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"I was fired up," says Larry Fine '72,
after coming out as gay at the end of
his sophomore year. He submitted this
classified ad, which appeared in the *Campus
Times* on Friday, May 8, 1970.

Forty Years Out

The closet isn't empty, but it's gotten a lot smaller,
thanks in part to the pioneers in Rochester's
Gay Liberation Front.



By Karen McCally '02 (PhD)

IN THE FINAL DAYS OF THE SPRING SEMESTER of 1970, sophomore Larry Fine '72 placed a few coins in an envelope, along with a note, and dropped the envelope into a slot on the office door of the *Campus Times*.

The note, seven words long, appeared in the classifieds the following week: "TAKE HEART BROTHERS, Gay Lib is coming!"

It was the year after the Stonewall riots, which had begun on a night in June 1969, at a popular gay bar in New York City's Greenwich Village, when patrons, long the target of police round-ups, decided to resist. The protest was a call to action, and within months, an organized gay rights movement was emerging nationally.

Much of the activity would take place on campuses. As Fine placed his cryptic note in the *Campus Times*, a graduate student in physics, Bob Osborn '74 (PhD), was also planning to bring the gay liberation movement to Rochester.

A southerner, Osborn had worked across the Deep South as a white ally in support of the African-American freedom struggle. He brought his experience in political organizing to Rochester where, in the fall of 1970, he laid the groundwork for a meeting in Todd Union on Saturday evening, October 3, that would officially launch the University of Rochester's chapter of the Gay Liberation Front. Rochester would become the third campus in New York state, after Columbia and Cornell, to open a chapter of the national organization.

In the next several months, Osborn, Fine, and a small, committed core of students from the River Campus and the Eastman School successfully petitioned Student Activities for official recognition; established an office in Todd Union; set up a small library of books and other resources related to gay issues; created a speakers bureau, in which members offered themselves as educational ambassadors, speaking before classes and local organizations; and with the help of a typewriter, a mimeograph machine, and a hand stapler, created a newsletter called the *Empty Closet*.

By spring 1973, the group, known by then as GLF, would spawn a series of organizations in the community—the Gay Brotherhood, Gay Revolution of Women (later the Lesbian Resource Center), and others—which would unite under the umbrella of the Gay Alliance of the Genesee Valley.

This year, as the alliance celebrates its 40th birthday, it's in the midst of a documentary project tracing its history and the history of the gay and lesbian community in Rochester and western New York. The project, called *Shoulders to Stand On*, has received funding from the New York State Archives as well as the Arts and Cultural Council of Greater Rochester.

More than 40 years after its inaugural issue, the *Empty Closet* is still in print, published by the alliance since the summer of 1973. It's the oldest continuously published gay newspaper in New York and the second oldest in the nation after the *Washington Blade*, which

moved to an all-digital format last year.

As part of the project, the Rush Rhees Library Department of Rare Books, Special Collections, and Preservation worked with the alliance to digitize the paper. Since last fall, well over 400 issues have been made available on a searchable online archive at www.lib.rochester.edu/?page=emptycloset.

"The *Empty Closet* has been, and is, the primary source of LGBT history in Rochester," says Evelyn Bailey, using the acronym for lesbian, gay, bisexual, and transgender. Bailey, a long-time member of the alliance and the executive producer of the project, says that in the past several years, volunteers from the alliance have used the paper to identify and locate almost 100 people interviewed for the next phase of the project, a documentary film titled *Shoulders to Stand On*. The film will premiere in Rochester this fall as part of the annual Image Out gay and lesbian film festival.

Bailey calls the students who forged the University's GLF "pioneers."

"The fear that went along with being gay in those early days was extremely crippling," she says. And not only for gays and lesbians, but also for the larger community. Bailey says that the GLF's pioneers forged a culture of openness toward gays and lesbians that brought benefits to the region. Before their work began, the environment "did not allow people to be who they were and to express their talents, be able to impact their workplace or the political or economic arena to the degree that they do today." Bailey notes that by a variety of indices, the Rochester metropolitan area ranks in the top 20 "most gay-friendly" cities in the nation.

There are many reasons for Rochester's status—its high proportion of college graduates and major employers that have long had a financial interest in gay-friendly employment practices, for example. But no degree of friendliness would be measurable unless someone, or some group, at one point began to challenge traditional norms.

LARRY FINE SAYS HE'S USED TO BEING INTERVIEWED, though not about gay issues.

"I'm used to being asked about pianos," he says from his home office in Palm Springs, Calif.

For the past 35 years, Fine has been a piano technician and publisher of *The Piano Book*, a nearly 250-page guide to purchasing and maintaining pianos. But when asked about his work with the Gay Liberation Front, he pours forth with the story of his personal awakening in the spring of 1970.

He'd been participating that semester in a psychology experiment in which he played the part of patient as the professor, graduate student in tow, led Fine through a series of counseling sessions. The scenario, by itself, was not unusual—"it *Continued on page 41*

"On the last day of Passover, I met, for the first time, a person who was openly gay. Somehow he communicated to me a self-respect and an enthusiasm for life which I had never before experienced. As I look back on it, I realize how suddenly, in the space of a few hours, the entire course of my life changed. As the sun set on that Jewish holiday of freedom, I set down a ten year burden and was set free."

—LARRY FINE, *THE EMPTY CLOSET*, APRIL-MAY 1971



Continued from page 32 often happened when you were a sophomore, you got recruited into experiments,” he recalls—but for Fine, the experiment would have far-reaching effects. As the sessions wore on and the semester drew to a close, the professor asked him about one subject that had yet to come up in all the 20-year-old young man’s hours of personal revelations: sex.

“I told him, ‘I think I’m a homosexual.’ He had me say it again and again to get used to it. And he said, ‘You need to meet other gay people.’”

Days later, Fine met a gay senior named Jeff, who would change Fine’s life through a long conversation on a River Campus lawn. “All of a sudden I realized I was part of a larger world,” Fine says. Aside from a chance encounter or two in the weeks leading up to graduation, Fine never saw Jeff again after that day. But the conversation left a profound impression on Fine. “I was fired up,” he says. He placed the fortuitous note in the *Campus Times*. And in August, he strapped a pack on his back, and hitchhiked to San Francisco in search of the gay liberation movement.

It’s not surprising that young people like Fine could go about their daily lives unaware that there was a gay community in their midst.

“The community at that time was cliquish,” says Bailey. “You would have certainly known gay men or gay women who had a circle of friends. They would gather fairly often for dinner parties, and they would invite people whom they knew would not out them.”

During his journey to the San Francisco Bay Area, Fine encountered a similar code of discretion. Verbal tips, handwritten notes, and pay telephone calls led him eventually to an abandoned warehouse.

“You had to knock a certain way, or say a certain thing when they answered the door so they knew you were OK,” Fine recalls.

EDUCATOR: Hagberg, a Suzuki piano instructor, spearheaded the speakers bureau, an educational tool founded at a time when many people “never had the opportunity to talk to gay people before.”

“Inside were young gay people who were involved in the GLF, and I found out from them other places to go.”

He spent a week in Berkeley, staying at a GLF crash pad for gay visitors and attending gay coffeehouses and other events. “I met a guy named Michael, who became my boyfriend for the next few months and who came back to Rochester with me—believe it or not.”

The Rochester GLF began with a simple announcement in a late September issue of the *Campus Times*: “UR Gay Liberation Front will hold an interest meeting. . . Open to all people who believe that realization of basic civil rights for all minority groups must come from organized effort.”

“It was Bob Osborn who started the group, not me,” says Fine. Osborn, who died in 2004, was the author of that announcement and organized and moderated the first several meetings of the group, which featured guest speakers and discussions on topics such as Military Service and the Homosexual, Homosexuals and the Law, Women’s Liberation, and Dialogue with the Church.

In those meetings and through the *Empty Closet*, Osborn, inspired by his activism in the South, would work to cast gay liberation as a natural outgrowth of the African-American civil rights movement. He’d sat in the U.S. Senate gallery during the passage of the 1964 Civil Rights Act. Friends recall that he had marched from Selma, Ala., to Montgomery in the 1965 demonstration led by Martin Luther King Jr. to secure voting rights for African Americans who’d long been harassed and intimidated at the polls.

“For him, this was a continuation of the civil rights movement,

and he spoke in those terms,” says Fine, who became fast friends with Osborn after the first GLF meeting.

In his mid-20s, Osborn was older and more overtly political than most of the group’s student members. Several students in the group, especially those coming to campus as freshmen undergraduates, were not even sure of their sexual identity, let alone how they believed it should be expressed in social and civic life.

Gary Clinton ’73 still remembers, word for word, the note that he read in the *Campus Times* at the end of his freshman year.

“It said, ‘Take heart, brothers. Gay lib is coming.’ I remember thinking, ‘This might be interesting.’”

That summer, at home on Long Island, Clinton continued to mull over that message. “I wasn’t sure what my sexuality was,” he says of himself as an 18-year-old freshman. “I knew I liked men. But I wasn’t sure what that meant in those days.”

When the GLF started in the fall, he was slow to take part. “I wasn’t much of a joiner then,” says Clinton, now the dean of students at the University of Pennsylvania’s law school.

Karen Hagberg ’76E (PhD), then a graduate student in musicology at the Eastman School, says, “I knew I was gay, somehow. But I’d never heard of anybody else who was. I mean, we really used to all think that we were the only ones in the world, no joke.”

Hagberg had come out to a few friends, such as Robert (R. J.) Alcalá ’71E, an undergraduate studying oboe at the Eastman School, who was also gay. But she’d never publicly identified herself as gay. “It was exciting and scary to actually go into a room that was designated for a group of gay people,” she recalls of her first GLF meeting.

Like Hagberg, Patti Evans ’73 came out first to a couple of friends and had little familiarity with gay life in Rochester. When she approached a Todd music room on October 3, 1970, it was her second attempt to walk into an on-campus meeting of gay students.

“There was a planning meeting before that one,” she says. “It was up on the Hill, which was my dormitory. I hadn’t come out on campus. I was kind of nervous.” Intent on going, she approached the lounge where the meeting was to be held. She saw just three people. “There was a very flamboyant man,” she recalls, and two women seated close together. She kept on walking.



Patti Evans

It was easier for Evans to approach the October meeting with confidence. “There were, like, 40 people at that meeting,” she says (*The Campus Times* would report an attendance of “approximately 100,” in its Dec. 13, 1970, issue). From that day forward, she became part of the small group of activists who shepherded the GLF through its early years.

She helped plan the group’s first dance, and more than 40 years later, she remembers vividly “the feeling I had at that dance.” It inspired her to write a letter about it in the *Campus Times* as well as in the *Empty Closet*. In both places, she signed her name “Patricia Evers.”

Today she laughs about that decision. “It was kind of naive of me to think I could get away with that. It wasn’t that big of a campus.”

Though she concedes now that the robust attendance at the dance may well have been due to other factors than a chance to experience freedom from proscribed social norms—“we had a live band and free beer”—the experience was indicative of the reaction she says she continued to feel around campus. She feared disapproval. She didn’t get it. “I guess I was surprised. I guess I didn’t fit a stereotype.”

Hagberg, too, remained active in the GLF from that first meeting forward. She established the speakers bureau, in which members of the group would volunteer to appear before classes at the University, and at schools and other local organizations to talk about homosexuality, what it meant to be gay or lesbian, and the nature of the discrimination they faced and sought to eradicate.

“Some of us thought that if everybody would just come out, we wouldn’t have a problem,” says Hagberg. “And that was the impetus for forming the speakers bureau.”

GLF speakers appeared in several psychology classes. Hagberg recalls appearing before psychology professor Vincent Knowliss’s Sex and Gender Roles class toward the end of the fall 1970 semester. Knowliss held the class in his home. “I’m not sure why,” she says. “I’m not sure if he didn’t feel comfortable having it in his classroom.” Regardless, Hagberg says the experience was “really amazing, because people never had the opportunity to talk to gay people before.”

“What happened in the MDC Lounge Saturday, December 5th? I was there; let me tell you a little about it. There were male homosexuals, female homosexuals, heterosexual women, heterosexual men, blacks and whites. What was such an unusual conglomeration of people doing in the lounge? They were participating in the most progressive and beautiful activity I’ve ever seen on this campus.

It was the Liberation Dance sponsored by the UR Gay Liberation Front and UR Women’s Liberation. But more than a dance, it was a unique experience in human interaction, free from the rules and regulations of a society that dictates to its people what is and is not natural for them.”

—PATRICIA EVERS, *CAMPUS TIMES*, DECEMBER 11, 1970

Today's Focus: Gender Identity

Since the Gay Liberation Front began on the River Campus in 1970, the University has maintained a student group dedicated to the interests and concerns of gays and lesbians. As the movement has progressed, students have followed in casting an even broader tent, embracing those who identify themselves as bisexual or transgender as well.

Today, the LGBT student group is called the Pride Network. Clint Cantwell '15, a rising junior from Palmyra, N.Y., who is the group's vice president and social chair, says that as of the end of the 2012-13 academic year, the network had just over 300 members, and about 20 whom he calls "active members."

"For lesbians, gays, and bisexuals, a lot has happened in terms of rights and acceptance," says Cantwell. While the GLF struggled in the 1970s to encourage gays and lesbians to come out of the closet and join the organization, the Pride Network has attracted a considerably larger population of LGBT students as well as plenty of straight allies.

And while the GLF had always counted a few quiet allies among faculty and administrators, today there are people in virtually every seg-

ment of the University who are openly part of the LGBT community.

But there's some substantial work left to do, Cantwell says. "Transgender people are the biggest issue right now."

They're a small minority of the community. Cantwell, who identifies as gay, estimates that there are about 10 to 15 openly transgender students on campus, two or three of whom are active members of the group. But they're the people who face the greatest difficulties and the most misunderstanding among their peers.

"It's very difficult to get gender-neutral bathrooms," he says, underscoring how something as simple as using a public restroom can be stressful and complicated for people who are transgender. Cantwell notes that the network helped bring about a gender-neutral bathroom outside Starbucks in Wilson Commons.

This fall, the group plans a series of events to help educate the community about the fluidity of gender identity and the variety of ways in which it's expressed.

—Karen McCally

"There was certainly no backlash," Fine recalls of the early days of the group. "I don't know what people were talking about among themselves, but there wasn't a lot of reaction. I think for the most part, people weren't paying attention."

The *Campus Times*, however, was giving prominent coverage to the GLF by the fall of 1971. A news article in October reported on the group's upcoming one-year anniversary celebration, a series of events including a concert, dance, coffeehouse, and teach-in. Noting that "everyone is welcome," the *Campus Times* reported, "Since last October, when Gay Liberation was still an uptight topic on campus, GLF has held four public dances at the university. Nobody knew, at first, exactly who would attend these supposedly far-out functions, but when the first dance was over, it was clear that people here are less hung-up than they might seem, or at least less hung-up than GLF members feared they would be."

In December, the *Campus Times* ran a front-page feature on the group in which reporter Marc Rosenwasser '74 cited GLF's claims about deeply ingrained societal homophobia and its members' political activities in response. The Rochester police had recently raided two popular gay bars, arresting three patrons as well as the owners of the bars—the patrons for loitering and the owners for "failing to display a license for dancing." "Osborn charges that the raids were illegal and stated that countersuits were being filed along the grounds of false arrest," Rosenwasser reported.

Meanwhile, the *Empty Closet* was fast becoming an effective tool for community building, both within and outside the University.



OUT AND ONLINE: More than 400 past issues of the *Empty Closet* are available online at www.lib.rochester.edu/?page=emptycloset.

"When it first began at the University of Rochester, it was the means of communicating among university students and the greater Rochester community," says Bailey. "As far as news about what was going on, it was the conduit."

Osborn, Fine, Evans, a freshman named Marshall Goldman '74, and others distributed the paper at Rochester's gay and lesbian bars.

Its readership was—and is, Bailey stresses—much larger than the openly gay community.

"I think the paper represented the touchstone between the LGBT community that was closeted, and not closeted." She tells about a man she met recently who reads the *Empty Closet* "every single month, cover to cover, front page, back page," but won't pick it up at a newsstand. "He's gay. He's not out. He won't pick it up outside because he doesn't want to be seen, identified with it. That's his major source of information and connection to the community and to the people in the

community. That has always been part of the real value of the *Empty Closet*."

The first issues of the paper combined national and local news about the gay rights movement with listings of upcoming GLF events, poetry, short prose, opinion pieces, the "GLF Bookshelf," and an advice column called "Dear Gale Gay."

The paper also compiled a written record of harassment and discrimination in the city as well as on campus.

"I have made my activities in GLF and the fact that I am gay known to the denizens of my dorm, and got generally good to indifferent reactions," wrote Goldman in the spring of 1971. But one day,



he alleged, some residents trapped him and a male friend in Goldman's dorm room by stuffing pennies in the lock, which the head resident came and removed. Later, freed from his room, Goldman lost his eyeglasses. He found them later in a Hoeing lounge, with an obscene rhyme attached that made reference to his homosexuality.

The "comment," as Goldman called it, and those like it "won't stop us from being ourselves and won't push us back in our closets."

In June of the same year, the paper reported allegations that the Eastman School dean of students was using her office to intimidate and penalize gay students. "This has resulted in a virtual reign of terror at the Eastman School, where gay students are extremely fearful of being open about themselves," the report noted.

Inevitably, though, gay students would form relationships, and in some cases, live openly as couples.

In his suite in Anderson Hall, for example, Fine shared his room with Michael. The room was a double, and Michael had moved in when Fine's roommate didn't return for the fall semester. "At some point, I had to tell my suit-mates who this guy was," Fine says. "They were very, very good about it. One of the guys was actually on the sex education committee for the student government. The others were curious. And who knew? I took a chance. It was scary when I first broached the subject."

By his senior year, Clinton would meet a freshman, Don Millinger '76, who would become his life's partner. The couple married in October 2011 in New York City, 39 years, virtually to the day, after they met.

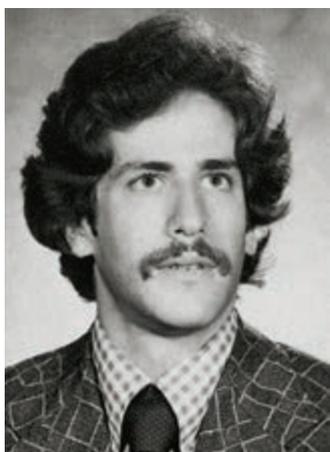
They lived openly as a couple on the River Campus during the 1972-73 academic year. "By the end of my first semester, I basically moved myself into Gary's dorm room in Helen Wood Hall from the Hill," Millinger says.

While Clinton had been initially reticent about taking part in GLF activities, Millinger jumped right in. In his second semester at Rochester, he began participating in the speakers bureau, standing before his classmates in psychology classes, serving as "a real-live, honest-to-God, three-dimensional homosexual," he says. "Things got around. People knew I was gay."

"And then he was elected treasurer of the student government," says Clinton.

As a national organization with chapters throughout the country, GLF was always intended to be a community-based

MARRIED? "When I'm at work, I'm married; when I come home, I'm single," says Millinger (left, above and opposite), who works in Manhattan and lives in Philadelphia with Clinton. The two met at Rochester in 1972 and married in 2011 in New York, which recognizes same-sex marriages.



“Gay Liberation as a campus organization is undergoing a structural revision. For the last three years we have existed as a campus organization partially funded by Student Activities, but with most of our money coming from off-campus. Because of the presence of non-students in the group (and the paranoia of coming out) students have been reluctant to become active. This must change if the group is to survive . . .”

—GAY LIBERATION FRONT, *CAMPUS TIMES*, APRIL 13, 1973

group. University students, however, were prominent among the leaders in many communities, not least Rochester.

In December 1971, Osborn told the *Campus Times* that the group had a “floating membership” of about 200 people, out of whom 12 were University of Rochester students.

According to the recollections of Evans, Fine, and others whom alliance volunteers interviewed for the Shoulders to Stand On project, Student Activities grew concerned about whether the group could genuinely be considered a student organization.

Today, members disagree about whether the students in the GLF were singled out unfairly by Student Activities.

“It wasn’t a hostile thing,” says Evans. “It was a legitimate concern that they had. It was using activities funds and serving only a handful of students.”

Fine disagrees, calling the concern expressed by Student Activities “a red herring.” He recalls appearing before a student appropriations committee to argue the group’s case.

“I said, ‘Look. There’s a foreign film festival and most of the people coming to it are from the city. You’re giving money to this festival, so you really have no basis for complaint here.’”

Fine says the GLF prevailed. But by the spring of 1973, GLF members voted to form two autonomous organizations: an all-student University of Rochester GLF, led by undergraduate officers, located on the River Campus, and retaining recognition and funding from Student Activities; and an organization for people in the greater Rochester community.

“Through the assistance of the University and student body,” the *Empty Closet* reported, the group has grown “to the point that [non-students] are now able to leave the campus, and move into town. It is anticipated that both students and townspeople will find expanded participation because of more convenient locations and a more comfortable peer relationship.”

The group’s membership and financial resources would shrink drastically. But Clinton and Millinger, both of whom were among the individual signers of a letter from the GLF to the *Campus Times* announcing the April 1973 “emergency meeting” to discuss the future of the group, say that in retrospect, the reorganization may have been a good deal for students, particularly undergraduates like themselves.

“I went to a few meetings at the beginning, and I remember thinking, ‘Who are these people?’” Clinton says. “They were older—which meant they might have been anything between 25 and 40—and I was used to student groups.”

“There were two separate kinds of priorities,” says Millinger. “Bob and the folks from town were looking at the social change

aspect. On campus, students were figuring out, ‘I’m 19, 20 years old, I think I’m gay, I am gay, I may be gay, but what does that mean to me, and what does that mean on campus, and how secure can I be, and who can I talk to—all those kinds of things.’” The reorganization of GLF into an all-student group, Millinger says, was “a good motivator to actually have a more significant student presence on campus.”

For the next several years, that goal proved elusive in practice. The GLF would never count more than a dozen members. Jay Stratton ’74 (MA), a graduate student in linguistics, kept a diary in which he chronicled the activities of the GLF through his eyes as a participant-observer. He donated a typed version of the diary to Rush Rhees Library last year.

From 1974 to 1980, he recorded car rides from the River Campus to the Gay Alliance meetings, a “gay table” in the dining hall, petition drives that proved disappointing, and dances that were sparsely attended.

The dances attracted spectators, according to Stratton, who eventually overwhelmed the dance floor. “It was rather funny in that most of the gay people had already left and they were gawking at others of their own kind,” he wrote.

But the group sustained itself as one among many student organizations. And the groups they spawned in the greater Rochester community sustained themselves too, with the help of tools and leaders shaped and developed in the GLF’s first years as a student organization.

Evans remained active in the alliance, advocating legal equality, and eventually becoming elected chairperson of the New York State Lesbian and Gay Lobby.

Hagberg participated increasingly in lesbian feminist activism, raising awareness of violence against women and of the ways in which sexism had infused the gay movement.

Evans, Hagberg, and Alcalá went frequently on the local airwaves as part of the speakers bureau. And the bureau, Hagberg says, remains a key part of the work of the alliance today.

“We were making it up as we went along,” Fine says.

Occasionally, he’ll look back and find some of his writings “childish.”

“I can be quite critical. I was 21 years old. I’m 62 now.” But he’s also astonished at what they accomplished, and the meaning it had for people who looked at the pioneers with silent admiration.

“A lot of the effect of what we did was not measurable at the time,” says Fine.

He tells about a gathering he attended years after he’d left Rochester. “I encountered friends from my college days who, unbeknownst to me, had been struggling with their sexual orientation at the time, but who were not ready to come out. I was a hero to them. I was greeted as a hero. And I was astounded. I had no idea.” 

What Lies **Beneath?**



A 21st-century technology is bringing long-hidden elements of cultural history to the surface.



FACE TIME: Jackson's research indicated that an outline of a face lay underneath the surface of a fresco at the Louvre that was suspected to be a forged example of a Roman-era work.

By Scott Hauser

BIANCA JACKSON WAS READY TO GIVE UP ON THE “THREE MEN.” NOW A POSTDOCTORAL researcher at the Institute of Optics, she had analyzed seven sections of the fresco in the Louvre with nothing to show for her efforts but a growing sense that maybe the faded paint and plaster had no secrets to yield to her scanning technology after all.

As she worked across the painting, Jackson moved a carefully controlled beam of terahertz pulses across a postcard-sized section of the fresco and repeated a time-consuming cycle of recording the signal as it was reflected to her equipment. There, a computer program she wrote calculated the maximum amplitude of each returning pulse, adjusted the noise-to-signal ratio, and presented a pixel-by-pixel string of data across her laptop screen.

“I was ready to give up because we weren’t really seeing anything, and you have to keep doing the same thing to each section,” Jackson says from her office in Goergen Hall. “If the layers are very thin and very close, what you’re looking for is very hard to identify. I think I was on the eighth one when we started to see something.”

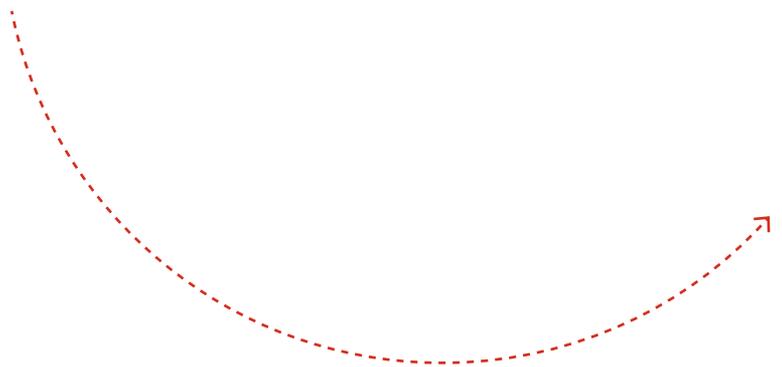
That “something” made international news this spring when Jackson reported the results at the American Chemical Society’s national meeting. She and her colleagues reported that below the surface of the left hip of one of the Romanesque men in the fresco, “Trois hommes armes de lances” (“Three Men with Lances”), the signals indicated the outline of what appeared to be a face. At a depth of a fraction of a millimeter, the equipment picked up a noticeable difference, a change in contrast, between the fresco’s plaster and another material that formed the outline of what seemed to be a separate, older work of art.

Was it possible that someone had painted over an original Roman-era work of art?

“We could not believe our eyes as the image evolved on the screen,” Jackson says. “We were seeing what likely was part of an ancient Roman fresco, thousands of years old.”

Using new technology to peer—at least metaphorically—into layers of cultural, archaeological, and artistic history has become something of a specialty for Jackson. A leading researcher on the use of terahertz imaging to examine historical artifacts and paintings, she has traveled the world during the past half decade, honing the application of the technology as a potential research tool for archaeologists, historians, art conservators, and curators.

In addition to the Louvre, she has undertaken research at Çatalhöyük, Turkey, a 9,000-year-old U.N. World Heritage site that’s considered the oldest example of a Neolithic-era human settlement; she’s scanned for decorative motifs that were painted over at an 800-year-old medieval cathedral in Riga, Latvia, and scanned Orthodox icons in Nizhny



Novgorod, Russia; she's climbed to the top of Chartres Cathedral in France for a project; and she's demonstrated the technology's possibilities by scanning Egyptian bird mummies at the Oriental Institute at the University of Chicago.

Gerard Mourou, a former faculty member at the Institute of Optics who is now a professor of physics and the director of the International Center for Zetta-Exawatt Science and Technology at the Ecole Polytechnique in Paris, says Jackson was one of the first researchers to demonstrate that terahertz technology could be used to identify "undercover" art—images that have been covered over by layers of paint, plaster, and other materials.

"She won't tell you this, but she really is a pioneer," Mourou says. "Bianca introduced a new electromagnetic frequency band to the archaeologists' panoply. She's made seminal contributions to the field."

While terahertz technology is probably best known for its potential use in some scanning machines in airport security lines, the field has been undergoing a scientific renaissance since the 1980s. Historically considered something of a "gap" when it came to understanding the electromagnetic spectrum, the terahertz band lies between frequencies that can be readily measured electronically with antennas or optically with detectors. Falling between microwaves, like those used in the common kitchen appliances, and the infrared light used in TV remote controls, the terahertz frequency region is invisible to humans.

And like all physical phenomena that are part of a spectrum, terahertz radiation not only shares properties of nearby frequencies but also has properties that set it apart. That's tantalizing for researchers hoping to capitalize on its potential.

On the plus side, terahertz frequencies are relatively weak as far as electromagnetic radiation goes. Unlike x-rays or ultraviolet radiation, terahertz waves don't "energize" the electrons of the molecules that absorb them. That means those electrons don't change their state, altering the underlying atomic structure in the way that living tissue can be affected by x-ray radiation or a work of art will change color if left exposed to the sun. Also in the plus column, terahertz waves travel deeply into dense material, transmitting especially well in materials that contain little moisture.

On the minus side, while terahertz waves propagate, their higher frequencies are easily absorbed by water and other molecules in Earth's atmosphere, meaning that unlike microwaves or radio waves, they can't travel far in the open air. And because terahertz radiation has relatively large wavelengths—on the order of 300 to 1,000 times larger than infrared and ultraviolet—the level of detail

at which terahertz images can be resolved is more limited than that of other imaging technology.

Xi-Cheng Zhang, the director of the Institute of Optics who is considered one of the leading experts in understanding the terahertz band, recognizes the trade-offs, but he says the technology has proven itself in several applications beyond imaging, particularly for quality control, nondestructive testing, and other manufacturing processes.

"I like to talk about terahertz technology as a complementary method to x-ray and infrared spectroscopy," says Zhang, the M. Parker Givens Professor of Optics. "There are certain materials for which terahertz wave technology does a better job than x-ray or infrared. For example, for low-contrast materials, such as low-density foam, terahertz wave technology has been demonstrated as having a better contrast ratio than x-ray images; on the other hand, for infrared imaging of some optical opaque materials, such as paper, plastics, or cloth, terahertz penetration capability is better. That's why now many airports use sub-terahertz wave imaging, and why we continue to push the frequency to the terahertz range."

WORKING WITH TERAHERTZ PIONEER DAVID Auston and others at Columbia University in the late 1980s, Zhang was among the first to demonstrate that terahertz signals could be consistently generated and measured using semiconducting materials and lasers. In 2012, he brought his internationally regarded program to Rochester when he moved to the Institute of Optics after a 20-year career at Rensselaer Polytechnic Institute, where he was director of the Center for Terahertz Imaging, acting head of physics, applied physics, and astronomy, and the Erik Jossion Professor of Science.

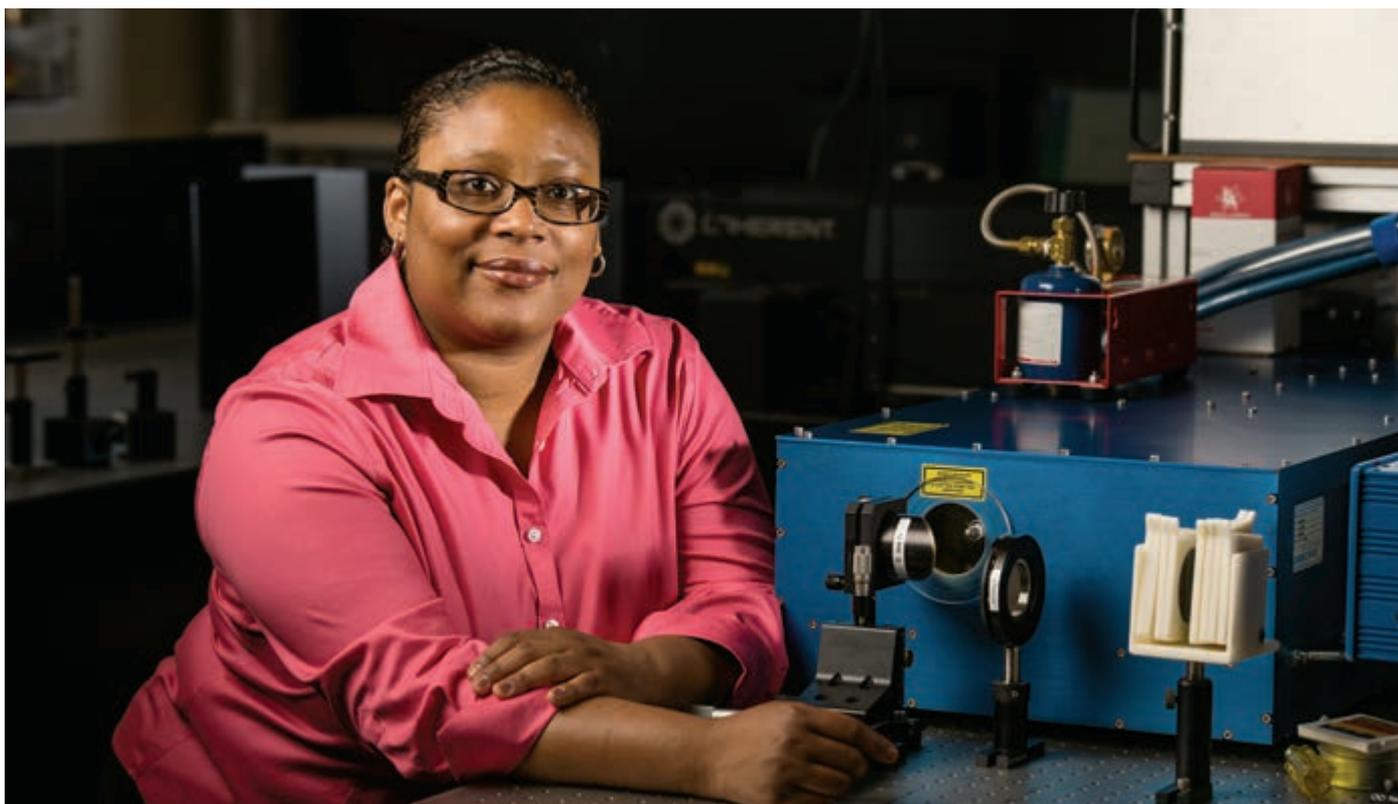
He and his group are currently leading work to explore whether terahertz technology can be harnessed for remote sensing and long-distance communications. Zhang invited Jackson to spend a year working at Rochester after learning about her work with terahertz imaging on several cultural heritage projects. He considers her work as part of a larger effort to build strength in terahertz at Rochester.

In many ways Zhang's initiative taps into a larger history of leadership in terahertz research at Rochester. As a scientist at the Laboratory for Laser Energetics in the 1970s, Mourou led a team that reported the first work in producing and detecting terahertz pulses. In 1988, he moved to the University of Michigan in Ann Arbor, where one of his former students, Steve Williamson '82, would later found Picometrix, one of the world's leading manufacturers of

Neolithic Art

At Çatalhöyük, Turkey, Jackson scanned walls (right) to determine whether her equipment could uncover Neolithic art (left) that had been plastered over by generations of occupants at the 9,000-year-old site.





terahertz equipment. The company's key principals also include Irl Duling '85 (PhD) and Janis Valdmans '84 (PhD). In 2005, Picometrix was purchased by Advanced Photonix Inc., a public company.

At Michigan, Mourou first met Jackson, whose PhD advisor was John Whitaker '88 (PhD), a scientist at Michigan's Center for Ultrafast Optical Science. Whitaker himself had worked on applications of terahertz radiation in electrical transmission lines as a graduate student in electrical and computer engineering at Rochester.

"It's like a circle almost," Jackson says of the connections between Rochester, Michigan, and terahertz research.

In the mid-2000s, Mourou had returned from a conference at the Hermitage in St. Petersburg, Russia, where he had heard the latest research on using infrared, ultraviolet, x-rays, and other frequencies to image art work and historical objects, and he had an idea: could pulsed terahertz waves be used for imaging cultural artifacts? He turned to Whitaker, who had been advising Jackson on

SCIENTIFIC IMAGE: "I like the idea of a gentle form of science, of a gentle form of imaging," Jackson says of using terahertz technology to analyze cultural and historical artifacts.

terahertz-based work to examine the ceramic coatings of jet engine turbine blades.

"We were basically looking for defects in the coatings on the blades," says Whitaker.

He suggested to Jackson that she undertake the research on artwork. To do that, Jackson and Mourou's daughter established a mini-art studio in the Michigan lab, using historically accurate painting materials and compounds to draw and paint images, such as butterflies, and then cover part of each work with different kinds of plaster, including gypsum, the mineral in modern drywall that's also found in the plaster at the Neolithic site in Turkey.

"Visibly, you would see half of a sketch, and then white plaster," Whitaker says. But with the terahertz equipment, it was possible to

Cathedral Walls

Jackson used terahertz imaging technology (right) to scan for decorative motifs under the painted walls of the Dom Cathedral, an 800-year-old medieval church (left) in Riga, Latvia.



“see” more. “Even though it was under the plaster, you could still see the image of the butterfly.”

Says Jackson: “We would have a 4- or 5-millimeter thick piece of plaster, and we could see the paint patterns behind it.”

The findings were promising for imaging, Whitaker says, but they also demonstrated that pulsed terahertz waves could be used for spectroscopy, or analyzing the molecular make-up of materials by the frequency at which they reflect electromagnetic radiation. By “tuning” the frequencies at which the pulses were emitted, Jackson could examine the makeup of individual compounds under the plaster, the “nitty-gritty spectroscopy of plaster and pigment.”

“One of the beauties of using terahertz pulsed imaging to look at art is that you’re not only doing imaging, but you’re also doing spectroscopy at the same time,” Whitaker says.

UNDERSTANDING THE RELATIONSHIPS AMONG FREQUENCIES and the contrasting properties of different types of materials when they absorb radiation is a key area of research, Jackson says.

“When you see something, you’re not really seeing the ‘thing,’” she says of one of the tenets of imaging science. “You’re seeing the difference between the ‘thing’ and what’s around it. If you have two materials that are very similar and neither of them is particularly absorbing, it’s going to seem like the ‘thing’ is invisible or transparent. You may see edges, but you won’t really see the whole object.”

For example, with x-rays, materials like plastics and polymers are difficult to detect because the materials do not absorb much of the radiation. In other words, the atomic density of plastic is closer to air than it is to something more substantial like bones, brick, or metal, allowing the radiation to pass through it.

“With terahertz, the structure of the material—the specific atoms that make up the material—aren’t as significant,” says Jackson. “So you can have carbon-based materials or organic materials that are very visible with terahertz because there’s still some absorption, there’s still some contrast between that material and the air around it.”

To analyze paintings, the molecular composition of some pigment compounds traditionally used by artists, such as red iron oxide, aka “red ochre,” have very low contrast when it comes to imaging. On the other hand, a fundamentally similar one, like iron oxide hydroxide, aka “yellow ochre,” might be identified well.

“So red ochre, no; yellow ochre, yes,” says Jackson. “That’s the kind of information I started picking up from my early experiments.” An early idea to scan the *Mona Lisa*, for example, eventually

failed to come to fruition after Jackson found that if Leonardo Da Vinci used red ochre, as was traditional for him and other artists of his era, indications of drawings underneath the surface paint would be nearly impossible for her to pinpoint.

After graduating from Michigan, Jackson began working in the field, where she discovered that, because most art exists in a world of clumps, splotches, and uneven surfaces, much of her work requires fine-tuning computer algorithms to adjust for such variables, a programming challenge that she takes on herself.

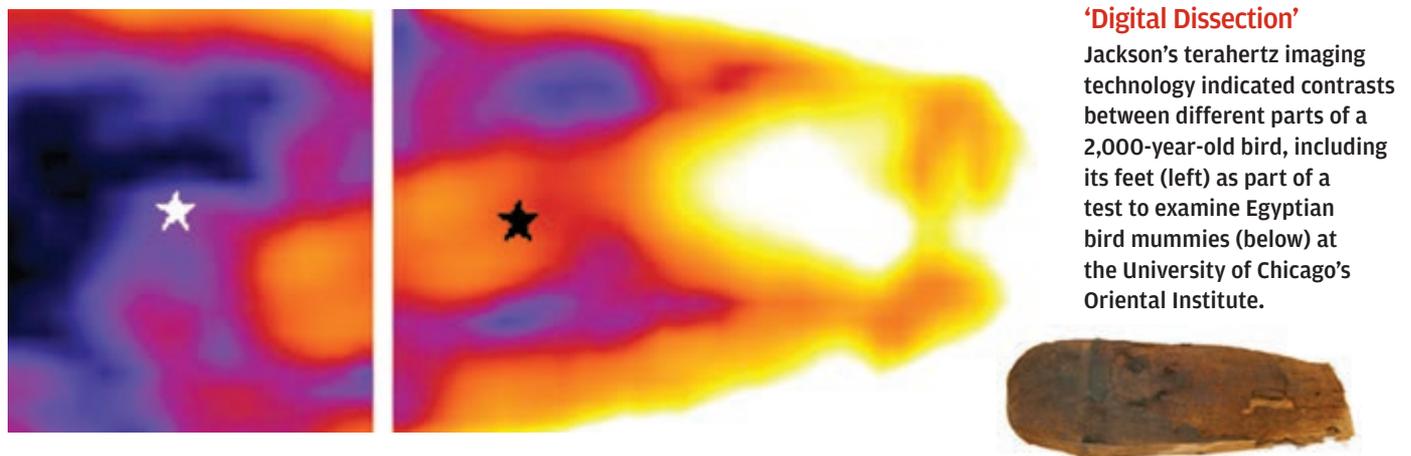
“Terahertz works well for layered artifacts, like old wall paintings, because it can scan at different depths,” Jackson says. “As work is painted or plastered over, each new addition adds a layer. Sometimes the previous work was erased, but sometimes it was simply plastered over. At sites like Çatalhöyük, that means centuries of plaster.”

That requires developing new algorithms to account for the layering, which colleagues reported with Jackson this spring in the journal *Optics Express*.

From academic positions in France and elsewhere, Jackson has become a go-to person in the world of terahertz applications in cultural heritage. For the “Three Men” project, curators from the Louvre had turned to her and her team to evaluate the fresco—part of the Louvre’s collection of pieces that once belonged to 19th-century collector Giampietro Campana—because they knew it was not an authentic Roman-era work. Art historians have long known that Campana was not above “restoring” pieces in his collection because he thought it important to save historical work such as frescoes.

Working with a portable system made by Picometrix, Jackson was able to conduct her work within the Louvre, something that she sees as an important benefit to terahertz imaging. With other scanning technologies, like x-rays or computer tomography (CT) scans, artwork has to be taken to the equipment, usually requiring transportation to a hospital setting. That can make curators and conservators uneasy about letting researchers examine artifacts that are often priceless and one-of-a-kind, and sometimes too large to move.

Jack Green, chief curator at the Oriental Institute Museum, says that conservators have long been interested in being able to “dissect objects digitally,” especially for artifacts like mummies, which cannot be opened without destroying them. The Oriental Institute invited Jackson to scan a 2,000-year-old Egyptian bird mummy as part of a larger research project on the institute’s collection of Egyptian artifacts. While the fragile mummies had to be transported to the University of Chicago’s hospitals to undergo CT scanning, Jackson conducted her work in the institute’s conservation lab. Jackson contributed a chapter to the catalog for the exhibition, *Between*



‘Digital Dissection’

Jackson’s terahertz imaging technology indicated contrasts between different parts of a 2,000-year-old bird, including its feet (left) as part of a test to examine Egyptian bird mummies (below) at the University of Chicago’s Oriental Institute.



TEACHER: As part of her work, Jackson teaches in a terahertz lab, where Jing Zhang, a visiting PhD student from Huazhong University of Science and Technology (pointing), and Rochester optics PhD students Xuan (Betty) Sun (left) and Fabrizio Buccheri conduct research.

Heaven and Earth: Birds in Ancient Egypt, on display at the Oriental Institute through July 28.

The results were not as detailed as the CT scanning, but Green says experimenting with new technologies is important to understanding cultural history. Jackson and the exhibition's guest curator, Rozenn Bailleul-

LeSeur, plan to conduct a more detailed comparison of the CT scanning and terahertz imaging that was done on the bird mummy.

"Obviously, we favor nondestructive testing," Green says. "And a tool like this can be incredibly useful if you're able to reveal information about the object layer by layer."

Gillian Walker, a researcher at the School of Systems Engineering at the University of Reading in the United Kingdom and a frequent collaborator with Jackson, says the noninvasive nature of terahertz imaging is one of its most compelling features. One of her first projects was trying to develop a way to detect skin cancer using terahertz imaging. "The mathematical problem is exactly the same as detecting layers of paint in plaster," Walker says.

And although she's intrigued by the opportunity to help conservators and archaeologists gain new insights into cultural history, "how that enhances the study of cultural history and archaeology is up to the archaeologists to decide," she says. "But it is where the impact of my work is, so it is important to work with good experts who are open and able to interpret the data I provide."

Whitaker says he expects terahertz data will become increasingly prevalent, particularly in areas such as biomedical imaging, the pharmaceutical industry, and in materials testing and quality control. Two challenges to address, he notes, include enhancing

the power that terahertz systems can produce and improving the signal processing of the systems. "Improving the signal-to-noise ratio is crucial," Whitaker says, noting "that's also something that will improve the resolution of the images over time."

Jackson says she's up for the challenge, excited by the chance to demonstrate the applicability of science and research to a problem that improves other people's lives. When people ask about her work, "I always say 'I do terahertz.' I think it's great technology."

"I've always been interested in science and cultural history," says Jackson, who describes her father as a "techie person" who taught her how to program using the BASIC computer language when she was in elementary school. Her mother is an artist who made her living as an art history teacher and who often had her students try to reproduce artifacts as a way of understanding art.

"So it worked out that I was able to use both sides of my brain growing up," Jackson says. "But as a scientist, I'm interested in being innocuous, but also being helpful and useful. I like the idea of a gentle form of science, of a gentle form of imaging. After 9/11, I think the interest in using the technology in providing a service and in making people safer gave me more incentive."

In 2014, she begins a Marie Curie Fellowship IntraEuropean, a program of the European Commission to support the work and geographic mobility of young investigators. She will be based at the University of Reading.

At Reading, Walker has finished scanning St. Thomas's Church in Salisbury with the French team, and has scheduled work to scan a contemporary work of art and a church in France this summer. Jackson will inherit the data about the Salisbury Church.

"I tend to think of myself as being more aligned with terahertz and being a promoter of terahertz," says Jackson. "But I like having fun. I like art. I like traveling. But that's mostly secondary to someone who wants to promote terahertz." 

Shelf Life

Looking for something to read—or listen to—this summer?

The wide range of scholarship, musical performance, and other creative work produced by Rochester faculty and staff received a celebratory round of applause this spring, as Provost Peter Lennie hosted the University's "Celebration of the 'Book.'"

The annual event recognizes authors and performers who published an academic, artistic, musical, commercial, or other work in the 2012–13 year. With the increasing influence of digital technology, the celebration has expanded to include materials that don't always fall under the rubric of "book"—hence the quotation marks in the title.

If you're looking for something to read or listen to this summer, we've put together a small library of suggestions. You can find a more complete list here: www.rochester.edu/news/photos/2013-celebration-of-the-book. 

The Challenge of Congressional Representation, by Richard Fenno, Distinguished University Professor Emeritus of Political Science.

Stravinsky: Octet and L'Histoire du Soldat, under the direction of Mark Scatterday '89E (DMA), professor of conducting and chair of the Eastman School's Department of Conducting and Ensembles, and the Eastman Virtuosi, with narration by Jan Opalach, assistant professor of voice at the Eastman School.

Derek Bermel: Canzonas Americanas, by Alarm Will Sound, a new music ensemble formed at the Eastman School whose stage director is Nigel Maister, the artistic director of the International Theatre Program.

The Power of Patient Stories: Learning Moments in Medicine, by Paul Griner '59M (MD), '65 (Res), professor emeritus of medicine.

Abrahamic Religions: On the Uses and Abuses of History, by Aaron Hughes, the Philip S. Bernstein Professor in Judaic Studies.

The Memorial Art Gallery: 100 Years, by Lu Harper, art librarian, Kerry Schaubert, curatorial assistant, and Marjorie Searl, chief curator, all at the Memorial Art Gallery.

A Herzen Reader, edited and translated from the Russian with an introduction by Kathleen Parthé, professor of Russian and director of the Russian studies program.



The Quest for Health Reform: A Satirical History, cowritten by Ted Brown, the Charles E. and Dale L. Phelps Professor in Public Health and Policy, and Susan Ladwig '03, '07M (MPH), a senior health project coordinator at the Medical Center.

Beyond the Asterisk: Understanding Native Students in Higher Education, coedited by Stephanie Waterman, assistant professor in the higher education program at the Warner School of Education.

Mercy! A Celebration of Fenway Park's Centennial Told through Red Sox Radio and TV, by Curt Smith, senior lecturer in English.

The Deerslayer, by James Fenimore Cooper, edited and introduced by Ezra Tawil, associate professor of English.

Franz Schubert's Winterreise, with tenor Robert Swenson, professor of voice at the Eastman School, and pianist Russell Miller, professor of vocal coaching and repertoire at the Eastman School.

From Afar, Nicholas Goluses, professor of guitar at the Eastman School.

American Anthem: The Music of Samuel Barber and Howard Hanson, by the Ying Quartet, the quartet-in-residence at the Eastman School.

What's That Sound? An Introduction to Rock and Its History, cowritten by John Covach, professor and chair of the music department in Arts, Sciences & Engineering, professor of music theory at the Eastman School, and director of the Institute for Popular Music.

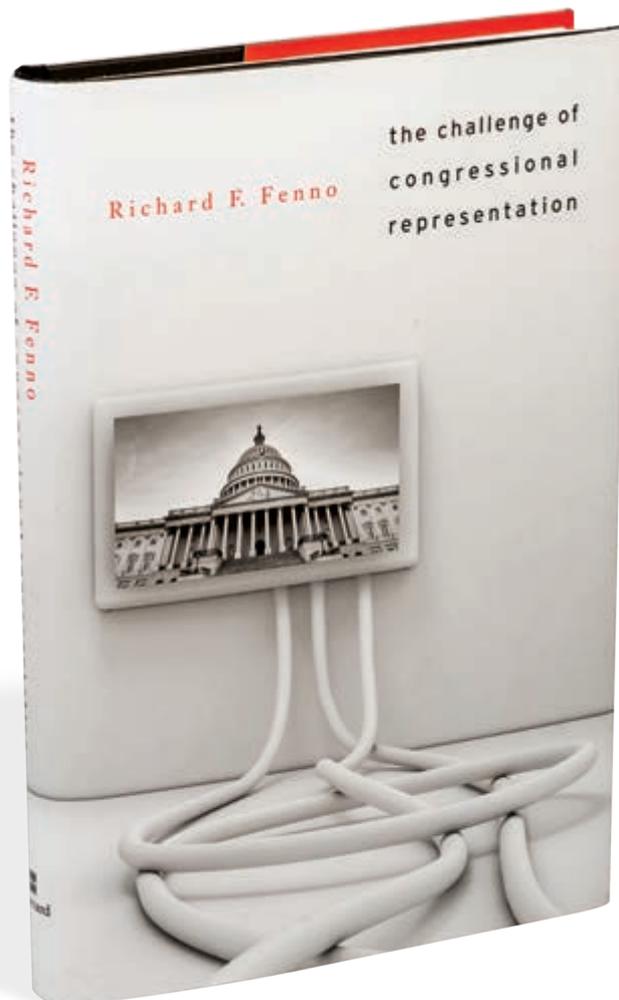
Reminiscences: A Journey through Particle Physics, by Adrian Melissinos, professor of physics and astronomy.



The Challenge of Congressional Representation

Harvard University

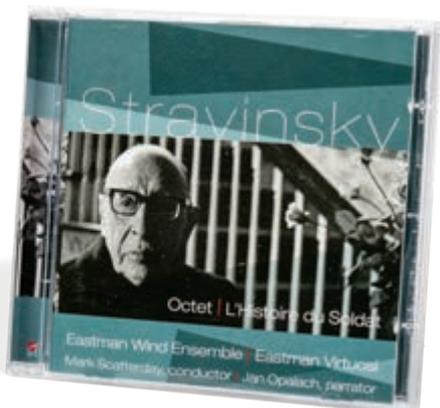
Richard Fenno, professor emeritus of political science, adds a chapter to his six-decade-long career of chronicling the lives of elected representatives. In his latest book, based on research conducted over four decades, he portrays one current and four former members of Congress, from across the nation and the ideological spectrum.



Stravinsky: Octet and L'Histoire du Soldat

Avie Records

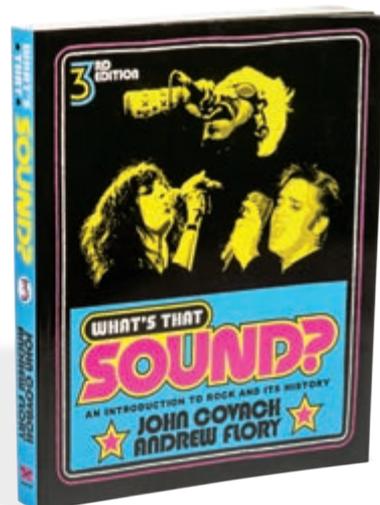
Under the direction of **Mark Scatterday** '89E (DMA), professor of conducting, and with narration by **Jan Opalach**, assistant professor of voice, the Eastman Wind Ensemble and the Eastman Virtuosi celebrate the 60th anniversary of the wind ensemble. The two neoclassical works demonstrate the range of the group and its ability to include many different sounds, says Scatterday.



What's That Sound? An Introduction to Rock and Its History

W. W. Norton

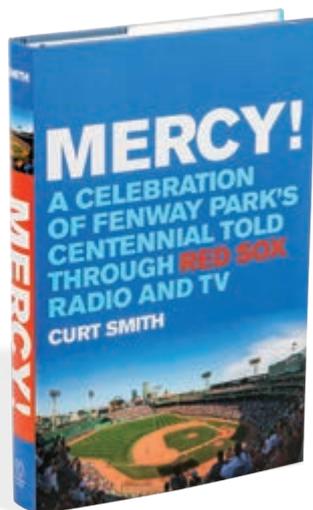
In the third edition of the history textbook, **John Covach**, the Mercer Brugler Distinguished Teaching Professor, and Andrew Flory, assistant professor of music at Carleton College, set out to organize the rock 'n' roll repertoire—"an enormous body of music that covers over fifty years of popular music history—to make it easier to understand and appreciate."



Mercy! A Celebration of Fenway Park's Centennial Told through Red Sox Radio and TV

Potomac Books

A speechwriter turned senior lecturer in English, **Curt Smith** celebrates the "mikemen" who tried to capture the spirit of the Boston Red Sox, their fans, and their historic baseball park.



Franz Schubert's Winterreise

Recorded at Kilbourn Hall

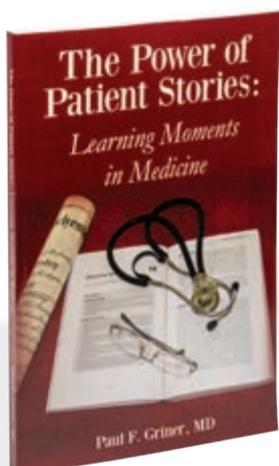
Tenor Robert Swenson, professor of voice, and pianist Russell Miller, professor of vocal coaching and repertoire, present Schubert's 1827 song cycle. "It is a dark journey, of course, at times wistful, hopeful, and despairing, but ultimately accepting of life on life's terms," says Swenson.



The Power of Patient Stories: Learning Moments in Medicine

Self-published

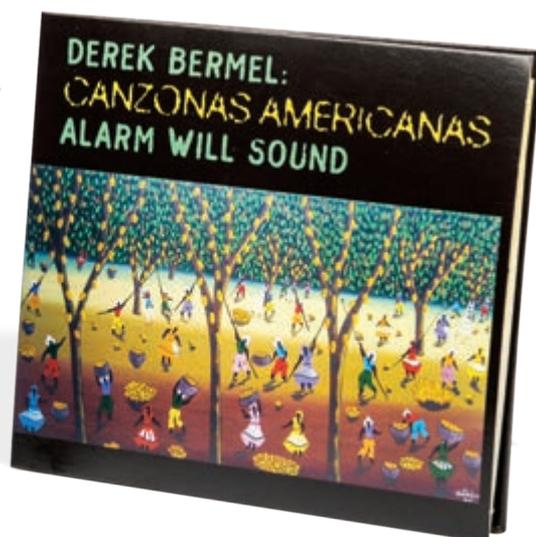
Trustee **Paul Griner** '59M (MD), '65M (Res), professor emeritus of medicine at Rochester and a former senior lecturer at Harvard Medical School, tells the stories of more than 50 patients whom he encountered as an internist and hematologist, and who "provided a learning moment for me."



Derek Bermel: Canzonas Americanas

Canteloupe Music

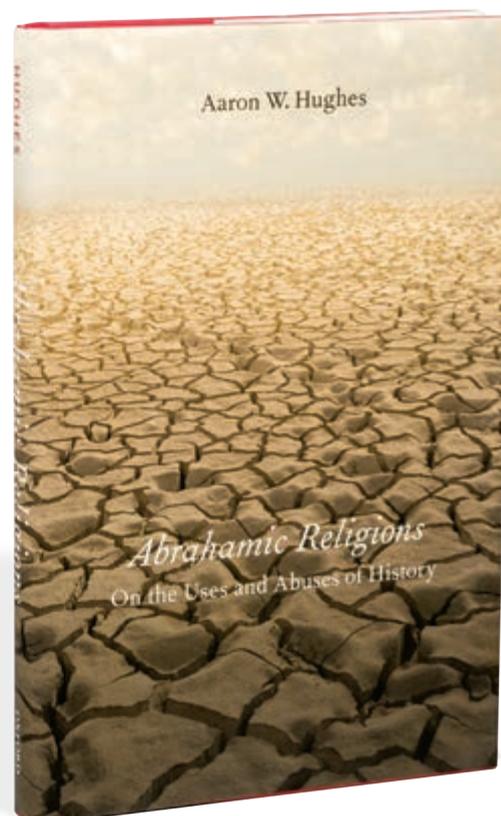
The Eastman-born ensemble Alarm Will Sound, whose stage director is **Nigel Maister** of the International Theatre Program, "draws together all of [Bermel's] works for Alarm Will Sound's sinfonietta instrumentation," according to ensemble conductor **Alan Pierson** '06E (DMA).



Abrahamic Religions: On the Uses and Abuses of History

Oxford University

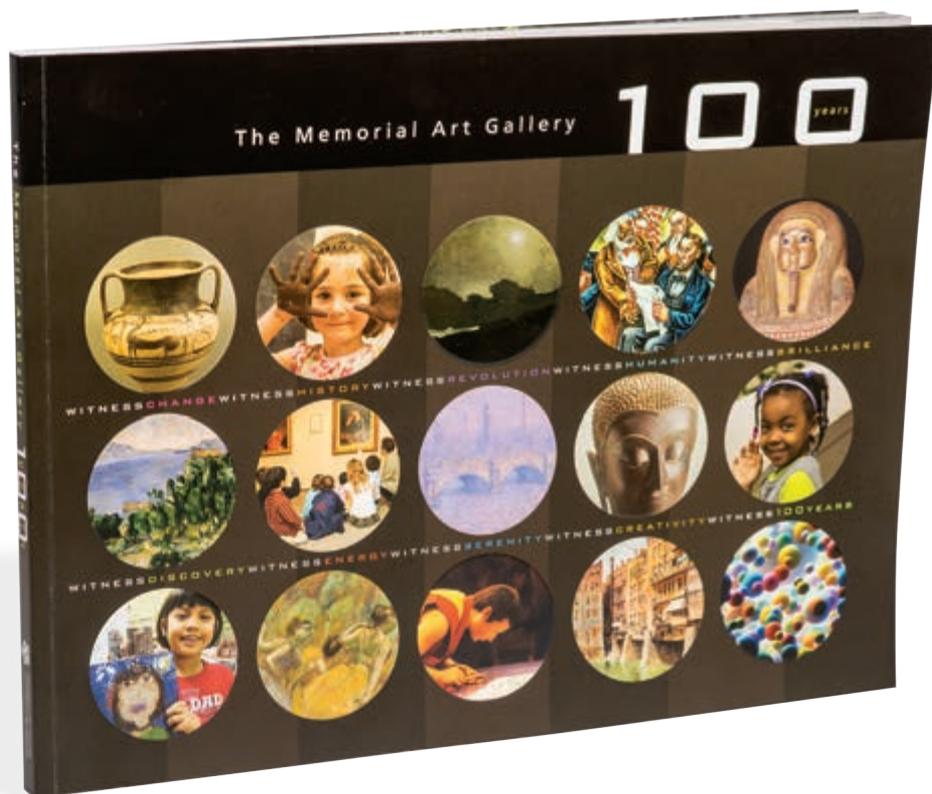
Bernstein Professor **Aaron Hughes** explores the term "Abrahamic religions," and his interest "in analyzing where the term came from and why we still insist on employing it."



The Memorial Art Gallery: 100 Years

Memorial Art Gallery

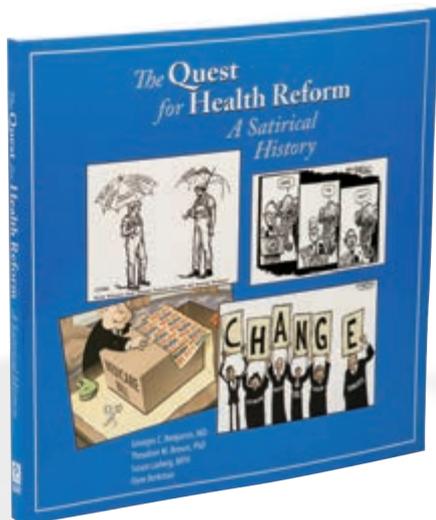
Curatorial and library staff members **Lu Harper**, **Kerry Schaubert**, and **Marjorie Searl** trace the timeline of an institution that was established, in the words of founding patron Emily Sibley Watson, for “the edification and enjoyment of the citizens of Rochester.”



The Quest for Health Reform: A Satirical History

American Public Health Association

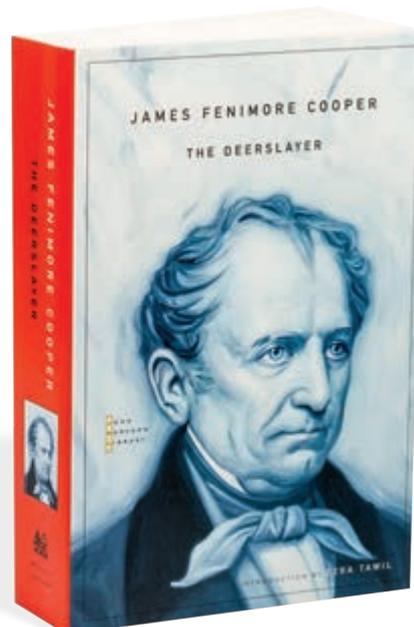
Phelps Professor **Ted Brown**; Georges Benjamin, executive director of the American Public Health Association; **Susan Ladwig** '03, '07M (MPH) of the Medical Center; and researcher Elyse Berman bring “together two American traditions—editorial cartooning as a medium for trenchant contemporary commentary and the long-standing effort to achieve universal national health reform.”



The Deerslayer, by James Fenimore Cooper

Belknap Press of Harvard University

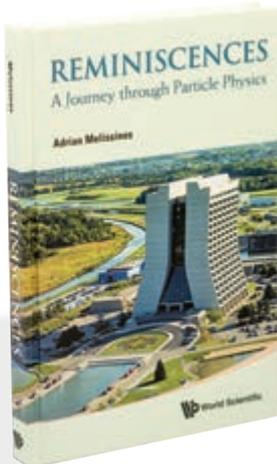
English professor **Ezra Tawil** edits and introduces a new edition of Cooper's final installment of the “Leatherstocking” series. Although the last to be written, the novel takes place before the four other tales, emerging “as a crucial work in the series, rather than an afterthought in a procession of sequels and prequels.”



Reminiscences: A Journey through Particle Physics

World Scientific

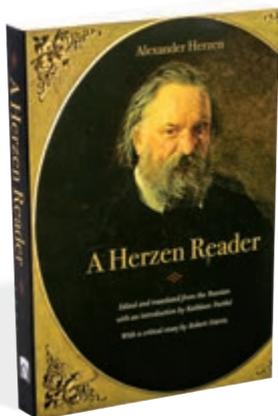
Professor **Adrian Melissinos** recounts a career in which “the dominant recollection is the enthusiasm and joy of doing physics, shared with many a distinguished colleague and with the many gifted postdocs and graduate students who made the whole enterprise possible.”



A Herzen Reader

Northwestern University

Kathleen Parthé, professor of Russian and director of the Russian studies program, adds to the narrative of the influential Russian thinker whose political writing and personal correspondence has previously been largely unavailable in English.



From Afar

Albany Records

For the title track, **Nicholas Goluses**, professor of guitar, records the first solo guitar version of a composition by former Eastman faculty member and Pulitzer Prize winner Joseph Schwanter.

American Anthem: The Music of Samuel Barber and Howard Hanson

Sono Luminos

The Ying Quartet—cellist **David Ying** '92E (Mas), violinist **Janet Ying** '92E, violist **Phillip Ying** '92E (Mas), and violinist **Ayano Ninmiya**—explore “what makes ‘American music’ . . . ‘American’” in a recording of major works by Howard Hanson, whose 40-year leadership established the Eastman School, and major works of Hanson’s contemporary, Samuel Barber.



Beyond the Asterisk: Understanding Native Students in Higher Education

Stylus

Editors Heather Shotton, an assistant professor at the University of Oklahoma; Shelly Lowe, the executive director of Harvard University’s Native American program; and **Stephanie Waterman**, assistant professor at the Warner School, bring together scholars to address why, “while enrollment of Native Americans in postsecondary institutions has increased, Native Americans remain grossly underrepresented in postsecondary education.” According to some estimates, Native Americans make up only about 1 percent of the nation’s college student population.

