

W I N T E R 2 0 1 6

LEHIGH

B U L L E T I N



TOY STORIES

Lehigh proves fertile ground for new crop of toy inventors.



TOY FAIR 2016

Lisa Glover '13, '14G shows her KitRex creations at the North American International Toy Fair in New York. Read more about her and other alumni in our feature, Toy Stories. Photo by Christa Neu

LEHIGH

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Lehigh proves fertile ground for new crop of toy inventors. *By Mary Ellen Alu*

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Lehigh researchers across numerous disciplines are working to thwart hackers and data thieves, with the ultimate goal of creating a world of trustworthy computing. *By Kelly Hochbein*

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The Oscar-nominated film chronicling *The Boston Globe's* 2002 investigation of the Catholic Church's cover-up of clergy sex abuse has put journalist Marty Baron '76, '76G, '14H in the spotlight himself. The legendary editor talks with the *Bulletin* about the film—and the state of journalism today. *By Mary Ellen Alu*



Marty Baron '76, '76G, '14H
(second from the right) is
considered one of the best
editors of all time.

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Five young alums are among a new crop of toy inventors who developed their ideas while at Lehigh.

Photo by Ryan Hulvat

Styling by Kate Cassidy



Yes, Your Letters Matter

Believe us, they really do. So our plea is simple: Send more

AS ANY WRITER or editor will tell you, nothing is quite so disconcerting as silence. When you spend a week working on a story, or four months working on a magazine, and then it gets sent out to the world, your singular hope is that somebody (or preferably, many somebodies) will read what you've put out there—and maybe take the time to respond.

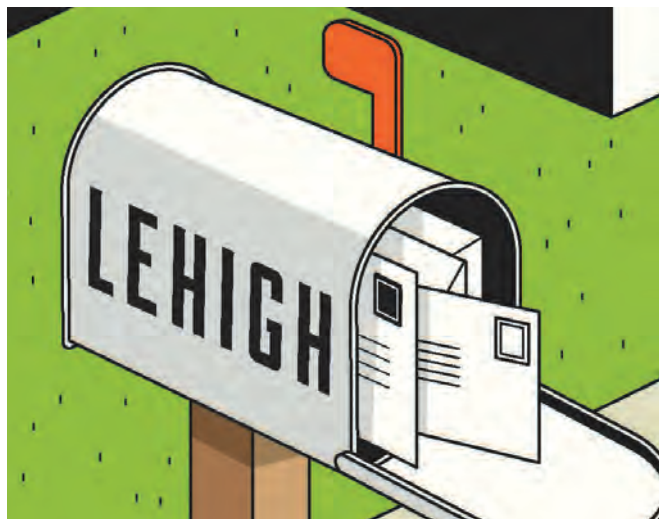
Thankfully, Lehigh alumni are not shy in the least about having their say.

For our Fall 2015 issue, the editors of the *Bulletin*, along with a committee of other staff from around campus, spent months working to identify the 150 people, places, events, breakthroughs and traditions that have made Lehigh what it is today—one of the finest universities in the nation. We thought we did a pretty good job, and we were quite happy with where our list ended up.

But a few weeks after the issue was mailed out, the phone started ringing and letters started arriving, and our faithful readers informed us that, no, we didn't include everyone who needed to be included in our supposedly comprehensive list. You can read a few of these letters—as well as some others, addressing other recent *Bulletin* stories—on page 4. We are grateful to those who took the time to share their thoughts, and of course, invite everyone to weigh in on this issue of the *Bulletin* as well; it is, after all, your alumni magazine. We are merely its stewards.

Other highlights of the issue include the following:

■ In mid-February, New York City hosted the 2016 North American International Toy Fair, one of the biggest events of the year in the multibillion dollar toy industry—and among the hundreds of aspiring entrepreneurs



who attended the massive gathering this year, four of them were young Lehigh alumni. In her cover story for this issue of the *Bulletin* ("Toy Stories," page 22), managing editor Mary Ellen Alu speaks to **Lisa Glover '13, '14G, Briana Gardell '14, '15G, Lauren Villaverde '14, '15G, Shannon Varcoe '15** as well as **Keith Martin '13, '14G** about their creations—and the hurdles they'll have to overcome to make it big in one of the most hyper-competitive markets in all of business.

■ By the time this issue lands in your mailbox, Lehigh alum Marty Baron '76, '76G, '14H may be basking in Oscar glory. Baron is the former *Boston Globe* editor (and current *Washington Post* editor) who was portrayed by actor Liev Schreiber in the critically acclaimed film *Spotlight*, which documents Baron's efforts at *The Globe* to uncover the Catholic Church's child abuse scandal. In an interview with Alu, Baron talks about his time at *The Globe*, his thoughts on the film, and his hopes for journalism going forward.

This issue also includes an interesting look at assistant professor of history and Africana studies Kwame Essien's new book about the Brazilian-African diaspora; a visit with Lehigh men's lacrosse captain Casey Eidenshink '16, who will be looking to guide the Mountain Hawks to a Patriot League title this spring; and so much more.

We thank you again for taking the time to read this issue of the *Bulletin*.

And remember, send those letters.

Sincerely,
Tim Hyland, *Editor*

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Taking Risks, in Search of Reward



ON THE ROAD

President Simon traveled the country to meet with Lehigh alumni last fall as part of the Our Lehigh tour. See highlights from the tour at lehigh.edu/president.

THE SPIRIT OF ENTREPRENEURSHIP is strong at Lehigh—among our accomplished alumni, among our ambitious students and in the increasingly varied ways that we approach teaching, researching and learning.

To lead and succeed in the world today, young people need knowledge, skill, the courage to take risks and the willingness to tackle the greatest challenges of our time. We strive at Lehigh to instill in our students precisely those traits, and as I read through this issue of the *Lehigh Bulletin*, I was heartened to see that, yes, we have clearly succeeded in doing so.

Mary Ellen Alu's cover story about the five young Lehigh alums who are striving to make it big in the toy industry is illustrative of the type of student that our university attracts today—and indicative, too, of the impact our teaching methods have on our students. Each of the five entrepreneurs understands fully the challenges and hurdles that stand between them and ultimate success. And we see in them the optimism that comes along with preparation and great confidence. These young alumni truly believe in what they are doing.

I believe everyone in the Lehigh family, our faculty, staff and students here in Bethlehem and our loyal alumni the world over, can learn something from these budding entrepreneurs. We should use their

stories as a reminder that every day brings new and important opportunities to change the world—in ways either big or small, locally or globally—for the better. It is our responsibility to make the most of those opportunities.

We encourage risks to be taken, new paths forged and new ways of thinking pursued. At Lehigh today, we are constantly questioning the ways we educate our students, because we know that the world is changing—and we must change with it. Through our acclaimed interdisciplinary and integrated learning programs, and through our continued efforts to redefine—and ultimately improve—the Lehigh experience, we are working toward the goal of producing the kind of graduates who can and will develop into leaders, innovators and agents of positive social change.

Lehigh has for decades built its reputation on its success in doing precisely this—and we remain as committed as ever to continuing this proud, enduring tradition.

Sincerely,
John D. Simon, *President*

Correspondence

You offered your thoughts on Lehigh at 150 and other matters, and we listened

REGARDING THE 150 ...

The following are some historical comments that might be added to the Lehigh 150 list:

The *Bulletin* states that Asa Packer (No. 150 on the list) donated \$500,000 and 57 acres to establish Lehigh University, but an 1888 *Harper's Weekly* article indicates that Packer gave \$500,000 and 125 acres to establish Lehigh, and a total of \$3.5 million to Lehigh (including \$500,000 to the library) in his lifetime.

The *Bulletin* comments that Lehigh's brown and white colors (No. 108 on the list) might have been chosen based on fashionable women's stockings in 1876, but the Lehigh University 1866-1886 book states that, "The adoption of brown and white had trencched upon the property of Brown University ...

The stories that refer their choice to certain aspects of apparel are ... creations of the imagination."

Richard Kaplan '65

REMEMBERING DEAN PALMER

Your recent issue of the *Bulletin* was an impressive overview of Lehigh's past. What stunned me was that nowhere in your review did the name Philip Mason Palmer appear. Dean Palmer survived a series of presidents and, almost alone at times, held the university together through his purposeful support of the Arts and Sciences in a school that repeatedly was identified as an "engineering university." Many graduates of Lehigh recall the quiet counseling given by Dean Palmer in his role as Dean. To publish a history of Lehigh without mention of Dean Palmer is a travesty and a reflection on the competence of the researchers who gathered together your published report. Even a prominent graduate of Lehigh, Eugene Grace (chairman of Bethlehem Steel), once commented that "Even engineers need to learn to write and communicate." Grace became a supporter of the School of Arts and Sciences.

Richard B. Palmer '43

Editor's Note: We appreciate the comments of Richard B. Palmer, the son of Philip Mason Palmer. The elder Palmer gave the arts college its shape, according to a narrative history of Lehigh's humanities written



by Jim Benner and Jim Wolfe. Palmer came to Lehigh in 1902 as an instructor in German, and in four years became head of the department of romance languages. He was appointed director of the College of Arts and Sciences in 1921 and became its first dean in 1936. Palmer made his scholarly mark with studies of Goethe, especially Faust, and his work was well respected in the United States, Britain and Germany. Lehigh's Palmer Hall, one of the Centennial II residential houses, is named after him.

MISSING THE MARK IN THE '150'

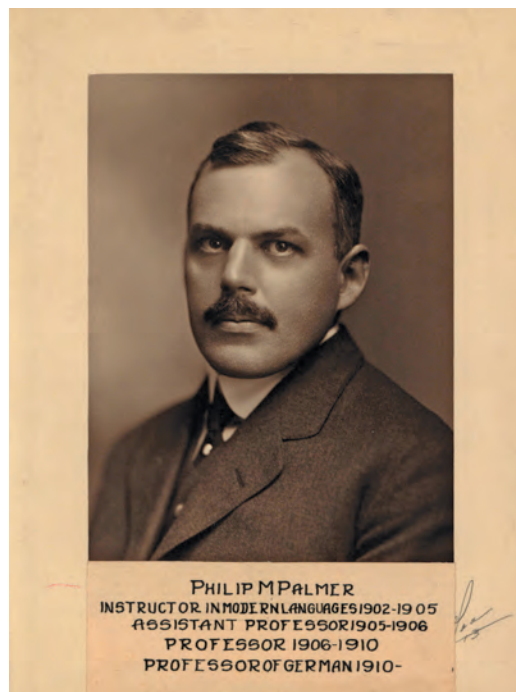
As president of the Class of 1960, and perhaps speaking for my generation at Lehigh, I cannot understand how a Lehigh group can write a 150-year history of the school citing 150 situations and mentioning 64 individuals including all the presidents of the university but fail to specifically mention Eugene Gifford Grace and Billy Sheridan.

Mr. Grace was president and chairman of Bethlehem Steel from 1916 to 1957, the second largest steel company in the second or third largest industry in the United States during that period. Bethlehem Steel was also the largest shipbuilding company in the world. He led the company through both World War I and World War II. It was a leading participant in the Arsenal of Democracy.

Regarding Lehigh, he was chairman of the Board of Trustees from 1924 to 1957, during a period when enrollment doubled, the endowment quadrupled and 13 new buildings were added. His accomplishments were far more significant than many of the presidents you mention. You also mention by name a number of recent Lehigh graduates whose personal achievements are impressive but who certainly are not a national figure like Mr. Grace.

Along with a strong alumni tradition, similar to Princeton and Dartmouth, Lehigh has had a number of outstanding board chairmen, including several in the last two decades.

Secondly, the history fails to mention Billy Sheridan, who put the Lehigh wrestling program on the national map. He was head coach for 31 years, with a 222-86 dual meet record, a charter member of the National Col-





Billy Sheridan

legiate Wrestling Hall of Fame, U.S. Olympic coach in 1936 and recognized as the Knute Rockne of college wrestling.

I rest my case.

John J. Kennedy '60

A DIFFERING VIEWPOINT ON 'AN EYE FOR WAR'

The author in the *An Eye for War* article (Summer 2015) wasn't totally wrong, in that there's a real cultural shift in military training over the past 70 years. He dramatically overstates the employment of video games as a means to encourage soldiers, sailors, airmen and Marines to perform differently in battle, though.

He also isolates the homemade "war porn" videos that service members seem to love as an example of a military policy to train troops to perform differently, but that also misses the mark. Employment of E-Type silhouettes on the rifle range—and having them drop when shot—is probably more significant than anything the author identified in the article (perhaps this point is made and expounded upon in the forthcoming book's pages). And, in response to a prior comment criticizing the author, let's not equate having a critical eye on military training to being non-supportive of Uncle Sam's kids.

And to rebut any ad hominem attacks, I am an active duty service member who previously deployed to Afghanistan and traveled outside the wire in and around the Kabul base cluster and Bagram Airfield. I am qualified on the M4 and M9 and went through a training program that was devoid of video games.

Frederic Pugliese '05

REMEMBERING PROF. TRESOLINI

Congratulations on this excellent issue of the *Bulletin*! It brought back many memories.

Thank you for mentioning Prof. (Rocco J.) Tresolini ("Lehigh at 150," pg. 37). I had excellent teachers at Lehigh, including Prof. Carl Strauch of the English Department. But Prof. Tresolini stands out in my memory because of the help and encouragement he gave me in the last semesters of my time at Lehigh. I had come to realize that my major, Industrial Psychology, was not the right one for me, and that I had no real interest in it. I wanted to use my remaining non-major hours to find something that would point me in a direction I could

take after Lehigh. By chance, I met with Prof. (Howard) Ziegler, who was counseling students in the Arts & Sciences College, and learned that I still had to satisfy the then distribution requirements. Of the three courses I could choose from, I chose Prof. Tresolini's Govt. 351, American Constitutional Law. That course and a second changed my life. He asked me during my second course with him if I was interested in law school, which I was. He arranged for me to meet the then visiting dean of the law school I eventually attended and wrote letters of recommendation for me to all the schools to which I applied.

My post-Lehigh life was very rewarding, and I owe that life in great part to his steadfast help. It was a great shock to learn in my last semester of law school (spring of 1967) that he had died. When the Tresolini Lectures were established, I was able to attend some of them as my family and I were living in Maryland at the time. He deserved that honor. Later, when I was Dean of Students at American University's Washington College of Law, I was able to assist in the admission of a Lehigh government major who was recommended to me by Prof. Tresolini's successor, whose name escapes me at the moment.

I apologize for writing so long a message, but I wanted to give my personal recollection of this splendid Lehigh faculty member.

Edwin R. Hazen '60

MORE ON PRESIDENT OBAMA, AND ON CIVILITY

The *Lehigh Bulletin* has published several letters from alumni accusing President Obama of being a Marxist. This reflects ignorance on the part of the letter writers and meanness on the part of the editors of the *Bulletin*. President Bush said GM wasn't going under during his presidency, and he made sure it didn't—maybe he's a Marxist. Fannie Mae and Freddie Mac were basically nationalized under Bush, too.

A cursory reading of history shows that President Obama's overall actions such as the Asian Free Trade agreement are not the actions of a Marxist. Most people do not even know what a Marxist is.

Obama's views and actions are nowhere near (those of) Bernie Sanders much less Joseph Stalin. In some regards (for political reasons) he is less liberal than Roosevelt. Whether you like the president or not, we should try to avoid the partisan name-calling that just ignores facts, and the alumni *Bulletin* should not spread these views especially without some sort of commentary or context.

Larry Herold '83

Editor's Note: Thank you for the note, Mr. Herold. You were not the only reader to express dismay at some of the political dialogue that has populated our Correspondence pages in recent issues, so we wanted to

briefly respond. First, we want to note that we do not in fact publish every letter we receive; if we feel any letter crosses the line from healthy debate into disrespectful dialogue, we will not run it. At the same time, we want our readers to use these pages as an open forum for the sharing of ideas—and at times, that will lead to heated back-and-forth. However, so long as the letters maintain a level of civility, we will publish them—and, of course, welcome responses in future issues.



Prof. Tresolini

ON CAMPUS

NEWS FROM LEHIGH



A Powerful Opportunity

Africana Studies program awarded \$500,000 NEH challenge grant that will be used to create endowment to expand public humanities initiatives

LEHIGH'S AFRICANA STUDIES PROGRAM HAS BEEN AWARDED a prestigious \$500,000 challenge grant from the National Endowment for the Humanities, an independent federal agency that funds high-quality research, education and public programs at universities and other institutions across the country.

The three-to-one matching grant will require Lehigh to raise \$1.5 million over the next five years. The funds will be used to create an endowment to expand the Africana Studies program, including enhancing curriculum, increasing public humanities initiatives and strengthening the program's community partnerships to further explore public concerns and social justice issues related to race, politics, gender, religion and other areas.

"The significance of the award acknowledges both the historical efforts of Africana Studies scholars at Lehigh—Bill Scott, Ted Morgan, Kashi Johnson and many others—and the promising future that Africana Studies has as a public-facing program committed to the interface between university and community," said James B. Peterson, director of Africana Studies and associate professor of English.

Peterson is principal investigator of the challenge grant. Monica Miller,

assistant professor of religion and Africana Studies, and Susan Kart, assistant professor of art, architecture and design, are co-principal investigators.

Plans include public humanities programs, workshops, digital documentations, visiting and graduate fellows, research grants and community partnerships.

"This grant offers a powerful opportunity to truly transform Africana Studies at Lehigh," said Donald E. Hall, the Herbert J. and Ann L. Siegel Dean of the College of Arts and Sciences. "It is acknowledgment of the hard work by all of the faculty in Africana Studies and recognizes their efforts to develop in-

CHRISTA NEU

terdisciplinary education and scholarship in an inclusive and diverse setting.”

Africana Studies as an academic discipline grew out of the civil rights movement of the 1960s, when public demonstrations underscored the need for serious academic analysis of the structural oppression of black people.



James B. Peterson, right, speaks with Prof. Michael Eric Dyson, of Georgetown University, at the Malcolm X conference.

In 2011, Lehigh opened a new chapter in its increasing commitment to diversity and interdisciplinary education when it selected Africana Studies as its first academic “cluster,” bringing together scholars/faculty in English, history, religion studies, theater, journalism, and art, architecture and design.

Over the past four years, the program has developed powerful public programming, including a 2015 conference on Malcolm X’s life and legacy that attracted scholars from around the world.

“Our commitment has always been to be public facing in our programs—to engage and interact with our local schools, churches and community organizations in a deliberate effort to create programs, develop new initiatives, and build knowledge together,” said Peterson. “Winning the NEH challenge means that we will be able to sustain and enhance this commitment well into the future.”—*Mary Ellen Alu*

FIGURE 1



More than 1,200 students received tutoring in 2014-15 through the Center for Academic Success



CHRISTA NEU

‘It’s Been a Privilege’

Longtime Vice Provost for Student Affairs John Smeaton announces plans to retire

AFTER 32 YEARS AT LEHIGH, JOHN SMEATON WILL RETIRE at the end of the academic year as vice provost for Student Affairs, a position he’s held for 20 years.

As part of the president’s senior leadership team, Smeaton has headed up one of the university’s largest divisions, which includes the Dean of Students Office, the Health and Wellness Center, University Counseling and Psychological Services, Health Advancement and Prevention Strategies, the Women’s Center, the Office of Multicultural Affairs, the Pride Center and ROTC. His tenure spanned four decades, six presidents (including two interims) and the ongoing evolution of the university from a primarily Northeastern, male-dominated student body to one now far more diverse and international in makeup.

Among his most significant contributions has been placing Lehigh at the forefront of national initiatives on Greek life, campus safety, mental health, health prevention strategies, reducing alcohol abuse and on learning outside the classroom, such as through Lehigh’s distinctive bLUeprint program.

Smeaton also oversaw development of the Graduate Student Life Office, the Pride Center, the Office of Multicultural Affairs and the Women’s Center, and he spearheaded the evolution of housing options on The Hill, which now includes fraternities, sororities, UMOJA House and Sayre Park Village student housing complex. But he hopes his legacy will be the caliber of his Student Affairs colleagues, whom he characterized as “deeply and genuinely committed to improving the quality of the student experience. I have been blessed to work alongside such caring, creative and competent professionals.

“Students are at the center of what we do,” he said. “This period of young adulthood—from 18 to 22 years old—is in many ways a magical time in an individual’s development. It has been an absolute privilege to contribute to their journey.”

Provost and Vice President for Academic Affairs Pat Farrell said that under Smeaton, Student Affairs has become a nationally recognized leader in support of students, innovations in student health and safety, and development of an inclusive campus climate. “His dedication to student life and improving the student experience has made a big difference to thousands of Lehigh students and graduates,” said Farrell.—*Linda Harbrecht*



Engineering Resiliency

Daniel Zarrilli '97 prepares New York City for the impacts of climate change



WHEN HURRICANE SANDY hit New York City on Oct. 29, 2012, it left in its wake a nearly worst-case scenario. Though the storm was downgraded just before it hit land, Sandy's impact was disastrous. Its storm surge inundated homes, businesses, hospitals and key city infrastructure, including the subway system. Millions were left without power. The storm closed the New York Stock Exchange for two days and New York City public schools for a week.

"It was devastating," says Daniel Zarrilli '97. "We lost 44 lives in New York City. There was \$19 billion in damages and lost economic activity, and in our communities all over the city, the impacts were devastating."

Now, Zarrilli helms the effort to ready the nation's most populous city for the next big storm.

As senior director of climate policy and programs, he oversees the Mayor's Office of Recovery and Resiliency of the City of New York and the Office of Sustainability. He supervises the city's climate mitigation efforts and leads the development and implementation of the \$20 billion OneNYC resiliency program, which prepares neighborhoods, the economy and public services to withstand the impacts of climate change and other threats.

Zarrilli spoke to Lehigh students about climate adaptation and urban resiliency in October as part of the Martindale Visiting Speaker Series. In his talk, Zarrilli encour-

"THERE'S A WIDER WORLD OF ISSUES
THAT NEED THE PROBLEM-SOLVING
SKILLS OF ENGINEERS TO HELP SOLVE,
AND I THINK THAT'S SOMETHING
THAT'S FUNDAMENTAL IN THE
LEHIGH EXPERIENCE."

—DAN ZARRILLI '97

aged students to consider career opportunities that might not be the most intuitive, particularly in engineering.

"The opportunity that I've been given, having been appointed by both Mayor [Michael] Bloomberg and now Mayor [Bill] de Blasio to run this office and really put in place the science-based investments—both technical and social—that we need to protect our city, is humbling," he says. "There's a wider world of issues that need the problem-solving skills of engineers to help solve, and I think that's something that's fundamental in the Lehigh experience."

Although he says the aspects of his job that involve managing people, politics and the press weren't included in his engineering coursework, the skills he developed at Lehigh have been essential.

"There's no substitute for hard work. That's something that you certainly learn at Lehigh," he says. "Do your homework, know what you're talking about and make sure that you're credible. [You get there] by doing the hard things that other people don't want to do. That's certainly a Lehigh engineering mantra."

Today, Zarrilli applies that mantra to his work bolstering a city that, since the terrorist attacks of Sept. 11, 2001, has experienced two hurricanes, a blackout, an earthquake and an Ebola scare. His work allows him to witness firsthand how New Yorkers step up and pull through, stronger than before.

"On the one hand, people need the government and the city to lead on issues and make sure there are resources available, but underlying all of this is how residents are able to really serve each other in so

many different ways in their communities," he says. "And that's really an inspiring testament to New York."

Zarrilli's talk was part of daylong activities co-sponsored by the Martindale Center for the Study of Private Enterprise; the Department of Civil and Environmental

Engineering; and the Science, Technology, and Society Program. Lehigh's Office of Sustainability provided support. To view Zarrilli's talk, visit martindale.cc.lehigh.edu/content/dan-zarrilli-lecture-video.

—Kelly Hochbein



CHRISTA NEU

HIRED Lehigh and the City of Bethlehem expanded their efforts to revitalize the South Side commercial district along Third and Fourth streets with the naming of Dan Friedman as the city's South Side Bethlehem Downtown Coordinator. The new position will be funded by Lehigh for three years.

The goal is to create a thriving shopping and arts district in downtown South Side and an enhanced sense of community. Plans include installing bike racks and public art, improving the streetscape, generating funding for marketing and branding of the South Side and increasing the number and quality of live events.

"I'm excited to build on the energy, creativity and history of the South Side," said Friedman, a former Los Angeles-based live events producer and community programming director.

The new position is the latest in a series of collaborative efforts between Lehigh and the city. Among these initiatives is the South Side Ambassador program, which provides services such as trash removal and hospitality assistance.

"The parents of our prospective students want to know that the community where their son or daughter will be living for four years is one they can be proud of," President John Simon said.

"The success of the Ambassador program is a major reason why Lehigh is again partnering with the city for this latest initiative."

FIGURE 1



The six-story building planned for Third and New streets will provide 125,000 square feet of office and retail space.

Signs of Renaissance

Lehigh to be anchor tenant in new South Side development

DEMONSTRATING ITS COMMITMENT as a community partner, Lehigh will become an anchor tenant in a new six-story building to rise at Third and New streets in South Bethlehem.

The \$20 million project, announced in December, was lauded by community leaders as key to the South Side's reurbanization. The new Greenway Park building will have retail space on the first floor and office space on the second through sixth floors. A series of pedestrian walkways will connect the building to a new 626-space city parking garage.

"This project will serve as a catalyst for more development on the South Side, but most importantly this development will serve as a gateway into the city from Route 378 and Fahy Bridge," said Bethlehem Mayor Robert Donchez. "It will also bring the much-needed foot traffic to [South Side] businesses."

Groundbreaking will be in the spring, with construction expected to be completed the following year. The developer is Dennis Benner '76.

When it's completed, Lehigh will move 140 employees from its advancement office into the building. Joining Lehigh as an anchor tenant will be St. Luke's University Health Network, which will use a floor as clinical, teaching and administrative space.

"Lehigh University is proud to play a significant role in this gateway initiative for South Side Bethlehem," President John Simon said. "We are happy to join St. Luke's as an anchor tenant in this building, and our presence will enable Lehigh to further demonstrate a strong commitment to serving as a positive community partner."

Donchez lauded Lehigh and St. Luke's for their involvement.

"We have talked about the rebirth of South Bethlehem for many years," he said. "I believe that this project, along with others, is the beginning of a true renaissance in South Bethlehem. The partnership between the City of Bethlehem, Lehigh University and St. Luke's could not be stronger. This is a major commitment by both institutions to the future vitality of the South Side."

The Bethlehem Historic Conservation Commission in December also recommended approval of the plan.



A Tireless Effort

Joe Kender '87, '93G steps down after eight years as
Lehigh's Vice President of Advancement

Vice President of Advancement Joe Kender '87, '93G says he decided on his career path early on—when he came to understand advancement's critical role in making college accessible to students who might not otherwise be able to afford it, as well as in attracting and retaining top-notch faculty members. "The philanthropy that Lehigh receives is a means to an end," says Kender. "And the credit for all this goes to the donors but also to the university community."

After eight years helping Lehigh grow in exciting new ways and open up important opportunities for students, Kender has announced plans to move on from his position at the end of February. He plans to initially consult in the not-for-profit leadership space, and says in the long-term he knows he will remain in the non-profit leadership arena.

Shortly after the announcement, Kender reflected on his tenure, during which the advancement office expanded its outreach to alumni and friends around the globe. "We've expanded our outreach as an institution," says Kender. "We've increased the number of faculty professorships and chairs. We dramatically increased the number of scholarships. We've added programs like the Iacocca internships. All sorts of new initiatives have occurred over the past eight years, driven by our academic community and fueled by donors." He pointed to Mountaintop, made possible by the generosity of Scott Belair '69, as one of the university's most important new endeavors. "I firmly believe that Mountaintop is going to be a towering legacy for Lehigh," he says. "It was energizing to be part of that."

President John Simon praised Kender for his "hard work and tireless effort," noting that annual fundraising during Kender's tenure increased from \$50 million per year to \$80 million. He also credited Kender with overseeing the successful conclusion of the Shine Forever campaign, and with helping raise \$400 million in advance of the university's next campaign. "Everything that we've accomplished, we've done as part of a team," Kender says. "We've enjoyed strong support from the board, the academic community and from university leadership. Their investment and belief in Lehigh and in how advancement can and should play a strong role has set the fundraising program up for long-term success. In addition, the advancement staff and our volunteers deserve my thanks and that of the University for their tireless effort."

"Working for my alma mater in this capacity has truly been an honor. Everyone should have this opportunity," Kender said. "Part of what made this experience so rewarding to me has been working with and getting to know so many alumni. I've been doing this for a long time and I am continually amazed and inspired by the generosity of donors and their desire to make a difference in the world. And this is what it's all about."—*Mary Ellen Alu*



"WORKING FOR MY ALMA MATER
IN THIS CAPACITY HAS TRULY
BEEN AN HONOR."

—JOE KENDER '87, '93G



CHRISTA NEU

KENNER LECTURE

At the 2016 Kenner Lecture on Cultural Understanding and Tolerance, held in February, former U.S. Senator, Olympian, NBA Hall of Famer and author Bill Bradley regaled a packed audience in Baker Hall with personal stories and "quick history" lessons to provide context for his candid insights on the state of America and what all Americans can do to ensure the future success of the nation.

"We must never forget that the foundation of this country is the goodness of the American people," he said. "And whatever the policies are, whatever the policy disagreements are, it is that that is important."

Bradley explained what he sees as the major problems facing America today. Globalization and the rise of technology, he said, have led to job loss. American infrastructure is crumbling; the current tax system requires significant changes; and "the role of money in politics today is corroding our democracy," he said.

"We need to look in the mirror and ask ourselves, 'Can we all do better?'" Bradley said. "... The reality is that America can be on the move again, but to do so, we need to see things clearly. We need to clean up that political system so it's responsive to people and not the special interests; we need to make decisions that will generate long-term jobs; and we need to understand that it's our example that sets us apart from the rest of the world."

The Kenner lecture is made possible through the generosity of Jeffrey Kenner '65.



THE WASHINGTON POST

Following Doctors' Orders

Study explores doctors' bargaining power in a hospital setting



Michael Santoro, professor of management, explores the role of physicians as drivers of organizational change in hospitals.

U.S. HOSPITALS ARE UNDER increasing pressure to retain their best, most highly sought-after physicians. After all, research shows, hospitals are only as competitive as the physicians they retain since patients tend to choose doctors, while hospital choices are often the result of physicians' affiliations, especially in the case of elective procedures.

Moreover, in the rapidly changing healthcare landscape, numerous regulatory shifts, such as adjustments to the Medicaid reimbursement rate and changes under Obamacare, also are making hospitals less profitable. Meanwhile, doctors are facing increased financial pressures as their salaries shrink and malpractice insurance and operating costs continue to skyrocket.

In response, many hospitals are abandoning their nonprofit model for a new one, a "hybrid." In a hybrid structure, parts of the hospital remain nonprofit, while other areas are for-profit, such as an orthopedic surgical center or a dermatology specialty group.

These for-profit centers play a dual role for hospitals: They help hospitals retain top physicians attracted by new income opportunities, and they offer new revenue streams. But relying on profit-generating centers, often physician-run, may add to a hospital's troubles.

A new study, which explores the bargaining power of physicians

in a hospital setting as a key driver of organizational change, found that physician-driven changes may be counterproductive to a hospital's long-term survival.

Following Doctors' Orders: Organizational Change as a Response to Human Capital Bargaining Power—authored by Michael D. Santoro of Lehigh, Jill A. Brown of Bentley University and Peter T. Gianiodis of Clemson University—appeared in a recent edition of *Organization Science*.

To get an in-depth understanding of this increasingly common phenomenon, the researchers studied a large hospital, Hospital X, for six years as it underwent a transition from a nonprofit to a hybrid model.

"We found that Hospital X administrators were either somewhat reluctantly OK with these physician-driven changes or simply acquiesced since they had no choice in order to ensure the hospital's long-term survival," said Santoro, professor of management in Lehigh's College of Business and Economics.

According to the study, Hospital X sought to retain physicians by offering them a share of for-profit revenues and allowing them greater autonomy. This, of course, had immediate benefits for the physicians, who gained access to new revenue streams in the face of eroding income. It also allowed Hospital X to retain these physicians and stay competitive in the wake of increasing external pressures.

However, it resulted in an escalation in replacement costs for physicians as they became part-owners of shared facilities. Any competitive marketplace advantage gained by Hospital X from the new organizational structure was undermined by weaker internal bargaining power with its physicians.

"We found that the power physicians hold to drive these changes actually intensifies once the changes have been made," Santoro said.

The study of Hospital X led the researchers to conclude that human capital bargaining power is a "double-edged sword," shifting the governance structure to benefit those with power by providing additional income streams, but creating challenges for the ongoing management and retention of such valuable human capital.

The findings have implications beyond hospitals and are relevant to the long-term survival of any talent-intensive organization where human capital power is strong.

—Lori Friedman

A Singular Research Success

Materials scientist wins coveted Keck Foundation grant
of \$1 million for 'groundbreaking research'



**MARTIN
HARMER**

is Alcoa
Foundation
Professor of
Materials Science
and Engineering
and senior
faculty adviser
for Engineering
Research
Initiatives.

THE W.M. KECK FOUNDATION HAS AWARDED a \$1 million grant to Lehigh to study and discover the mechanisms that govern anti-thermal processes that appear to reverse nature. The work has the potential to revolutionize scientists' basic understanding of thermal processes and inform the development of new materials that can withstand higher temperatures.

A breakthrough in this area could lead to significant increases in engine efficiency, for example, saving billions of dollars in fuel costs.

Known for funding science and engineering projects with the potential to pioneer new territory in a field, the Keck Foundation has awarded the grant to the project's principal investigator, Martin Harmer, Alcoa Foundation Professor of Materials Science and Engineering and senior faculty adviser for Engineering Research Initiatives. Harmer's collaborators on the project, *Anti-thermal Behavior of Materials: Reversing the Trend of Nature*, are Elizabeth Holm and Gregory S. Rohrer, both professors of materials science and engineering at Carnegie Mellon University.

President John D. Simon said the grant "affirms the groundbreaking work and collaboration being done by our world-class faculty. This is very exciting news, and I thank the Keck Foundation for its continued support

of pioneering research and discovery."

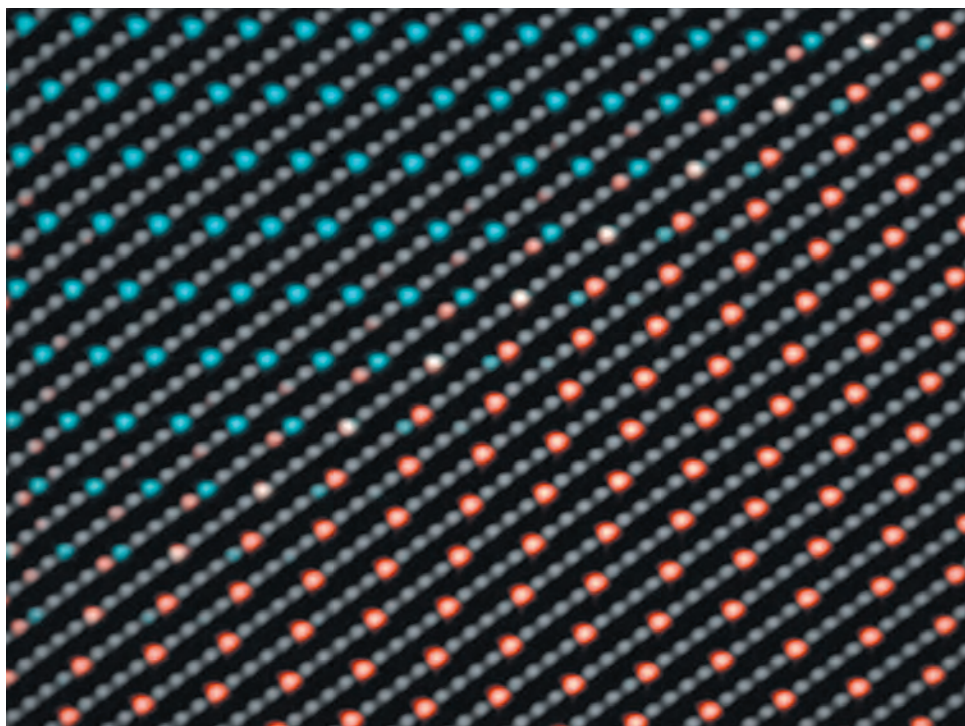
Harmer, Holm and Rohrer will seek to understand why some atoms behave in a manner contrary to nature, a phenomenon about which little is known.

The atoms in solids typically move exponentially faster with increasing temperature, obeying a classical law of physics. This motion fundamentally limits the properties and performance of materials. For example, turbine engine components start to weaken at higher temperatures limiting the maximum operating temperature and efficiency of the engine.

One of the major challenges in condensed matter science is to learn to combat this trend of nature in order to produce materials that are more efficient, resilient and enduring.

"I'm extremely grateful to the W.M. Keck Foundation for its vision in supporting and enabling high-risk research such as this," said Harmer. "This project will allow us to explore uncharted territory that could potentially uncover the secrets of nature's counterintuitive thermal behavior and pioneer new approaches to materials science.

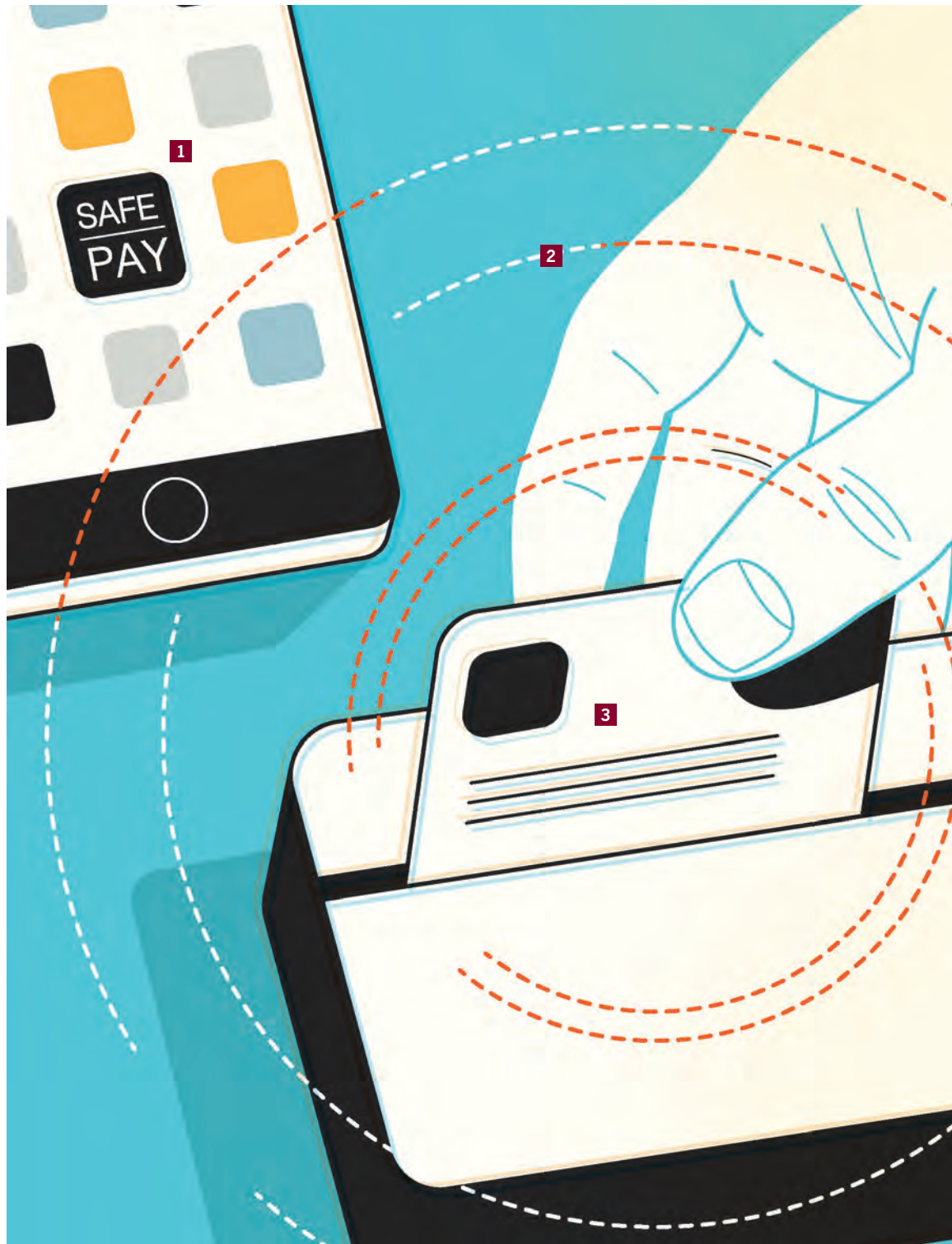
"My graduate student, Chris Marvel, refers to anti-thermal behavior as the 'Benjamin Button phenomenon of materials science,' where nature reverses its course—I like his analogy!"—Lori Friedman



UNCHARTERED TERRITORY

An atomic-resolution image of a twin boundary in nanocrystalline Ni-W. Twin boundaries are crucial to the understanding of anti-thermal behavior.

SCHEMATIC SafePay

**1 Download**

The user downloads and executes the SafePay mobile banking app. During a transaction, the app communicates with the bank server, which provides the user with credit card numbers that expire after a limited time or a single use. Once it receives a card number, the app generates an audio file in wave format and plays the file to create electrical current.

2 Connect

The electrical current connects with the magnetic card chip via an audio jack or Bluetooth. In the absence of wireless Internet access, the mobile app can collect and store several card numbers for future use.

3 Swipe

The user swipes the magnetic card chip at a point of sale. The card chip is fully compatible with existing card readers and functions the same way as a magnetic card stripe on a credit card.

YINZHI CAO, assistant professor of computer science and engineering, was on a train, reading a newspaper article about a retail store's massive breach of customer information, when he had an idea about how to protect credit card information from theft.

Seeking to address the problem from the

user end, Cao partnered with two colleagues from Northwestern University to develop SafePay, a low-cost, user-friendly solution that transforms disposable credit card numbers into electrical current and uses a magnetic card chip to simulate the behavior of a traditional magnetic card.

‘Unmatched Fortitude’

A new book follows the fortunes of the freed slaves who returned to Africa from Brazil



KWAME ESSIEN
is also the co-author of *Culture and Customs of Sudan* and co-editor of *Pan-Africanism and the Politics of African Citizenship and Identity*.

WHEN KWAME ESSIEN LOOKS AT A MAP of the Atlantic Ocean, his eyes are drawn to a point near the equator where the vast ocean narrows and the continents of Africa and South America make their closest approach.

Only 1,600 miles, Essien notes, separates the edge of West Africa from Brazil. On close inspection, the easternmost knob of Brazil appears like it might once have fit into the Gulf of Guinea, beneath modern-day Nigeria and Ghana.

From the 16th century through much of the 19th, says Essien, countless ships crossed the Atlantic carrying people who had been captured in West Africa to the New World, there to plant and harvest crops or to toil in mines. Some 10 to 15 million Africans were enslaved in the Western Hemisphere, nearly 5 million of them in Brazil.

In the 1800s, a relative handful of people, descendants of African slaves, embarked on a reverse migration of their own volition. Uprooting themselves from Brazil, the only home they knew, they journeyed back to Africa to seek the homes of their ancestors.

Essien, assistant professor of history and Africana studies, tells the story of these pilgrims and their descendants in his latest book, *Brazilian-African Diaspora in Ghana: The Tabom, Slavery, Dissonance of Memory*,

IN THE 1800S, A RELATIVE HANDFUL OF PEOPLE, DESCENDANTS OF AFRICAN SLAVES, EMBARKED ON A REVERSE MIGRATION OF THEIR OWN VOLITION.

Other books have been written about the migration of former slaves from the New World back to Africa, says Essien, a native of Ghana, but his is the first academic book to look at migrants who went from Brazil to Ghana. That migration, he says, took place in three waves. The first came in the 1820s, after some slaves had gained their freedom. The second followed the Malé Slave Revolt of 1835, when Muslim leaders of the uprising were forcibly repatriated by the Brazilian government. The third wave took place after slavery was outlawed in Brazil in 1888.

Most of the Africans returning to Africa were transported by abolitionists, the British navy or both. Britain had taken the lead in ending the slave trade, says Essien, but sought to replace slavery with colonial rule in Africa, in part to keep wars between European countries from occurring on European soil and in part to acquire natural resources and control the development of Africa.

The former Brazilian slaves who returned to Africa became known as Tabom, a word derived from the Portuguese “Tudo bem,” meaning “Everything’s good,” which was often said in response to the greeting “Como está?” (“How are you?”).

Brazilian-African Diaspora in Ghana is the product of 10 years of research. Essien traveled to Ghana, Nigeria, Brazil, Italy and England to interview descendants of the Tabom and to search through government and private archival documents and family records.

The book traces the lives of four Brazilian-Ghanaian family leaders. João Antonio Nelson, who arrived in Ghana around the 1830s when he was 3, became the second leader of the Brazilian diaspora in Accra, Ghana’s capital. Ferku, a freed Brazilian slave,



Identity and Locating Home, which will be published this year by Michigan State University Press.

Brazilian-African Diaspora in Ghana, says Essien, examines “the complexities of reverse migrations and imagining a distant ancestry over the Atlantic waters, as well as the challenge of reclaiming a ‘lost’ heritage.” The book also explores what Essien calls the “unmatched fortitude” of the modern-day descendants of the early migrants, now living in Ghana, as they attempt to locate the homes in Brazil where their ancestors lived.



HOMEBOUND

One photo acquired by Essien shows freed slaves returning to Africa after the Malé Slave Revolt. Left: The Brazil House in Accra is believed to be the first house built by Brazilian returnees (in 1835).

settled in Lagos, Nigeria, moved to Accra, and crisscrossed the Atlantic before dying in Lagos in the 1930s, leaving an estranged wife and an unsettled land dispute. Georgina T. Wood, the current chief justice of Ghana's Supreme Court, journeyed to her ancestors' home in Brazil in 2011. George Aruna Nelson, grandson of João Antonio Nelson, died in 2009 at 93.

"The story of the Brazilian-African diaspora in Ghana is so complex," says Essien, "that I simplified it by writing only about the families for whom I could find court records and other documents."

In Ghana, the Tabom met with fortune and oppression alike. They were welcomed by local chiefs who gave them free land for settlements. Arguments over land ownership became common within and between Tabom families and between Tabom and migrants from other parts of Ghana. Meanwhile, some property owners lost their land to crooked British colonial officials but gained it back after going to court. One of these was João Antonio Nelson, who was jailed for protesting British land ordinances.

"The Tabom understood where they were, and they were determined not to allow anyone to kick them around again," says Essien. "For many, this was the first land they had owned. They said no to the seizure of their land, challenged other laws as well, and got much of their property back."

Even in Africa, the Tabom lived in fear of being recaptured and sold back into European slavery, says Essien. But some Tabom were enslaved by fellow Africans, while others even became slave owners themselves.

"Many freed slaves left Brazil and the subjugation of slavery only to travel to Ghana and own slaves there," he says. "One local chief told me that as a child in the 1950s he could remember slaves serving in his home in Accra. This is not the only story of its kind that I encountered."

The Tabom, says Essien, shared a common dream—to find a home in a land they'd never seen, even if that home might no longer exist.

"The Tabom had a desire to return to a place they'd never known. This place existed only in their imaginations; it was based on memories or

on stories that had been passed on to them by their parents or other family members.

"These migrants never saw themselves as Brazilians but as African slaves in Brazil. Some of them knew exactly where in Africa their ancestors had come from. Others were searching for a place they believed was the home they had come from. All of them were yearning to be home, to connect to a culture that they thought they were part of."

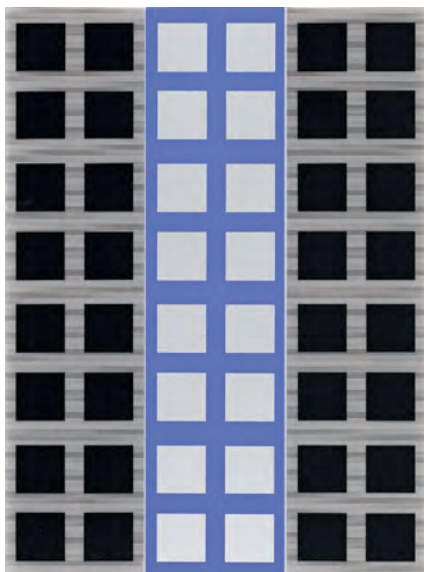
In his book, Essien includes photos he obtained from government and family records. A black-and-white photo on the title page is of a 19th-century sailing ship. The boat is moving across the water, Essien says, offering symbolic promise to the African slaves in Brazil.

"The migrants put their trust in whoever was steering the ship to take them to the place that might be their home. The ship was the point connecting the known and the unknown. Not everyone knew where they were going, but everyone knew they had to go on, they had to leave Brazil. If they got on the ship, they might find their home."

"There were no guarantees they would find their home. Even after they made it to Africa, there was no guarantee that being there would ensure their freedom. So the boat represented a risk that people took, because there was no guarantee of freedom at all in Brazil."

—Kurt Pfitzer

EXHIBITION: ...OF THE AMERICAS



ARTISTS FROM TOP LEFT, CLOCKWISE: WIFREDO LAM, UNTITLED, N.D., CARLOS AND MIGUEL VARGAS, RETRATO DE MUJER EN DISFRAZ DE CARNAVAL (PORTRAIT OF WOMAN IN CARNIVAL COSTUME), C.1920, DIEGO RIVERA, OPEN AIR SCHOOL / LA ESCUELA DE AIRE LIBRE, 1932, EUGENIA VARGAS PEREIRA, UNTITLED, 1990-1992, JESÚS RAFAEL SOTO, COMPOSITION IN SILVER, COBALT AND BLACK FROM THE SERIES: JAI-ALAI, 1969, JOSÉ DINIZ, FADA II, FROM THE SERIES NOTURNAS, 2007 / 2012

THE POLITICS OF IDENTITY, abstraction and conceptualism are aspects of contemporary art in the Americas. And, not surprisingly, such concerns belong to artists of many diverse backgrounds.

...OF THE AMERICAS: *Contemporary Latin American Art* focuses on the ways Latino artists have carved out a place within the mainstream of art history or have positioned themselves against it.

From the LUAG Teaching Collection, the works are on view through June 4, 2016, at the LUAG Lower Gallery in the Zoellner Arts Center.

Artists such as Diego Rivera, Wifredo Lam and José Clemente Orozco have become highly visible, but countless other artists from Argentina, Brazil, Mexico, Chile, Cuba, Jamaica, Ecuador and elsewhere have contributed to the complex story of contemporary art.

The artists, reflecting aspects of gender, diaspora, poetics and political commentary, address the reality of life in the 20th and 21st centuries.

To see images from the exhibit, go to luag.org.



PHOTOS BY CHRISTA NEU



Live, at Pegg's Bell

New acoustical performance space installed in grove near Alumni Memorial Building

IN 2015, AS PART OF LEHIGH'S Hammerschlag Design Series, Anthony Viscardi, professor of art, architecture and design, worked with visiting professor Richard Kroeker of Dalhousie University in Nova Scotia to design and construct a permanent installation in the grove near Alumni Memorial Building.

The result was Pegg's Bell, an acoustical shell featuring an adaptation of "tim-brel vaulting," a self-supporting tile arch system introduced in the United States by Spanish architect Rafael Guastavino.



Viscardi and Kroeker dedicated nearly three months of painstaking labor to design and build the shell, named for Kroeker's mother-in-law, Peggie Sisson, a dance teacher and music lover who died in 2015.

Students participated during their structured class times and whenever else they were available.

After anchoring rebar to serve as a visual guide, they constructed the thin inside layer of the dome by interlocking square tiles at different angles, holding each in place until the plaster dried and the dome-like structure began to form. A second layer of mortar provided additional strength to the structure, after which horizontal terra-cotta tiles were placed in a herringbone pattern.

The bell came to life in November 2015 when a choral group from the Lehigh Valley Charter High School for the Arts performed inside. Viscardi describes that experience as incredibly moving.

The bell came to life in November 2015 when a choral group from the Lehigh Valley Charter High School for the Arts performed inside. Viscardi describes that experience as incredibly moving.

"As a professor of architecture, I gain great satisfaction providing these design-build projects for my students," Viscardi said. "They experience, first-hand, the blood, sweat and tears that go into making something meaningful."

—Kelly Hochbein

A Climb for Justice

Activist Bree Newsome talks about her decision to remove Confederate flag from 30-foot pole

ACTIVIST AND FILMMAKER BREE NEWSOME told a Lehigh audience in Baker Hall that her decision last summer to climb a 30-foot flagpole outside the South Carolina capitol and take down the Confederate flag was a “deeply personal” one.

As a descendant of African-American slaves, Newsome said, she was always bothered that the flag, a symbol of enslavement, was flown on state house grounds. And after a white man gunned down nine parishioners in a historic black church in Charleston, she said, she found discussions about the flag “just insulting,” especially when it was not lowered to half-staff, like the American flag was, in mourning for the victims. Lawmakers’ approval was needed.

“Part of us doing this was to strip [the flag] of its power,” said Newsome, who was aided by other activists. Though she was arrested, South Carolina lawmakers within two weeks voted to remove the Confederate flag from the statehouse grounds.

Newsome talked about her activism and her art in an hour-long conversation that was part of the January events of Lehigh’s MLK Committee. A screening of her film *Wake*, a Southern Gothic tale of self-righteousness, preceded the discussion. Newsome took questions from Darius Omar Williams, professor of theatre and Africana Studies, and Madeleine Centrella ’18, then from audience members.

Asked about the fear she faced in removing the Confederate flag, Newsome said that even though she considered the potential dangers and consequences of her actions, she was committed to the greater goal of freedom. “Because it’s not just about the flag,” she said. “It’s about ripping down an ideology. It’s about ripping down hatred.”

For young people who may want to intervene in issues that are important to them, Newsome advised that they not overthink the matter but to “jump up and do it.” She said she became an activist by first participating in a march, then finding like-minded people. “You tend to find your community of support,” she said. —Mary Ellen Alu



LUIS CRUZAZACETA

MAKING ART MORE ACCESSIBLE

Students in Lehigh’s 3D Design Foundations classes have joined with Lehigh University Art Galleries (LUAG) to make art more accessible to those with vision loss and other disabilities.

As part of LUAG’s Accessible Art Project, in recognition of the 25th anniversary of the Americans with Disabilities Act, the students created 3-D, touchable representations of select artworks currently on display in LUAG’s *...Of the Americas* and *Object As Subject* exhibits. The select works also carry an audio description or recorded educational guide to allow for alternate ways to experience the art.

The project got under way a year ago, when LUAG reached out to Brian Slocum, managing director of Lehigh’s Design Labs and Wilbur Powerhouse Prototyping Lab, for help in creating the 3-D representations. Slocum saw the project as giving students in his 3D Design Foundations class an opportunity to put what they learned into practice. It also allowed them to have an impact on someone’s art experience.

The Accessible Art Project required students to approach design in a unique way—keeping the sense of touch in mind first, rather than the sense of sight. Over last summer, students completed four 3-D representations of works, and over the Fall 2015 semester, 10 students created 3-D representations.



CHRISTA NEU

Heart and Soul

Lehigh goalkeeper Ani Nahapetian's patience pays off in the end—and sets a strong example for her teammates, too



BRINN MCCLENNAN '17

PROUD PARENTS

Lehigh goalkeeper Ani Nahapetian '16 has drawn inspiration and motivation from her parents, who she says "put 100 percent effort into everything they do."

ANI NAHAPETIAN'S DRIVE to succeed has led to an exceptional career as a member of the Lehigh women's soccer program. A four-year standout goalkeeper, student and leader, she has left a legacy.

Nahapetian's success has been driven by relentlessness that stems from her parents, who immigrated to the United States in 1992.

"My dad earned an education, got a job and started our family here," Nahapetian '16 says. "My parents put 100 percent of their effort into everything they do, and it's for a better life for their children. I see how hard my parents work, and if I don't work even half as hard, I'm doing them a disservice."

Nahapetian's accomplishments should undoubtedly make her parents proud. A con-

tributor for the Mountain Hawks' vision.

"Ani epitomizes everything about our vision ... everything," says Lambinus. "She loves the game of soccer and played with a passion."

Nahapetian is thankful for her opportunity at Lehigh. "I don't think

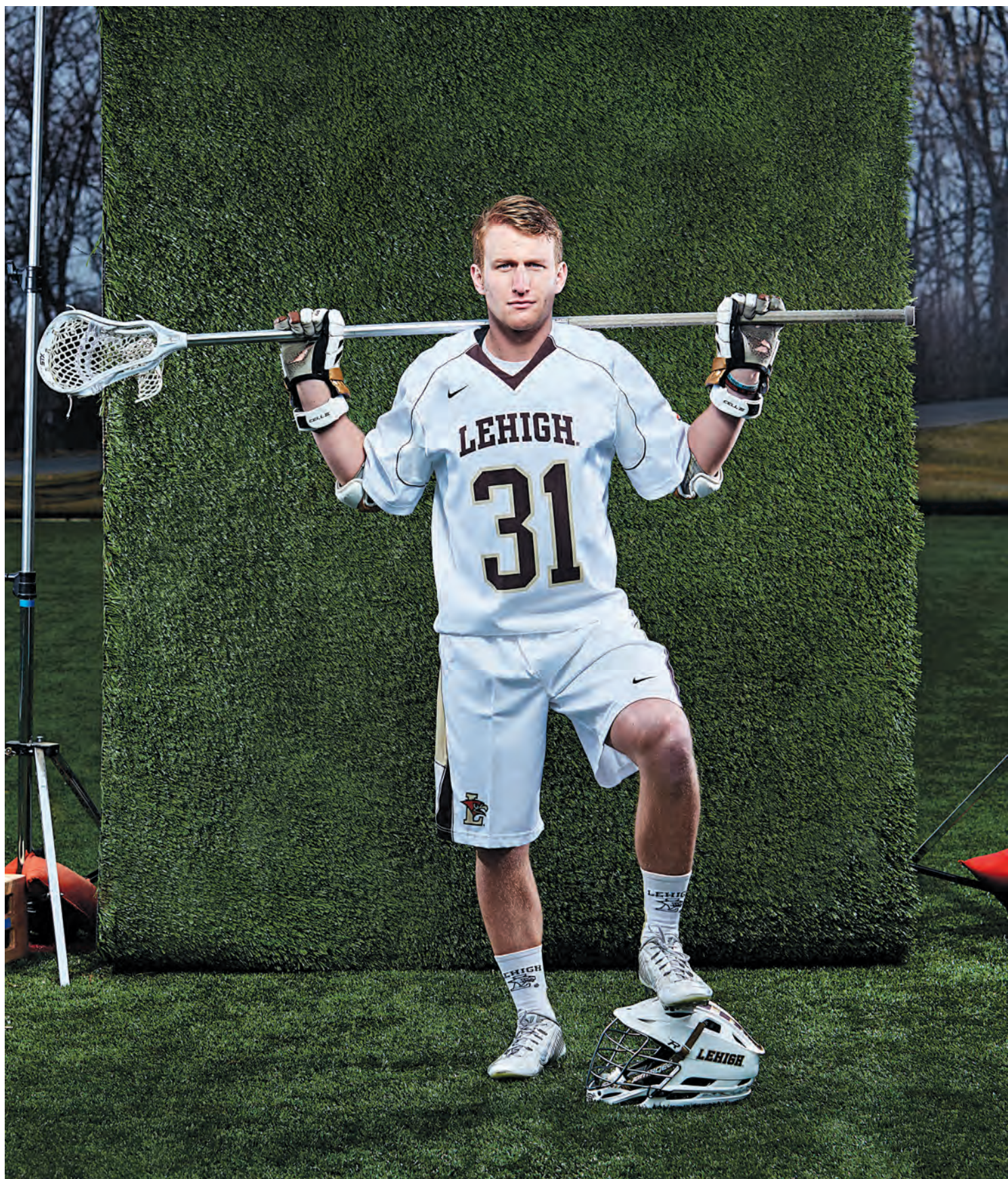
I'd be the person I am today without my Lehigh experience," she says. "I've learned a lot about different people and different parts of the United States ... I'm more comfortable with myself. I know who I am and what my roots and beliefs are. I struggled with that prior to Lehigh."

"THE SOCCER PROGRAM HAS TAUGHT ME HOW TO INTERACT WITH DIFFERENT TYPES OF PEOPLE. I'M MORE COMFORTABLE WITH MYSELF. I KNOW WHO I AM AND WHAT MY ROOTS AND BELIEFS ARE. I STRUGGLED WITH THAT PRIOR TO LEHIGH."

—ANI NAHAPETIAN

She added, "I hope when people talk about me, the one thing they'll say is I gave my heart and soul to the team. I have a lot of passion for the sport and these girls. I truly care about every single one of them. Hopefully 10 years down the line, my teammates all know I'm there for them.—Justin Lafleur

PROFILE Casey Eidenshink '16



STEVE BOYLE

Senior defender Casey Eidenshink '16, who was recently named one of three captains for the 2016 Mountain Hawks, talks to the *Bulletin* about his love for the “fastest game on two feet” and his goals for the season to come.

MAJOR Finance

POSITION Defender

HOMETOWN Wyncote, Pa.
(LaSalle College High School)

HONORS Named second-team All Patriot League in 2015 while also earning Academic All-Patriot honors. Started all 16 games, led the team with 50 groundballs and caused 23 turnovers. After a key performance in a big win over Boston University, was named Patriot League Defensive Player of the Week. As a sophomore, played in 18 games, starting one, and recorded 29 groundballs, 16 caused turnovers and one assist. As a freshman, made an immediate impact both on and off the field, playing in seven games while being named to the Patriot League Academic Honor Roll.

HOW I GOT STARTED IN LACROSSE “I started playing when I was in second grade, because my older brother hated baseball and started playing lacrosse. So naturally, I followed in his footsteps.”

WHAT I LOVE ABOUT LACROSSE

“I love the fast pace and unpredictability of lacrosse. I think it’s the most entertaining game to play and watch. I also love being a part of the close-knit lacrosse community. I have made so many lifelong friends through playing lacrosse. It’s been an awesome experience being able to play against my childhood and high school teammates during my college career.”

MY BIGGEST ACHIEVEMENT (AS AN INDIVIDUAL) SO FAR AT LEHIGH

“Winning the Patriot Championship in 2014.”

IF I DIDN'T PLAY LACROSSE, I WOULD BE PLAYING

“Soccer or ice hockey.”

MY FAVORITE ATHLETE IS

“Former Philadelphia Eagles safety Brian Dawkins.”

MY HERO IS

“My mother.”

HOW I LEAD

“I started out as a ‘leader by example,’ but I have grown into a vocal leader—both on and off the field.”

OUR GOALS FOR THIS SEASON

“We want to win the Patriot League Championship, and then make a run in the NCAA playoffs to win the National Championship.”



TOY STORIES

LEHIGH PROVES FERTILE GROUND FOR NEW CROP OF TOY INVENTORS

When she first came to Lehigh, Lisa Glover '13, '14G envisioned a career in sustainable architecture, one that involved renovating old spaces and bringing them back to life. That all changed with a “Making It” homework assignment for Lehigh’s Technical Entrepreneurship master’s program.

Tasked with exploring the manufacturing process and demonstrating it uniquely, Glover drew on the origami skills she first learned as a child and created a 15-foot cardboard velociraptor. When she wore it as a costume to a Halloween party, she was a hit. People constantly asked, “How can I get one?”

Scaling it back in size to a more marketable product, Glover created KitRex—cardboard puzzle crafts that fold into colorful 3-D dinosaurs. Two successful crowdfunding campaigns followed; a third one is planned for March.

“This has been an unexpected but amazing journey for me,” said Glover, 25, who was encouraged by Lehigh professors and others to run with her idea. “This whole project has been one that I did on a whim. Other people believed in it and thought it was cool.”

Glover is among a new crop of toy inventors who developed their ideas—by accident or design as part of class assignments—while at Lehigh. All were winners in the EUREKA! Ventures Competition, a series of student entrepreneurship competitions run by Lehigh’s Baker Institute for Entrepreneurship, Creativity and Innovation. As they look to market their toys, they hope to have an impact on play, and perhaps inspire creativity or foster learning.

Glover and Briana Gardell '14, '15G exhibited their inventions in mid-February at the venerable North American International Toy Fair in New York,

which draws buyers, manufacturers and others from around the world. Last year, they attended the show, along with Shannon Varcoe '15 and Lauren Villaverde '14, '15G, with the support of alumna Alita Friedman '87, CEO of Alita’s Brand Bar and former chief brand officer of the UglyDoll brand, for which she won the Women in Toys award and Toy of the Year.

“I was proud to bring them there,” said Friedman, who wanted the budding entrepreneurs to make connections.

What does it take to succeed in the toy industry?

“A lot of passion and a considerable amount of hard work,” said Friedman, who advises entrepreneurs to perfect their product and pricing, build relationships and develop marketing. “They also need to innovate. They need to constantly think about what’s next.”

Last year U.S. toy sales grew nearly 7 percent to \$19.4 billion, according to research firm NPD Group.

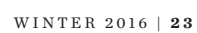
E-commerce sales are growing by double digits every year, Friedman said, so sales now come from a variety of platforms including brick-and-mortar retailers, online retailers, distributors, crowdfunding, social media and more. “You can’t afford to have a void,” she said.

An established toy company might opt to buy an inventor’s product, she said. Or, a company might opt to license an inventor’s idea or design, resulting in that company handling the manufacturing and paying royalties to the inventor on every unit sold.

Given the competitiveness of the toy industry, Friedman acknowledged that it’s easy to get discouraged. “But if you are passionate about what you’re doing,” she said, “and you believe in it, no one can stand in your way.”

The *Bulletin* talked with the inventors about their toys—and what’s next.

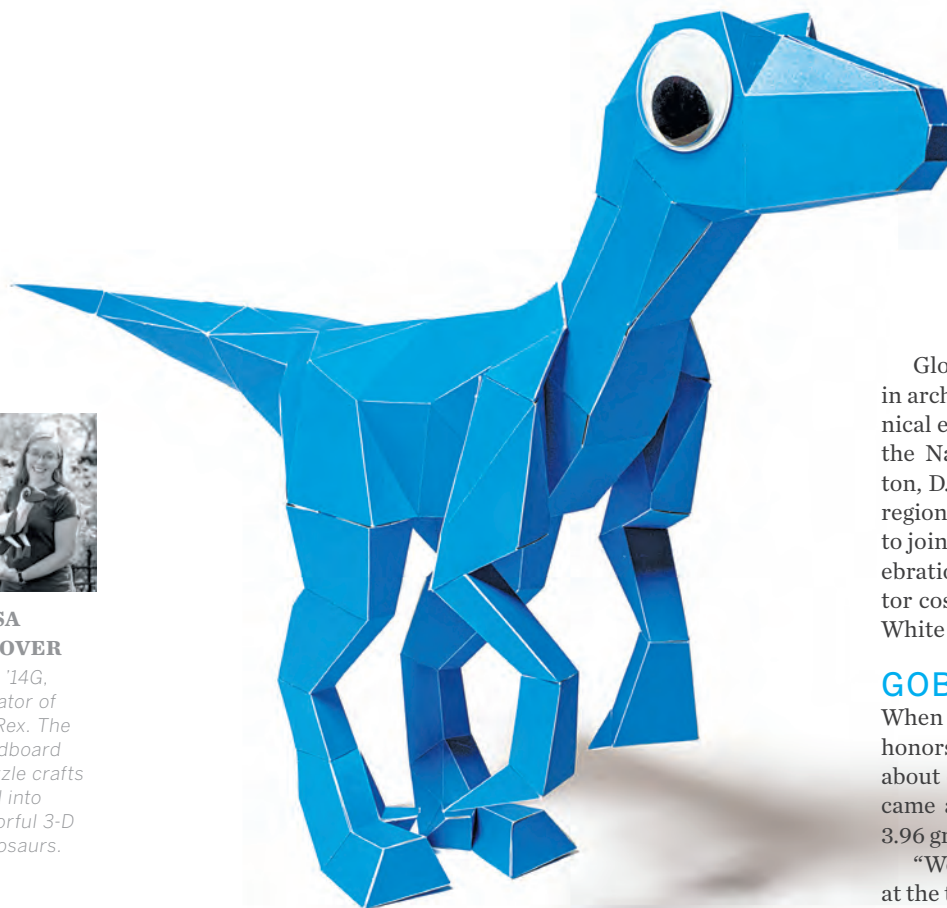
STORY BY MARY ELLEN ALU • PHOTOS BY RYAN HULVAT





LISA GLOVER

'13, '14G, creator of KitRex. The cardboard puzzle crafts fold into colorful 3-D dinosaurs.



KITREX

Through a widely successful Kickstarter campaign, Lisa Glover raised more than \$110,000 to buy equipment and produce KitRex kits that allow customers to build their own 3-foot-long cardboard velociraptors. Last year, she launched another successful Kickstarter campaign for her pterodactyl design, which folds to have a 3-foot wingspan. A bulkier triceratops design—which folds into a 2-foot-long creation—launches next as she expands her product line.

In less than two years of production, Glover has sold her dinosaur kits to more than 4,000 customers in 49 states, 42 countries and 10 retail outlets, including Amazon.com, the Moravian Book Shop in Bethlehem and her kit-rex.com website.

"I'm hoping to get into a lot more specialty retailers," said Glover, who had a booth in the launch pad area of the International Toy Fair in New York.

While at Lehigh, Glover won first place in the graduate student division of the EUREKA! Ventures Competition, which earned her access to Baker Institute office space at Ben Franklin TechVentures on the Mountaintop campus. She now has an office at the Bridge-works Enterprise Center in Allentown.

She tests her kits with children to ensure that assembly of the cardboard dinosaurs is challenging, not frustrating, and as a result, has made some changes. But watching children and adults assemble her creations brings her validation. "It challenges them, and it brings them a lot of joy," she said. "That makes me happy. It makes me feel that what I'm doing is worthwhile."

Glover said the more she learns about the toy industry, the more she realizes that she needs to slowly build her company, Architrep, so that the business is sustainable over a long period of time, not just one or two holiday seasons. "I know I can turn this into something awesome," she said.

Glover, who received her bachelor's in architecture and her master's in technical entrepreneurship, has exhibited at the National Maker Faire in Washington, D.C., and other Maker Faires in the region. This past summer, she was asked to join the National Week of Making celebration, which included her giant raptor costume being photographed on the White House lawn.

GOBLIES

When Briana Gardell spoke at Lehigh's honors convocation in 2014, she talked about early setbacks she faced but overcame as an undergraduate, achieving a 3.96 grade point average.

"We need to remember," Gardell said at the time, that the only people who can define "what we are capable of is ourselves. No one has a monopoly on good ideas. No one can define what is possible."

Using her Presidential Scholarship to enroll in Lehigh's Technical Entrepreneurship master's program, Gardell put her words to the test. Though she dreamed of becoming an entrepreneur, she said, she had no idea what she wanted to do. Like Glover, she found inspiration and creative freedom in the program's "Making It" assignment, creating Goblies (pronounced go-bleez)—biodegradable paint blobs that you toss like water balloons. They break on impact, creating colorful splats.



BRIANA GARDELL

'14, '15G, creator of Goblies. The biodegradable paint blobs are tossed like water balloons.



In the manufacturing assignment, Gardell had worked at replicating an egg yolk out of soap. She thought it could be interesting to make a paintball.

Working through 26 prototypes, her “aha!” moment came in October 2014, a moment she captured in a phone diary post. “I think this could be my new business idea,” she wrote, with a photo of a blob in the palm of her hand.

Validation came the following month when her company, Mezzimatic, named for her grandparents, won the Joan F. & John M. Thalheimer ’55 grand prize in the 2014-15 EUREKA! Ventures Competition. The win allowed her to work out of Baker Institute office space at Ben Franklin TechVentures. Recently she received a \$15,000 technology grant from the Southside Bethlehem Keystone Innovation Zone and relocated to the SoBeCoWorks collaborative space in Bethlehem.

In July, Gardell launched a successful Kickstarter campaign for Goblins Starter Kits, which contained the food-based ingredients, dyes and molds for making 100 Goblins. The science kits—refill packs are also available—contain information for young learners about the chemistry involved in making them.

***“It’s really great
that I can utilize
the toy to teach kids
about science.”***

—Briana Gardell

“I like that it’s a fun product,” said Gardell, 23, who has a provisional patent and sells the kits on MakerShed.com and goblins.com. “It allows me to talk to a lot of people and capture their attention.

It’s really great that I can utilize the toy to teach kids about science.”

Gardell, who received her bachelor’s in business information systems and her master’s in technical entrepreneurship, dreams of growing her company and expanding her product line to include glow-in-the-dark Goblins and premade Goblins. While it’s “pretty terrifying” to want to support oneself from a business, she said, she has appreciated every step of the process, adding to her resume.

“You just have to really want it,” she said, “and that makes it worthwhile.”

STACKABLZ

As an undergraduate in an industrial engineering class, Lauren Villaverde had problems converting two-dimensional drawings into 3-D renderings.

So when she created Stackablz 3-D puzzles for spatial development, she was hoping she’d be able to help children avoid the struggles she’s had with spatial skills—the ability to think three-dimensionally, the ability to understand how much space an object takes up in relationship to other objects.

Like fellow Lehigh toy inventors, Villaverde created Stackablz while a graduate student in the Technical Entrepreneurship program. Assigned to identify and address a problem, she first thought of developing an interactive book to help children read.

But in conferring with Robin Hojnoski, associate professor of school psychology in Lehigh’s College of Education, she learned of the lack of books to help preschoolers develop spatial skills. *OK, how can I address this?* Villaverde asked herself, recalling her own struggles.

That put her on a new path to discover a way to help children develop those skills and improve their performance in science, technology, engineering and mathematics (STEM) studies.

Using the 3-D printing process, Villaverde created a prototype



LAUREN VILLAVERDE

’14, ’15G,
creator of
Stackablz.
The 3-D puzzle
toys are de-
signed to help
children develop
spatial skills.





Classmates started playing with the notched pieces, as did a cousin when she brought some pieces home. That got her wondering, ‘Could this be something?’

for Stackablz, which are 3-D manipulatives composed of stackable slices that come in animal shapes, such as ducks, frogs, turtles and squirrels, as well as geometric shapes. The gender-neutral puzzles are paired with books, and children gather the slices as they read the story to put the shapes together.

“It’s an educational project,” said Villaverde, 24, who has filed a provisional patent. “This isn’t just another plastic toy. It’s something I created with a lot of thought. There’s research behind it.”

Villaverde’s project got a boost when she won first place in the graduate division of the 2014-15 EUREKA! Ventures Competition, which she said opened doors and helped her further develop her idea. The award also gave her access to Baker Institute office space at Ben Franklin TechVentures. In August, Villaverde, who received her bachelor’s in industrial engineering and her master’s in technical entrepreneurship, founded her company STEM-powered. She is now working on a manufacturing and distribution plan.

“I really want to get it out as soon as I can,” said Villaverde, a featured speaker at a recent TEDxLehighRiver event. “I really want to get it to market. That’s my goal.”

ZYX BUILDING STICKS

In her sophomore year at Lehigh, Shannon Varcoe, 22, was taking a design class that challenged her to create a sculpture inspired by three words pulled from a hat. She drew the words “small,” “minimal” and “prop.” Varcoe had to work first with paper, then poplar, and began cutting angled grooves in the wood as part of the function of her design.

Classmates started playing with the notched pieces, as did a cousin when she brought some pieces home. That got her wondering, “Could this be something?”

Bolstered by the response to her designs, Varcoe went on to create a wooden building-block toy set that doesn’t come with any instructions. “You let your creativity tell you what to do,” she has said.

The pieces are made of unfinished natural wood and vary in length. Though seemingly simple in design, they allow users to build elaborate structures, both abstract and practical, that challenge spatial skills and creativity. In testing and developing the toy set while still an undergraduate, Varcoe watched children in play. One took the pieces and created a stool, then sat on it. Another competed with her mother to see who could build the tallest structure.

“You really can’t be bad at this,” said Varcoe, who received an Integrated Degree in Engineering, Arts and Sciences (IDEAS) and is now in Lehigh’s Technical Entrepreneurship master’s program.

At Lehigh, Varcoe chose courses that could help her in her venture. She won first place in a EUREKA! Ventures Competition social ventures category and built on her idea at the LaunchBayC summer student idea accelerator space offered through the Baker Institute at Mountaintop. She made more prototypes, experimenting with sizes, cuts and shapes.

At Mini Maker Faires (one at SteelStacks in Bethlehem, another



SHANNON VARCOE

’15, creator of Zyx Building Sticks. The building-block toy set challenges spatial skills and creativity.

at a Barnes & Noble), she took note of how children and adults played with the pieces, which pieces and how many they used. She took part in LehighSiliconValley, an entrepreneurship immersion program offered under the auspices of the Baker Institute. And last year, she won a Ripple Effect award in the Values and Ventures Business Plan Competition at Texas Christian University.

Varcoe has named her company Trouble-MakerToys. “It’s good to be a trouble-maker,” she said, in explaining the startup’s name. “Trouble-makers become innovators. They’re the best change-makers.”

This spring, Varcoe plans a crowdfunding campaign, possibly with Kickstarter, to ask supporters for the funding she needs to get her 36-piece toy sets, which she is calling Zyx Building Sticks, into production. She is currently looking for a manufacturer and is launching a website, buildzyx.com. Though the toy sets will be aimed at children ages 6 to 12, she is looking at a possible market for adults.

“The journey,” said Varcoe, “has been really interesting.”



KEITH MARTIN

'13, '14G, founder of IncuMagic LLC. His fingertip markers have two potential markets: as a toy for children’s crafts and as an adaptive device for those with disabilities.

INCUMAGIC LLC

Keith Martin had to come up with 100 product ideas one summer for a creativity class in Lehigh’s Technical Entrepreneurship graduate program. A fingertip-mounted writing device was one of them.

Martin didn’t think too much of his idea—until he created a prototype for another course later that year that impressed his classmates. He did some patent research and found nothing similar.

“I figured I should go for it,” said Martin, 25, who is working for The Linde Group, a global industrial gas company, while running and raising capital for IncuMagic LLC, the company he founded while at Lehigh.

As a grad student, Martin won second place in a Michael W. Levin ’87 Advanced Technology Competition, part of the EUREKA! Ventures Competition. The prize gave him access to two teams of students in Lehigh’s Integrated Product Development course who conducted more market research and reaffirmed his findings and earned him access to Baker Institute office space at Ben Franklin Tech-Ventures. He also was a finalist in the Licensing Executives Society’s business plan competition.

Martin sees two potential markets for the fingertip markers—one as a toy for children’s crafts and another as an adaptive device for those with disabilities who have trouble holding pens or pencils.

His company has developed, and tested, several prototypes, using 3-D printing for the colorful shells.

“I wanted to get them out there to test their functionality,” said Martin, who received his bachelor’s in materials science and engineering and his master’s in technical entrepreneurship. He found kids “had a blast” playing with the markers, putting them on each fingertip like a color wheel.

“It added a new dimension to coloring,” he said.

Martin has talked with representatives from larger companies about licensing of his fingertip markers, but he is awaiting patent approval before proceeding with further talks.


His patent application encompasses various designs, including pencils, crayons and paintbrushes. **L**



MORE ON TOY STORIES:

To watch a video of the inventors at the North American International Toy Fair, go to lehigh.edu/bulletin





CAN WE TRUST THE SYSTEMS?

BY KELLY HOCHBEIN

ILLUSTRATIONS BY WILL BARRAS

You're sick and can't get to a doctor, so you post a question about your symptoms on an online health forum. In doing so, you've left a digital footprint. You're hungry and in an unfamiliar neighborhood, so you use your smartphone to search for nearby restaurants. Another footprint.

You frequent a particular online vendor, so you store your credit card information in your account to expedite checkout. Yet another footprint.

Regardless of how you've used your computer or mobile device, when you enter information into a website, search engine or social media platform, you've left a digital breadcrumb of sorts that can potentially be seen or tracked by others.

"We have left so many footprints on the Internet, and we have no idea what type of information we have left," says Ting Wang, a Lehigh assistant professor of computer science and engineering. "[And] if someone wants to dig in, they can find out."

There's no shortage of digging going on, either. When former National Security Agency subcontractor Edward Snowden leaked classified information in 2013 about the NSA's surveillance activity, he triggered a global conversation about privacy in an age where most everything, including our personal data, is digitized.

"Privacy, whether it's abused by attackers or whether it's abused by our own government, is a very big concern," says Daniel Lopresti, professor and chair of computer science and engineering and director of Lehigh's Data X Initiative. "So privacy and security go together hand in hand, and the bigger rubric is trustworthy computing—can we trust the systems?"

Today, individuals with malicious intent operate from anywhere in the world, attempting to access and manipulate software, networks, physical systems and the data stored within each of them. The protection of personal information has become a critical issue, and Lehigh researchers are working to strengthen systems and bolster user trust in a variety of ways.

DEMONSTRATING THE PROBLEM

The goal in privacy research, says Wang, is to raise people's level of concern by making them aware of the risk. In one area of his systems-based work, Wang and his team use data mining and machine learning tools to understand and quantify privacy risk.

Many online systems request basic personal information, such as age, sex and zip code, but allow users to operate under pseudonyms or avatars, providing a sense of privacy. In not providing a full name, people assume they can't be identified.

"Many think this is effective protection," says Wang. "[But] there are attacks that can break the protection and reveal some sensitive information about people."



**EVERY TIME YOU
HAVE NEW CHANGES IN AN
OPERATING SYSTEM, YOU TEND
TO HAVE SOME VULNERABILITY,
AND THE MINUTE THE ATTACK-
ERS KNOW THAT THERE IS SUCH
VULNERABILITY, THEY WILL
LAUNCH AN ATTACK.”**

—MOOI CHOO CHUAH

Even without immediate access to names, an attacker can use what's known as a “linking attack,” connecting one particular dataset with public datasets such as voter registration lists. Correlating the datasets can reveal user identities. In fact, says Wang, 98 percent of U.S. citizens can be uniquely identified by just three attributes: zip code, age and gender. In the case of medical information, correlating data can reveal such private details as an individual's disease or other health affliction.

In a recent paper currently under submission, Wang and colleagues Shouling Ji, Qinchun Gu and Raheem Beyah, all of the Georgia Institute of Technology, demonstrate the vulnerabilities within online health forums. They introduce in the study a new online health data de-anonymization (DA) framework, which they call De-Health. De-Health identifies a candidate set for each anonymized user in a forum and then de-anonymizes each user to a user in its candidate set. Applying De-Health to user-generated datasets from popular forums WebMD and HealthBoards, the researchers linked hundreds of anonymized users to real-world people and their personal information, including full names, health information, birthdates and phone numbers.

Wang and his colleagues hope De-Health will help researchers and policymakers improve the anonymization techniques and privacy policies utilized on websites like these.

Beyond exploring risk, Wang focuses on building technical tools that can help people understand the potential privacy leakage, or privacy price, of the things they do and say online. He also investigates protection mechanisms that will help individuals control who has access to their information. There's a balance, he says, in the amount of information shared and the service or results received.

“There's no free lunch with privacy,” says Wang. “Companies need information to do personalized service. Everyone understands that. But no one understands [if] the information is too much, if it reveals too much about themselves. ... Society lacks an understanding of how the system of data use works.”

HIDING INFORMATION

Even with an awareness of the risks, sensitive information still finds its way onto the Internet. Mooi Choo Chuah, professor of computer science and engineering, studies ways to protect that data and defend it from network-based attacks.

“Every time you have new changes in an operating system, you tend to have some vulnerability, and the minute the attackers know that there is such vulnerability, they will launch an attack,” says Chuah.

Chuah's research includes mobile computing, mobile healthcare, disruption-tolerant network design, and network security. Another focus involves the design of data mining techniques over encrypted data. Encryption is particularly useful in the healthcare sector. In clinics and hospitals, data mining of patients' data allows for more effective, personalized treatment, but unencrypted data stored on computers are subjected to sensitive information leakage when such systems are breached. Thus, it makes more sense for the data to stay encrypted until it is accessed by applications.

In terms of individual patient service, Chuah has designed a protocol in which the data of a patient with diabetes, for example, can be encrypted such that only his or her primary care physician and endocrinologists who specialize in diabetes at affiliate hospitals can open it. This attribute-based encryption, which allows only individuals with defined characteristics to open the data, en-

ables patients to determine who can see their information.

Chuah's encryption design also enables healthcare providers to learn how to better serve a patient without risking the safety of patient data. Patient information, accessed through an information-sharing coalition with other hospitals, can allow for improved service, says Chuah. When encrypted using Chuah's design, sensitive data can be shared and explored for patterns, but only those authorized users with the appropriate keys can view the actual data. This allows for data mining without the risk of information leakage.

“[It's] the safest way [to perform data mining],” says Chuah. “You can outsource your computation to a public cloud like Amazon, but they have no idea what your data is because it's in encrypted form.”

DISGUIISING INFORMATION FLOW

Data is not the only thing that can divulge information about users. The way it flows reveals quite a bit as well.

Suppose, for example, you log in to your bank account. The data associated with that account is encrypted, but the fact that you have an account with that bank is not a secret.

“That is sensitive information,” says Parv Venkitasubramaniam, associate professor of electrical and computer engineering. “Nobody has a right to know which bank you bank with. [Privacy is essential because] any information flow and any communication in cyberspace cannot be without an element of sensitive information. ... What we are looking at is even if the information is encrypted, there's still something that's being leaked implicitly.”





Even if someone isn't able to read a message shared between two individuals, that person can still know two people are communicating, and the timing of how the message is sent tells a story all its own. That, says Venkitasubramaniam, is a violation of privacy as well. His solution is to change how the information flows.

One focus of Venkitasubramaniam's research is user anonymity in wireless networks. He seeks to understand how to prevent information leakage through transmission timing. Venkitasubramaniam uses the analogy of sending a letter via the postal system to explain the concept: When one person sends a letter to another, he or she prints the recipient's name and address and the sender's own name and address on the envelope. The message itself is hidden, but the sender, recipient and postmark are obvious to an observer. Similarly, in a wireless network, transmission timing can reveal information about the sender and receiver as well as the routes of information flow.

To disguise the journey of the letter, the sender might put the envelope inside another envelope and place that one inside yet another envelope, addressing each envelope to a different recipient. Each recipient will in turn mail the letter to the next, unaware of the start or end points of the communication, and eventually the letter will reach its intended recipient. This method provides information flow security, but it comes at a cost: time. The same is true with electronic transmission in a wireless network, so Venkitasubramaniam's work also involves understanding a fundamental trade-off: the price paid for information flow security in terms of increased delay, network bandwidth consumption and additional use of resources.

Venkitasubramaniam's graduate research focused on communication and signal processing methodologies, a more mathematical approach. Information flow security is a good match, he says, because it involves changing the protocol, and protocol changes affect the performance metrics of a network. His current re-

search is primarily theoretical. He and his team attempt to drive an algorithm, changing control variables to understand how to best achieve the desired network performance while minimizing information retrieval from transmission timing.

When it comes to privacy, Venkitasubramaniam says, it all depends on the expectations of individuals, who tend to operate on a scale.

"On the one end, you have people who share every moment of their lives on social media, and then you have those who are nonexistent on social media," he says. "You have to develop a system that caters to all of them. In that sense, the way we try to address this challenge is by having some sort of fluid metric for privacy and claim that, depending on where you stand on the scale, this is the kind of performance you can expect from the network."

DENYING ACCESS

The problem of security doesn't arise only when communicating online. Personal data is at risk even in brick-and-mortar stores.

When customers in Target stores swiped their credit and debit cards at the height of the 2013 holiday shopping season, they were un-



aware their confidential customer data would fall into the hands of thieves. Millions of Target shoppers were affected by this large-scale breach, and the company later revealed that the personal information of millions more had also been stolen. The company lost millions of dollars in addition to the trust of many customers.

Yinzhi Cao, assistant professor of computer science and engineering, thinks a defensive measure against this kind of attack can be the card itself.

Cao and his colleagues, Xiang Pan and Yan Chen, both of Northwestern University, developed SafePay, “a system that transforms disposable credit card information to electrical current and drives a magnetic card chip to simulate the behavior of a physical magnetic card.” SafePay is a low-cost, user-friendly solution that would be compatible with existing card readers while preventing information leakage through fake magnetic card readers or skimming devices.

SafePay utilizes a bank server application, a mobile banking application and a magnetic card chip. The user downloads and executes the mobile banking app, which communicates with the bank server. During transactions, the bank server provides the mobile app with disposable credit card numbers, which expire after a limited time or even one use. In the absence of wireless Internet access, the app can collect and store several disposable card numbers for future use.

Once it has a card number, the mobile app generates an audio file in wave format and plays the file to generate electrical current, which connects with the magnetic card chip via an audio jack or Bluetooth. The magnetic card chip func-

tions like a magnetic card stripe on a traditional credit card, making it compatible with existing card readers.

Test results show that SafePay can be used successfully in all tested real-world scenarios. The team, whose work was supported by funding from Qatar National Research Fund and the National Science Foundation, envisions banks distributing the SafePay device to users in an effort to safeguard account information.

RECOGNIZING ATTACKS

In 2013, a man in New Jersey using an illegal GPS jamming device to hide his location from his employer inadvertently interfered with the satellite-based tracking system used by air traffic controllers at Newark Liberty International Airport. The relatively inexpensive jamming device confused the airport’s radar, which sends out a signal that bounces off an airplane to determine its location.

This type of attack, though in this case unintentional, prevents air traffic control from receiving signals from airplanes. However disruptive, it’s easy to recognize—when nothing works, it’s obvious that something is wrong.

Rick Blum, the Robert W. Wiesenman Professor of Electrical Engineering and professor of electrical and computer engineering, examines far more sophisticated attacks on sensor systems and networks. Through U.S. Army Research Office funding, Blum works to develop the fundamental theory of cyberattacks on sensors employing digital communications while advancing state-of-the-art design and analysis approaches for estimation algorithms under attack.

Sensors, which can be as complicated as radar and as simple as a thermostat, collect and respond to data. Like anything connected to a wireless network, sensors can be compromised. An attacker can, for example, employ a spoofing attack to slightly modify the data going into a sensor without being detected. In the case of an airplane, someone might tamper with the delay of the radar signal returning to air traffic control. In another type of attack, known as a man-in-the-middle attack, an attacker can modify the data coming out of a sensor by physically taking it over or by intercepting communications.

The first step in protection, says Blum, is to make sure the signals received are what you’d expect.

“The signal coming from this airplane has got to look like the signal I sent, but delayed,” he explains. “If it looks really different, then somebody did something. ... [But] with sophisticated attacks, you really have to be more sophisticated.”

Devices called “bad data detectors” serve as



THE INTERNET OF THINGS SAYS THAT WE'RE GOING TO HAVE SENSORS ALL OVER THE PLACE—IN OUR HOMES, IN OUR CARS. ... WE HAVE TO FIGURE OUT HOW TO PROTECT IT."

—RICK BLUM

a level of defense, determining whether or not data looks the way it should. Still, some bad data can pass through the detectors. Consistency here is key.

"The data that one sensor is getting should be consistent with the data the other sensor is getting," says Blum. "If it's not, you can see it by looking at it. It's really good to have lots of sensors because they can't attack them all. You have to look at things that are going on in different places and think, 'Are they consistent?' We have mathematical models for what the sensor data should look like, and we can sort of say, 'Okay, that's really way too different.'"

With enough data and time samples at each sensor, Blum and his team can determine which sensors have been attacked. They also conducted mathematical analyses to determine what to do with data that has been compromised—whether it's safe to use to make an estimation or if it should be discarded. The risk of sensor attacks increases with the rise of the "Internet of Things," the network of physical objects that collect and exchange data via computational elements.

"The Internet of Things says that we're going to have sensors all over the place—in our homes, in our cars. ... We have to figure out how to protect it," Blum says.

DEFENDING CYBER-PHYSICAL SYSTEMS

As connections between cyber systems and physical systems continue to develop, much more than information can be threatened. When linked by communication networks, critical infrastructure is at risk as well.

Take the U.S. electrical power grid, for example. Advanced electricity systems, or "smart grids," help make our use of energy more technically and economically efficient as well as more environmentally friendly. In the past, says Chuah, a large-scale outage would occur because of a local substation disturbance known only by the local control center. Because power lines are interconnected and the stations didn't communicate, other stations didn't receive warning and couldn't prepare ahead of time. Smart grids help prevent that.

"You can collect data regarding the current and the voltage going through all these transmission lines, and that data can be sent to remote power centers to provide a more global view to look at the health of the power systems," says Chuah. "But, unfortunately, anytime you put smart meters on a network—especially over a wireless network—it's bound to be compromised."

An attack on the smart grid targets more than data—it targets the system itself. A malicious user with access to the system might embed a virus within it or access sensitive customer information, but attackers might also inject false data into the power grid system, prompting incorrect and potentially devastating control decisions.

Blum directs Lehigh's Integrated Networks for Electricity (INE) cluster, a team of engineers, mathematicians and economists dedicated to research and education on advanced electricity networks. Nine cluster members compose a Lehigh team that has partnered with four other universities—the University of Arkansas, the University of Arkansas at Little Rock, Carnegie Mellon University and Florida International University—and has received a \$12.2 million grant from the U.S. Department of Energy to develop and test new technologies to modernize and protect the U.S. electrical power grid. Participating Lehigh cluster members are Blum, who serves as the team's principal investigator; Chuah; Venkitasubramaniam; Liang Cheng, associate professor of computer science and engineering; Boris Defourny, assistant professor of industrial and systems engineering; Shaline Kishore, associate professor of electrical and computer engineering; Alberto Lamadrid, assistant professor of economics in the College of Business and Economics; Wenxin Liu, assistant professor of electrical and com-

puter engineering; and Larry Snyder, associate professor of industrial and systems engineering.

The Lehigh team will develop and test algorithms to protect core power grid controls and operations, incorporate security and privacy protection into grid components and services, protect communications infrastructure, and execute security testing and validation to evaluate the efficacy of the measures they implement.

MAKING NO ASSUMPTIONS

Lopresti, whose research has included electronic voter systems and biometric security, emphasizes vigilance in research and practice.

The problem of hackers and other data thieves, he says, isn't going away, so researchers at Lehigh and elsewhere will need to continue their work to throw up new cyber roadblocks.

"Security researchers don't typically build something and sit back and claim that it's secure," he says. "That's pretty rare. Sometimes you can claim security if you create mathematical models and then within that mathematical framework prove it's secure, but then those models have to be implemented, and invariably that's where the problems arise. It's not that the math is wrong—the math is right—but you put it out in the real world and there are 50 other ways it can be broken."

Biometrics, he notes, were once considered the final solution for user authentication. But, as he's proved in some of his research, even if a security measure appears to work, it might have some serious flaws.

And so the work continues.

"If the systems in use aren't trustworthy, people won't use them," he says. "If you've ever been in an elevator and it shakes, it's like, 'I'm using the stairs from now on.' That's exactly what we're talking about. It's very, very much like that." **L**



This story will appear in the inaugural issue of the Lehigh Research Review, an annual publication exploring scholarship, discovery and thought leadership at Lehigh. Set to launch this spring, the magazine can be viewed in full at lehigh.edu/news/review.



SPOTLIGHT:

MARTY BARON

BY MARY ELLEN ALU

SPOTLIGHT, THE FILM CHRONICLING THE BOSTON GLOBE'S 2002 INVESTIGATION INTO THE CATHOLIC CHURCH'S COVER-UP OF CLERGY SEX ABUSE, HAS PUT AWARD-WINNING JOURNALIST MARTY BARON '76, '76G, '14H IN THE SPOTLIGHT HIMSELF.

Baron, who graduated from Lehigh with both a B.A. in journalism and an MBA, launched the Pulitzer Prize-winning probe as the *Globe's* then-editor. He's portrayed by Liev Schreiber in the film, which earned six Oscar nominations, including Best Picture.

Baron, currently executive editor of *The Washington Post*, has held editorial leadership positions at several of America's top newspapers. He is considered by

present and former colleagues to be "the best news editor of all time," according to *Esquire*.

In 2014, Baron delivered Lehigh's 146th commencement address and received an honorary Doctor of Humane Letters degree. He was back on campus in mid-February for a *Spotlight* screening.

Now, Baron takes the Bulletin's questions about *Spotlight*, journalism and those Lehigh years.

Marty Baron, left, with
real Spotlight reporters
Mike Rezendes and
Sacha Pfeiffer.



Q SPOTLIGHT IS GENERATING OSCAR BUZZ AS BEST PICTURE. HOW MUCH IMPACT, IF ANY, DO YOU THINK THE MOVIE WILL HAVE ON THE JOURNALISM INDUSTRY?

The full impact remains to be seen. The movie already has brought acclaim from critics. And I know, from emails and Facebook posts and the like, that it has given a lift to many journalists. They feel affirmed and encouraged by *Spotlight* because it reflects accurately and honestly how we do our work, particularly investigative stories, and because it makes clear that our work can be essential in addressing wrongdoing and in confronting powerful interests. They feel buoyed by a film that reflects our purpose in society at a time when the credibility of journalists has taken a beating, when politicians score cheap political points by crudely berating people in our profession, and when the industry is under unrelenting financial pressure that has resulted in a seemingly endless series of cutbacks.

I still say the full impact remains to be seen because I'd like to see its influence extend well beyond the morale of journalists themselves. I'd like to see it cause media owners, publishers and editors to re-dedicate themselves to investigative journalism. I'd like to see it cause a skeptical public to reflect on the necessity of journalism and, specifically, investigative reporting and what's required to do it right. And I'd like to see it cause journalists and others to listen to people who seem to live at the margins of our society who've been left voiceless. They can have something very powerful to say, and they deserve a hearing.

ARE YOU COMFORTABLE WITH LIEV SCHREIBER'S PORTRAYAL OF YOU? WHAT DID HE GET RIGHT?

I'm totally honored that Liev agreed to play me. He's a superb actor, and I'm not an easy person to portray. He did an amazing job.

As I said at the Toronto Film Festival in front of a crowd of 2,000: How do you portray someone who does not emote? I have to defer to the judgment of those who know me well when it comes to the accuracy of the portrayal; that is, my professional colleagues and my closest friends. My professional colleagues almost all say, *He nailed you*. My very closest friends frequently say the character in the film did not capture my warmer, perhaps more redeeming, qualities. Thankfully, they believe I have some.

But I do have to remind my friends that the period captured in the film was not a joyful time for me. I had arrived at a newspaper where I knew pretty much no one. I knew almost no one in the city either. I had been labeled an "outsider" in Boston. Very quickly, we were into some awfully serious news events, too. We had launched the Church investigation, and I certain-

ly understood the implications of that. Then there was 9/11. Those attacks took place six weeks after I got to Boston. And then, within days of those attacks, we had the anthrax scare. So it was a sobering time, and not an easy time for me personally.

YOU'VE HAD TO NAVIGATE A NUMBER OF CONTROVERSIES THROUGHOUT YOUR REMARKABLE JOURNALISM CAREER, NOT ONLY THE CLERGY SEX ABUSE BUT ALSO THE NATIONAL SECURITY AGENCY'S SECRET SURVEILLANCE PROGRAMS. WHERE DO YOU FIND THE COURAGE?

I don't know that I'd describe it as courage. I'd rather describe it as a simple determination to do my job as a journalist. When there is an important story in front of us, when there is a subject of enormous public interest, or when there is wrongdoing, we have to do our jobs as journalists. We have to pursue the story. We have to discover the underlying truths. We have an obligation to bring before the public information they should know. If we have to confront powerful interests and pursue that journalistic obligation, we can't be dissuaded. In fact, it should motivate us even more. Why? Because if not for us in the press, no one knows. No one would tell the public what it has a right to know. No one would expose the wrongdoing—because powerful interests would make sure it remained concealed.

YOU SPENT A LOT OF YOUR TIME AT LEHIGH IN THE BASEMENT OF THE UNIVERSITY CENTER, WHERE THE BROWN AND WHITE HAD ITS EDITORIAL OFFICES. WHAT WERE YOU LIKE AS A COLLEGE STUDENT?

I guess I was fairly studious. I was a good student. I got good grades, and I was interested in what I was studying. But I spent more time in the basement of the University Center, in the old offices of *The Brown and White*, than I did studying. The journalism for *The Brown and White* was work, but it was work worth doing. I'm happy to say that I came away from Lehigh with a great appreciation for the educational experience but also for the close friends I made. There weren't dozens upon dozens of good friends, but there were enough—and the friendships I had were close and enduring.

THOUGH YOU COULDN'T HAVE KNOWN WHERE YOUR JOURNALISM CAREER WOULD TAKE YOU AFTER GRADUATION, DID YOU THINK YOU COULD MAKE A DIFFERENCE AS A REPORTER AND EDITOR? IF SO, HOW?

my college career, President Nixon resigned. You'd have to be clueless not to see the impact that journalism can have. That said, I didn't go into the field expecting to do anything equivalent. But I felt that journalism served a social good in informing people about their community, country and world. And if those Watergate observations left me with a message, it was this: Central to the mission of journalism is holding powerful individuals and institutions accountable.

TODAY'S COLLEGE CAMPUSES ARE DIFFERENT PLACES. THE WASHINGTON POST RECENTLY PUBLISHED AN ARTICLE THAT CARRIED THE HEADLINE "CAN COLLEGES PROTECT FREE SPEECH WHILE ALSO CURBING VOICES OF HATE?" WHERE DO YOU STAND IN THE DEBATE?

I favor free speech. I want people to be respectful, of course. But I believe that those who go to college should understand from the start that they will encounter ideas, words and people that make them uncomfortable or get them upset. My view of that: Welcome to the real world. And a college experience

When I arrived at Lehigh, it was right about the time of the Watergate scandal. So I couldn't help but be absorbed by what was happening and the role that journalism—most notably my current employer, *The Washington Post*—played in that investigation. Midway through

should be, at long last for many students, an introduction to the real world—not one their parents have sought to choreograph for them, not the world as they wish it would be, but the world as it is. And college is a good place to learn how to deal with it all, messy as it might be.

You disagree with something someone said or did. Then, yes, argue. There's nothing wrong with a healthy argument. And we should all be able to cope with an angry argument. The worst thing, in my view, is to suppress speech and to prohibit argument.

THE WASHINGTON POST RECENTLY MOVED INTO NEW HEADQUARTERS, LEAVING BEHIND THE BUILDING WHERE WOODWARD AND BERNSTEIN HAD MADE HISTORY. WHAT DOES IT MEAN FOR THE POST'S FUTURE?

Our new facility pays homage to the history of *The Washington Post* in many ways. But it also conveys that we want to be a forward-looking news organization. The facilities themselves facilitate our progress in an information era that has been reinvented and that continues to be transformed at a rapid clip.

Within our newsroom, reporters, editors, videographers, data visualization specialists, social-media experts and engineers will all be more integrated. They'll sit side by side. That's because new storytelling forms have emerged that require the participation of all of them. That will increasingly be the case. The reason should be obvious: Most people are getting their information on digital devices. It could be your desktop computer or a tablet. But it's mostly a mobile phone. This requires us to think hard about how the information we want to convey is received and processed by the reader, or user, or viewer.

It has become clear that the Internet is its own distinct medium. Newspapers are a distinct medium. So is radio. So is television. But so is the Web. Each of those mediums requires its own storytelling approach. You don't read a newspaper story on television, for example. Instead, you write a television script. They're different. So the Web is its own medium, and mobile also may be its own medium.

Changing habits of consuming news and information require us in the media to change in response. And that's what we're doing. Our new facilities will help us to do that. Ultimately, however, it is the people in the facilities who have to rise to the challenge. **L**



Director Tom McCarthy, second from left, with some of *Spotlight*'s cast and the real journalists who exposed the Catholic Church's cover-up of clergy sex abuse.



THIS LITTLE PIGGY was rescued by Lehigh alum Perry Smith '87 and his family, who spotted him on the side of a road near Hagerstown, Md., during the January blizzard. Smith believes the piglet, which the family named Wee Wee, was close to death from

hypothermia when the family found him and wrapped him in a Lehigh sweatshirt to keep warm. The piglet was eventually taken to an animal sanctuary to live out his life. The rescue, chronicled in *The Washington Post*, *BuzzFeed* and other outlets, has gone viral.