BEHIND THE STORY



Annual Report 2016 / 2017



FROM THE PRESIDENT

To the Case Western Reserve community:

The quadriplegic man is able to move.

The wrongfully imprisoned are set free.

The scourge of malaria meets a formidable foe.

With these and so many other examples, people usually learn of an accomplishment once it is achieved.

In a time-pressed world, the order makes sense. Almost always, the development becomes newsworthy after it actually happens—not when the idea first emerges, not during many revisions en route to discovery, and certainly not when it fails, flops or flounders.

Yet there is a reason that nearly every superhero saga includes an origin story. As impressive as outcomes are, they seldom happen without a "why" I hope you find their stories as fascinating as I did. that drives them.

This year's report looks at some of Case Western Reserve's biggest stories from the 2016–17 year.

In each case, we try to illustrate the moment that matters most.

When the brother of a friend is paralyzed in a freak accident.

Or when students realize due process sometimes deserves doubt.

Or when a teenager discovers a passion for infectious diseases at a summer camp, then returns, years later, to try to defeat them.

I want to congratulate all of those chronicled in this volume—and the thousands more who contribute to Case Western Reserve's mission in countless other ways.

As you will read, we had an extraordinary year—one whose roots date back years and, in some cases, even decades.

Barbara K. Ingdu Barbara R. Snyder

President

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EVERYBODY HAS A STORY.

Where does it begin?

What moment sparked such passion—and still drives to this day?

In the pages that follow, we highlight 20 members of the Case Western Reserve community their achievements that earned recognition this year, and the experiences that inspired them.

We put you in their shoes, and take you behind their stories—

FROM THE LAB,

where their research offers life-changing potential...

TO THE SPOTLIGHT,

where their innovative ideas draw major attention...

ACROSS THIS CAMPUS,

where their excellence inspires so many...

AND AROUND THE WORLD,

where their work deepens understanding...

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HIS MOVE

When a teenage Bob Kirsch began dating his future wife, Donna, he quickly found that her family would become an important part of his personal life. It wasn't until far later that he realized how much they would drive his career—and, decades later, catalyze a landmark discovery.

As the lead researcher on a project that gave a Cleveland man with quadriplegia the power to move his paralyzed limb with his thoughts, Kirsch created a first-of-its-kind connection that drew worldwide attention.

After years of testing, Kirsch, who is chair of the university's Department of Biomedical Engineering, and his team discovered a way to pair electrical stimulation with a unique brain-computer interface that allowed the man move his arm and hand—and even feed himself—just by thinking.

Kirsch's inspiration? Donna's late brother, paralyzed at 18 by a sports injury.

"I saw there were things I could do for ... people like him," Kirsch said.

And with this breakthrough, he has.



\$20 million

in biomedical engineering research grants this year

paralyzed person in the world to have brain-controlled movements restored

1968

the year the biomedical engineering department was founded—among the first in the world

most popular undergraduate major: biomedical engineering

\$6.5 million

National Institutes of Health grant to CWRU and Brown University that jumpstarted Kirsch's research

BACK IN TOUCH

As a child, Dustin Tyler bought an Atari 800XL—not to play games, but to program.

This fascination with STEM fields ultimately led him to the then-emerging field of biomedical engineering.

When he began working with patients at the Louis Stokes Cleveland Veterans Affairs Medical Center, Tyler quickly found a focus for his knowledge.

Prosthetics could restore some sense of normalcy for individuals who had lost a limb, but they craved more. "Everyone we talked to said, 'I want to be able to feel again,'" recalled Tyler, the Kent H. Smith II Professor of Biomedical Engineering.

Tyler and his team crafted a system that used electrical stimulation to give patients not only sensation, but also the ability to gauge the level of pressure applied.

"Our goal is not just to restore function," he said, "but to rebuild a connection to the world."

"The patient told me, 'I'm becoming **two-handed** again.""



DIGITAL **DIAGNOSIS**

When Pallavi Tiwari first got her hands on a computer as a high school student in India, she had to figure out by herself how to use it.

But even that self-taught experience was enough to steer her to technological studies—and, last fall, a discovery that may transform human health.

As an assistant professor of biomedical engineering, Tiwari works on ways that computers can improve patient care. One of her most recent projects involved identifying alternatives to risky biopsies for evaluating brain tumors. Using magnetic resonance imaging, Tiwari and her team developed artificial intelligence algorithms that taught the computer to distinguish between spots that either could be the recurrence of cancer or a benign effect of radiation—a task so difficult that neuroradiologists often turn to surgery to be certain.

The more scans the software reviewed, the better it became, ultimately discerning features the average eye could not.

In a test against two human experts, the computer correctly diagnosed 80 percent of brain scans, while the physicians only got about half right.

Tiwari still needs to assess the technology's accuracy with larger numbers of scans, but if it continues to work, patients could well have more promising futures.



"The existing solution just wasn't good enough."

—Pallavi Tiwari

NATURE'S NAVIGATION

Roy Ritzmann's research career began with a "dreaded" undergraduate course: invertebrate biology. Through that class, though, he found a lab opening, which, in turn, led him to learn from Nobel Prize winners and other experts in the field. From that point on, he was hooked.

Ever since, he's worked to understand more about how even these seemingly simple creatures traverse complex paths.

One surprising answer? GPS.

The biology professor's team found that, like humans and other mammals, cockroaches appear to have a sophisticated navigation system in their brains that helps steer them through new surroundings.

The finding likely represents convergent evolution—the idea that distinct animals developed similar systems to manage the same problems. Ritzmann hopes to discover more about the cockroaches' system to expand our understanding of how all animals navigate their surroundings.

"Some of the most amazing things we see in the animal world involve navigation."

—Roy Ritzmann

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CLOSER CONNECTIONS

The night before her first Consumer Electronics Show (CES), Xyla Foxlin soldered circuit boards by the light of her iPhone, feeling unprepared and overwhelmed.

But the next morning, people who stopped by her booth shifted quickly from casual curiosity to intense interest.

They "started pulling out their credit cards," she remembered, "saying, 'Can I buy this now?'"

"This" was Parihug, a wireless-enabled stuffed animal that can transmit cuddles to other Parihugs around the world.

The idea emerged from a stressful day as a secondyear college student. With loved ones hundreds of miles away, Foxlin realized the only way to feel the connection she craved would be to create it herself.

Three years after building her first prototype in the Larry Sears and Sally Zlotnick Sears think[box], Foxlin has raised more than \$200,000 for her startup and even appeared in Microsoft television commercials.

In 2017, Foxlin returned to CES, where Case Western Reserve claimed more booths than any university, thanks in part to the assistance of the entrepreneurship program CWRU LaunchNet.

The showing is just one of ways that demonstrates how our students think beyond the possible.





student startups created at the university since 2012

booths at 2017 CES in Las Vegas—the most of any university

\$10.1 million in external funding raised by student companies

50,000

-square-foot innovation hub, the Larry Sears and Sally Zlotnick Sears think[box] in the Richey Mixon building—the largest open-access makerspace at a university in the world

2/3

admitted students cite Sears think[box] as a determining factor in enrollment





"The surgeon started **singing** show tunes."



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A HEALTHY CHILL

As a nurse for 30 years, Jill Byrne has seen firsthand how tempers and temperatures can rise in the operating room.

To chill out heat-stressed surgeons and others, Byrne invented a vest outfitted with ice packs to put under their often-stifling gowns.

"Wearing the vest, the surgeons are calmer and cooler—which is healthier for them," said Byrne, a PhD student at the Frances Payne Bolton School of Nursing and a Cleveland Clinic nurse. "One even broke into song."

The vest proved so popular that Byrne found herself making hundreds for colleagues, continuing to update her designs. Ultimately, she recognized the business potential of the concept, and connected with Cleveland Clinic Innovations, the commercialization arm of the hospital system, to seek a patent. Today, they are working to facilitate licensing the product with a goal of making the vests available worldwide.

Meanwhile, the idea applies to her academic endeavors as well. The subject of her dissertation? The occupational hazards of heat stress.



"It's beyond dispute that our system is fallible."

—Carmen Naso

TRUE JUSTICE

Three wrongfully imprisoned men are free today thanks in part to Case Western Reserve law students and faculty.

Teens when they were convicted of murder in 1996, the East Cleveland men won release after students in the school's Milton A. Kramer Law Clinic Center joined the Ohio Innocence Project in challenging the original verdict.

Under the supervision of senior law instructor Carmen Naso and associate dean Judith Lipton, the students spent months poring over documents and helping prepare the attorneys, including Naso, who argued the case in court.

Judges ultimately agreed that prosecutors' withholding of information that was favorable to the defense—coupled with a witness recanting an identification—cast enough doubt on the men's guilt to overturn the jury's decision.

For Naso, who has practiced law for more than 30 years, the case was a chance to right a grave injustice.

"We've done so much to improve our criminal justice system," he said, "but if we're really serious, we need to go back and fix our mistakes."

SELF(IE)-HELP

Lance Vernon turned to dentistry after stints in special education and clinical research and found a risky but often-overlooked effect of a lack of health care access: periodontal disease.

Bleeding gums can sound minor, relative to untreated ailments like asthma or diabetes. Yet an abundance of research has shown that people with periodontal disease are more likely to suffer heart attacks and strokes—in some studies, more than twice as likely as those without the condition.

Since earning degrees in dental medicine and public health 15 years ago, Vernon, now senior instructor at Case Western Reserve's dental school, has looked for better ways to help patients head off gum problems before they grow worse. He's found evidence that, although people floss and brush their teeth, many need to improve their skills.

One solution: the selfie. In a study with colleagues in India, Vernon showed that taking a video selfie with a smartphone while brushing, and later having it reviewed by a dentist, can increase the accuracy and number of brush strokes—as if being supervised.

"Getting guidance by phone can be a new way to promote oral health and prevent disease," he said.

"People were slipping through the cracks."

—Lance Vernon



"I" M ACHIEVING DREAMS IT NEW ERMENT HIGHT E ABLE TO A BENEVA BE A B E TO TO IN

FULL SUPPORT

When it came to selecting a college, Ambar Solis-Fuentes and Ethan Voss considered three factors: academics, social life and, equally important, cost.

As a first-generation college student, Solis-Fuentes recognized that schools' scholarships and aid would play a primary role in her decision.

Voss, meanwhile, knew early that Case Western Reserve was his first choice. Actually enrolling here, though, would depend on the financial support he received.

The two applied at an opportune time: The Class of 2021 is the first accepted under the university's new policy of meeting the full need of every admitted student. Previously, about a guarter of students received aid lower than their demonstrated need. The new approach has dramatically increased diversity—including representation of economically disadvantaged students.

Today both Voss and Solis-Fuentes are first-year students. He's majoring in engineering while she's pursuing biochemistry on a pre-med track—and working to realize the dreams of her immigrant parents.

"They came here," she said, "to give my siblings and me the chance to be more successful.'

25,000+

applications to the Class of 2021

-point increase in average SAT scores since 2007

> 100% of financial need met for all

times the number of undergraduate applications since 2007

consecutive years of record-breaking application numbers

among all private institutions in the AAU for application growth



"Without something like this, the world could possibly

never get rid of malaria."

—Brian Grimberg

CROSS-CAMPUS COLLABORATION

Brian Grimberg first studied infectious diseases at Case Western Reserve as part of a gifted program for youth.

22

12

A decade and a half later, he was back on campus—this time with malaria as his designated target.

The disease persists as one of the developing world's deadliest, in part because of the difficulty of securing accurate diagnoses in remote areas.

Grimberg, an assistant professor of pathology in the School of Medicine's Center for Global Health and Diseases, connected with Distinguished University Professor Bob Brown and his physics research group to develop MOD (for Magneto-Optical Detector), a portable device that can detect malaria with one drop of blood.

It not only is 20 times faster than traditional rapid-test methods, but is also more accurate and less expensive. Last year, the team earned one of four Patent for Humanity awards given out by the U.S. Patent and Trademark Office.

"This teamwork with Brian is a poster child for the good things that can come out of interdisciplinary work," Brown said.

Brian Grimberg and Bob Brown

atra



TRIPLE THREAT

University record-holder. All-American. National champion.

By the end of his sophomore year, C.J. Krimbill (CWR '16) already had made university history as half of the NCAA champion men's doubles tennis duo—the first time Case Western Reserve claimed a national title in that sport.

Over the years, his on-court success continued and his off-court accomplishments proved just as impressive, among them a 3.94 cumulative GPA and extensive community service, including tutoring math and teaching tennis.

This combination of achievements made Krimbill an NCAA Today's Top 10 Award recipient—the first athlete in school history and the first men's tennis player in any NCAA division to receive the honor, which previously was awarded to the likes of Archie Griffin, John Elway and Drew Brees.



"I was by no means expecting this."

—C.J. Krimbill

"She is my hero."

—Makela Hayford



MORE THAN A NAME

It's not hyperbole when Makela Hayford calls double alumna Stephanie Tubbs Jones her hero.

Hayford is a sociology major (as was Tubbs Jones) who wants to earn a law degree to advance social justice (as did Tubbs Jones).

Hayford served as president of the university's African American Society (which Tubbs Jones helped found), and in 2014 co-founded the student group #webelonghere (which, in 2016, suggested that the university name its new residence hall name after Tubbs Jones).

She "embodied the type of leadership and student activism that creates lasting change," Hayford told the student newspaper that year.

Tubbs Jones, who died in 2008, was the first African-American woman to become an Ohio Common Pleas court judge, and then the first to become a county prosecutor. In 1998, she became the first African-American woman elected to represent Ohio in Congress. Fittingly, the residence hall marks the first time a campus building bears the name of an African-American woman.

"We are thrilled this residence hall will celebrate her legacy," Hayford said at the dedication. "But I don't think Stephanie Tubbs Jones would want us to stop with this naming today."

20



A WELCOME **OPPORTUNITY**

Cami Ross studied abroad four times as a college student—and each trip deepened her appreciation of cultural differences.

So when President Trump limited travel to and from several predominantly Muslim countries, Ross said she "thought of our students first."

As the program coordinator in the university's Center for International Affairs, she worried whether students from affected countries would have to eave. She wondered whether their families could visit here. And she feared that the university would not be able to bring in future students from the dentified countries.

Ross rallied the community around a customized version of the national #YouAreWelcomeHere campaign designed to show campus support for international students

Soon, #YouAreWelcomeHereCWRU buttons and signs began appearing everywhere. The idea: to remind international students that, at Case Western Reserve, they are valued, appreciated and always welcome.



countries represented in our student body



percent of our students spend time abroad

percent of our student body is international

"All numbers tell their own story."

DATA IMPACT

When April Hirsh Urban befriended a childhood classmate too shy to speak to anyone else, she felt guided by the same force that inspires her today: an innate desire to understand the perspectives of those who need help.

"I try to see everything through a lens of potential impacts on already-vulnerable people," she said.

Now a research associate at the Jack, Joseph and Morton Mandel School of Applied Social Sciences, Urban has expanded her focus from one to many—and her tools from conversation to multi-layered analysis.

In a report for the Western Reserve Land Conservancy that she co-authored, Urban and her colleagues mined and mapped public data to find surprising outcomes. Chief among them: Violent crime rates are higher in areas with large concentrations of vacancies. The finding-and the statistics that support it—will help guide officials working to make Cleveland neighborhoods safer.

percent of the Class of 2021 is international—more than double the figure from five years before

23

faculty-led study abroad programs **annually**



—April Hirsh Urban



"Meet people where they are, even when they're in a low place."

—Lee Hoffer



"Human caring saved me." —Linda Burnes Bolton



When severe childhood asthma forced Linda Burnes Bolton into frequent medical care, the compassion shown by nurses helped her recover.

It also pointed her toward a career in caregiving.

Now a university trustee, vice president of nursing and chief nursing officer at Los Angeles' Cedars-Sinai Health System, and an American Academy of Nursing "Living Legend," Burnes Bolton has achieved such renown that she is asked regularly to contribute her expertise on critical health issues.

The most recent example involves opiates, where she joined Case Western Reserve faculty member Lee Hoffer on an expert committee the epidemic.

Convened by The National Academies of Sciences, Engineering, and Medicine, the group issued a 482page report in July that calls for expanding access

Photo credit: John Livzey

CARE AMID CRISIS

to treatment, increasing research and encouraging more responsible prescribing among health care providers. The report found that, as of 2015, about 2 million people have a "use disorder" involving prescription opioids, and 600,000 have the disorder relating to heroin.

"Data from the front lines, so to speak, helps policymakers be better informed to fix this issue," Hoffer said.

As an anthropologist whose research focuses on heroin, Hoffer is all too familiar with the havoc the drug can wreak.

As his research led him to know some heroin users, providing analysis and recommendations for easing Hoffer detailed their everyday experiences as a way to humanize the problem for the public.

> "Caring about others," Burnes Bolton explained, "means doing what you can, no matter who vou are."

TRAINING GROUND

Thanks to a boost from federal programs during tough times in the 1940s and '50s, Sue Helper's parents were able to raise a family and achieve a dream: sending their children to college.

Helper seized the opportunity, winning acceptance to Oberlin College and then Harvard University for graduate school. After earning her doctorate there, she established such a strong scholarly reputation that, in 2012, the White House appointed her to work as senior economist to its Council of Economic Advisers and then, a year later, as the chief economist of the U.S. Department of Commerce.

Back on campus as the Frank Tracy Carlton Professor of Economics at Weatherhead School of Management, Helper advocates for initiatives she believes benefit the nation. Among her favorites: apprenticeships—and she hasn't let a change in administration slow her efforts.

In the spring, she penned "Will Trump be the one to take apprenticeships to scale?"—a Brookings Institution piece that noted the president's embrace of the German apprenticeship model. Citing research she conducted with former Department of Commerce colleagues, she noted that such programs not only benefit participants, but can provide significant return for companies as well.

"All people should have a chance to reach their potential, and apprenticeships are a proven path," she said. "My parents proved what **a little help** could do."

—Sue Helper



"If we can **starve** the tumors, **we can stop them** from **growing**."

—Zhenghe "John" Wang

DREAM **TEAM**

As a young researcher from China in graduate school in the U.S., Zhenghe "John" Wang found himself captivated by the possibilities of the thenemerging field of genome sequencing.

After earning his PhD, he began working with one of the world's pioneers in the subject. Within a few years, Wang himself discovered a gene mutation that appeared to have a connection with colorectal cancer.

Now, through a promising clinical trial, he and his team are testing whether a one-two punch blocking a key amino acid while delivering a specific chemotherapy drug—can "starve" the kinds of cancer cells found in patients with the mutation Wang found.

Recognizing the promise of this and other work, a group of researchers from Case Western Reserve and the Case Comprehensive Cancer Center has been named to one of 20 "Dream Teams" designated by the American Association for Cancer Research and Stand Up to Cancer. Wang is one of the national team's co-leaders and heads up the Cleveland group.

"To work with the world's research leaders to find treatment for cancer patients," Wang said, "is beyond my wildest dream."

DEGREES AND CAMPUS STATISTICS

July 1, 2016 - June 30, 2017

DEGREES AWARDED

BACHELOR'S	1,249
MASTER'S	1,451
PHD	_ 206
OTHER DOCTORATE (JD, MD, DMD, DNP, DM, DMA, SJD)	_ 451

DEGREES BY SCHOOL (UNDERGRADUATE AND GRADUATE)

CASE SCHOOL OF ENGINEERING	-741
COLLEGE OF ARTS AND SCIENCES	675
FRANCES PAYNE BOLTON SCHOOL OF NURSING	268
JACK, JOSEPH AND MORTON MANDEL SCHOOL OF APPLIED SOCIAL SCIENCES	-191
SCHOOL OF DENTAL MEDICINE	-81
SCHOOL OF LAW	-196
SCHOOL OF MEDICINE	-563
WEATHERHEAD SCHOOL OF MANAGEMENT	654

ENROLLMENT (FALL 2017)

5 150
6,674
— 50
- 81

ALUMNI + HONORS

3,501

3,098

267

400

ALUMNI	112,661
NOBEL LAUREATES	16

CAMPUS

FACULTY (FULL-TIME) -

CAMPUS SIZE (ACRES)

UNIVERSITY CIRCLE

STAFF (FULL-TIME AND PART-TIME)

UNIVERSITY FARM (HUNTING VALLEY, OHIO)

RESEARCH AND TECHNOLOGY HIGHLIGHTS

TECHNOLOGY TRANSFER

NEW INTELLECTUAL PROPERTY DEALS WITH INDUSTRY	59
LICENSING REVENUES	– \$2.21 million
NEW INVENTIONS	236

COMPETITIVE SPONSORED RESEARCH PROJECTS

PROJECTS AWARDED

AWARDED, IN MILLIONS*

1,364 —	TOTAL	—— \$337.1
62 —	OTHER GOVERNMENT	\$9.1
578 —	NONPROFIT, FOUNDATIONS, ASSOCIATIONS, SOCIETIES	\$66.7
153 —	INDUSTRY	\$16.5
95 —	OTHER FEDERAL	\$5.9
15 ——	NASA	\$2.0
8	DEPARTMENT OF ENERGY	\$3.3
35 ——	DEPARTMENT OF DEFENSE	\$14.7
55 —	NATIONAL SCIENCE FOUNDATION	\$14.2
363 ——	NATIONAL INSTITUTES OF HEALTH	—— \$204.7

*NUMBERS HAVE BEEN ROUNDED.

FINANCIAL HIGHLIGHTS

July 1, 2016 - June 30, 2017

GIFTS AND PLEDGES FROM PRIVATE SOURCES



\$ IN MILLIONS

29



*Surplus includes revenue less expenses as well as uses of retained surplus.

TOTAL OPERATING REVENUES AND EXPENSES

TOTAL OPERATING SURPLUS*



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As of Jan. 1, 2018

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