler says there's a "traditional view" that methane is produced in oxygen-free environments, such as deep in the sediment at the bottom of lakes and oceans. But scientists have recently found that methane can be produced in lakes and oceans where oxygen is abundant. "That process is not well understood," he says. Among his goals is "trying to figure out how this specific environment is producing methane."

Follow the Methane

Naturally occurring methane gas is released from sediments on the floor of the Great Lakes or produced in the overlying waters. It can be emitted directly into the atmosphere or consumed by microbes and converted to carbon dioxide. Both methane and carbon dioxide are greenhouse gases.



LAKE ERIE

Surface elevation: 571 feet
Area: 9,910 square miles
Average/maximum depth: 62/210 feet
Volume: 116 cubic miles

Studies similar to Kessler's have measured methane in the shallowest of the Great Lakes, including methane released from leaking underwater natural gas wells.

LAKE ONTARIO

Surface elevation: 246 feet
Area: 7,340 square miles
Average/maximum depth: 283/804 feet
Volume: 393 cubic miles
 Kessler's research has focused on the final link in the Great Lakes chain.

Methane: A moving target

Although Kessler and his team are focused on methane, they won't be considering it in isolation. The key to climate change is in the interaction of gases with one another, and the dynamics of that interaction are in constant flux. Certain processes add to the atmospheric concentration of greenhouse gases; other processes work to remove them. Many of those dynamics are not well understood.

"I think that one of the things that motivates a lot of us to do this research is [to get] a better predictive understanding of how the planet functions," Kessler says. That entails answering some complex questions. As the planet warms, or as it gets wetter or drier, how will those changes affect the future interactions among gases? Will natural emissions change? If so, how?

Meet the Team

John Kessler

Associate Professor of Earth and Environmental Sciences

John Kessler's principal interest is the dynamics of methane in oceans. He joined Rochester's faculty in 2012 from Texas A&M University, where he had conducted headline-grabbing research on the aftereffects of the Deep Water Horizon oil spill in the Gulf of Mexico.



The spill, he said, provided him "a natural laboratory" to answer some basic questions, such as, "What happens when a large release of methane is emitted to the ocean. Where

does it go? What is its ultimate fate?" He discovered that within months of the spill, methane levels had returned to pre-disaster levels as rapidly reproducing microorganisms devoured more than 200,000 metric tons of the gas.

Kessler cautions against the hope that nature may have provided humans with a microscopic cleaning staff. "These organisms eat incredibly quickly," he says. "It can have some adverse effects on the environment, like the removal of oxygen from the waters, and potentially, an acidification effect as well."

The research he and his group of mostly undergraduates are conducting this year is an initial phase of what he hopes will be an extensive investigation. They'll be measuring the concentrations of methane in each of the Great Lakes at varying points in space and time. That data, he says, will lead to some hypotheses to address larger unknowns about the source of the methane and the dynamics of its release and impacts.

Widely recognized on the River Campus as an inspiring teacher, Kessler won the Goergen Award for Excellence in Undergraduate Teaching in 2015.



Amy Eisenstadt '16
Brooklyn, New York
BS, geological sciences;
pursuing MS degree



Benjamin Riddell-Young '18
Slingerlands, New York
Major: environmental science



Sawyer Johnson '16
Los Angeles
Major: environmental science



Nicola Wiseman '18
Waterford, Connecticut
Major: environmental science



Colin McCormack '16
Randolph, New Jersey
Major: environmental science



Eric Yarmoff '16, '17 (T5)
Maisons Laffitte, France
Major: geological sciences

But when the team repeated that same journey about a month later, much of that methane was gone. The levels were "only a quarter to a third of what they were," he says. "What's causing those massive changes, we don't know."

The course began last spring semester, as the students each developed individual research plans in which they would examine some aspect of methane cycling in the Great Lakes and nearby waterways. They prepared formal research proposals, outlining hypotheses and experiments as if they were applying for a National Science Foundation grant. At the end of the semester, the students conducted mock panel reviews.

They also worked together to develop their own equipment to take measurements. The traditional method is to collect vials of water and bring them back to the lab for analysis. The students did some of this, but as Kessler says, "the problem with doing it that way is that there are really only so many vials that we can fill up in a day and physically bring back to the lab."

They developed a means of vacuum gas extraction in which water is pumped continuously through a gas-permeable membrane, while a vacuum removes dissolved gases from the water stream. The extracted gases are then pumped into a spectrometer where they can be analyzed in real time. They used that equipment, as well as traditional methods, to collect and analyze data.

Over the summer, not everything went as they had hoped. The group had to cancel a few of their excursions. It was unusually hot and dry throughout July and August—except on many of the days Kessler planned trips. "I was joking that I could single-handedly end the drought in western New York just by scheduling more of our trips on Lake Ontario," he quips, referring to the



EXTRA MEASURES: Eisenstadt prepares a water sample from Lake Ontario to be transported to a lab for analysis.



PRIME PUMP: Kessler's team designed instrumentation (above) that Eisenstadt, Riddell-Young, and Kessler (left) used last summer to provide continuous measurements of methane levels in Lake Ontario. Kessler was awarded a National Science Foundation grant that enabled the group to test the equipment on Lake Superior in the fall.

excessive rain and winds that befell the region on several of the days the students were to collect data.

Nonetheless, their efforts paid off. They'd begun with a small budget: a \$10,000 Pump Primer grant from Arts, Sciences & Engineering, and some additional monies from the Elizabeth Wright Dunbar fund, which supports the Department of Earth and Environmental Sciences. Based on the seed data the group collected last summer and the instrument prototypes they developed, the National Science Foundation awarded Kessler a two-year grant that enabled them to spend a week in October collecting data on Lake Superior in a state-of-the-art, fully staffed NSF research vessel.

Nicola Wiseman '18, an environmental science major from Waterford, Connecticut, says the voyage was galvanizing. "The crew of the ship was wonderful. We accomplished a lot in terms of data collection, so we're all thrilled," she says.

The students divided into day and night shifts, taking surface methane samples every hour while their continuous gas extraction equipment ran without interruption. The fully equipped vessel made it possible for them to conduct some quick data analyses and prepare the data for a full analysis back in Kessler's lab. Wiseman is looking forward to that process, as well as to continuing the research for the long haul.

"I'm hoping to continue my involvement in this research even after the class has ended," she says, noting that the NSF grant also funds


a second trip to Lake Superior, and potentially other Great Lakes, this coming summer. "This trip really made me realize that doing research is what I want to do for the rest of my life, and I'm incredibly excited to see where we go from here."

Eric Yarmoff '17, an environmental science major who was born in Princeton, New Jersey, and raised in France, says the course is teaching him a great deal not only about science, but also about the life of a scientist conducting field research.

"I've learned plenty about the geochemical methane cycle and the processes influencing it," he says. "But more importantly, I've learned quite a bit about the research process itself: securing funding, planning trips, organizing teams for research excursions, and how to be flexible in the face of unpredictable situations."

Kessler revels in surprise and uncertainty, and delights in furthering a similar spirit of adventure among his students. For this group, that spirit seems to have come naturally.

"The success of an endeavor like this largely hinges on the quality of the students," he says. On Lake Superior, the group hit some rough weather—the kind that can knock scientists out for hours at a time.

"Everybody got seasick," Kessler says. "But we kept working, and it was awesome." 

Includes additional reporting by Peter Iglinski, Jim Mandelaro, and Matthew Mann.