

### from the **PRESIDENT**

To the Case Western Reserve community:

How you look can decide what you see.

True, this maxim carries literal meaning: Examine an object from another side, and it can appear entirely different.

But it also applies to other kinds of perspectives:

- the dentist who doubted the common perception that only powerful pharmaceuticals could combat pain, then proved her point by looking through hundreds of research studies;
- the researcher whose play with her children sparked a memory of origami figures from her girlhood—which in turn inspired an exciting new approach to robotics; and
- the professor who spotted a striking sculpture in Brooklyn and, years later, transformed the vision into a high-tech dance performance viewed through Microsoft HoloLens.



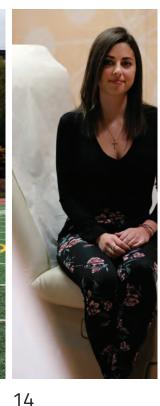
This year's annual report not only includes these and other stories; it also shares each from one individual's point of view. Experience the emergence of an idea, the overcoming of obstacles, and the achievement of a goal—all through another's eyes. We could think of no better way to provide insight into how our people live this university's mission, every single day.

Barbara R. Snyder President

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An unsolvable problem suddenly gets a workable answer. A hopelessly flawed argument is fixed with a small tweak. The unattainable goal becomes a fully realized reality.

Looking from a different angle can lead to breakthroughs in research, insights in education, even empathy among people on opposing sides of an argument.

In short, it can often be core to achieving our mission as a university. So this year, we're taking a new perspective on some of Case Western Reserve's most intriguing stories of 2017-2018.

That is, we're telling—and showing—them from the participants' point of view.

Hear their stories.





## MIND GAMES

Student entrepreneur devises a quick way to track and train athletes' brain health

Between recent movie and media coverage, people finally have begun to recognize just how dangerous concussions can be.

But as much as coaches and trainers want to be more careful about their athletes' brains, standard testing devices can cost \$18,000 or more.

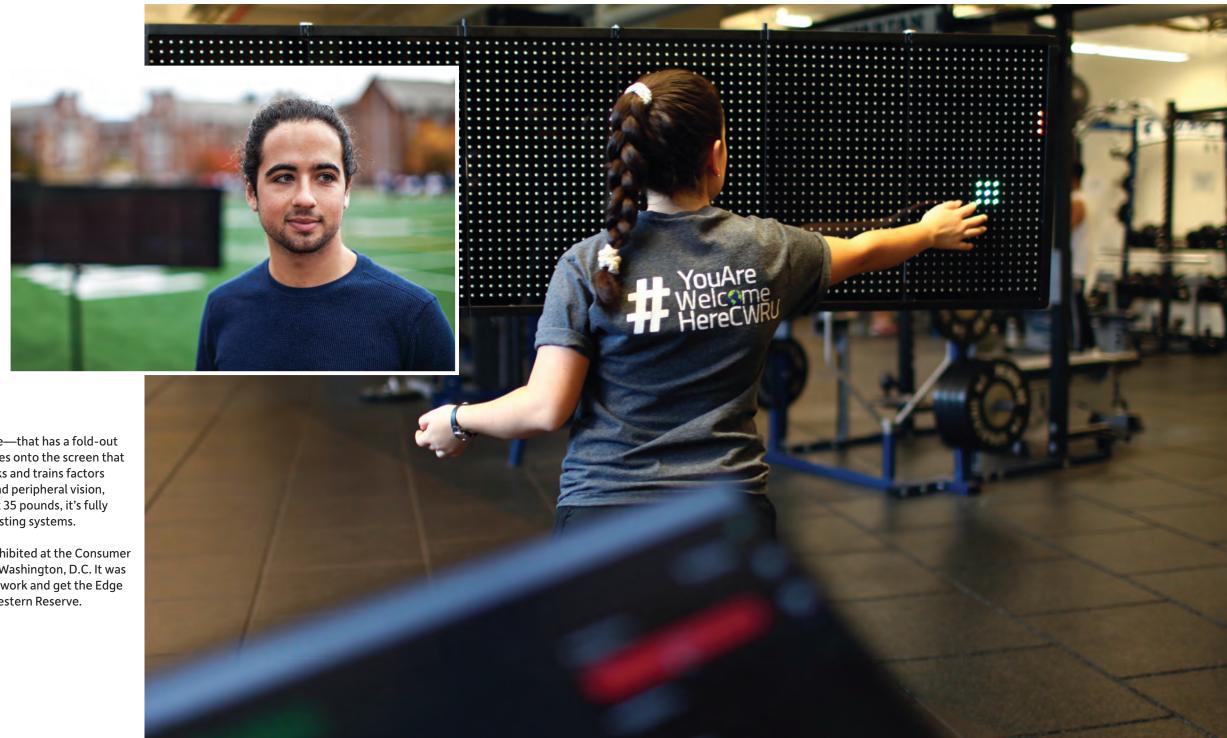
When a coach told one of our high school classes about this problem, two friends and I started thinking about how to solve it.

We ended up creating a device—called the Edge—that has a fold-out screen with over 2,500 LEDs that project modules onto the screen that athletes touch based on the task. It quickly tracks and trains factors like reaction time, memory, depth perception and peripheral vision, data critical for players in high-impact sports. At 35 pounds, it's fully portable—and less than a fifth of the cost of existing systems.

We call our startup Reflexion, and in 2018 we exhibited at the Consumer Electronics Show (CES) and at CES on the Hill in Washington, D.C. It was great to have the opportunity to expand our network and get the Edge in front of people, and also to represent Case Western Reserve.

#### Matt Campagna,

a senior studying computer engineering



## INSPIRING **HOPE**

Law student wins national award for nonprofit honoring her late boyfriend

I'd never heard of CTE before my longtime boyfriend, Zac, mentioned it in 2015.

He suspected CTE—chronic traumatic encephalopathy—was causing tremors in his brain, memory lapses and mood swings. And he felt confident, based on his research, that the concussions he sustained in high school football were to blame.

He wanted his loved ones to make sports safer for everyone.

Less than a year later, he took his own life. I had just completed my first semester of law school.

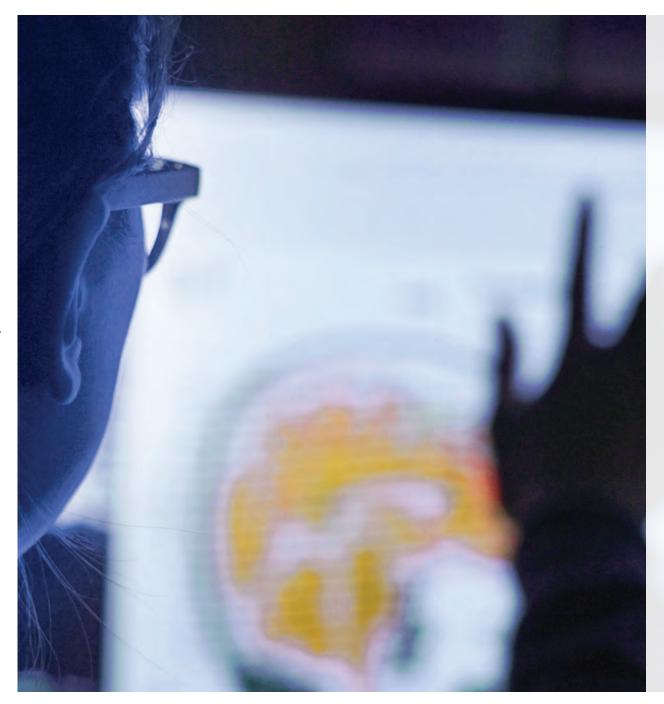
A medical report later confirmed that Zac had CTE. Through letters he wrote before his death, he made his last wishes clear: He wanted his loved ones to make sports safer for everyone, and to raise awareness of CTE.

So his family and I co-founded CTE Hope, an organization aimed at ensuring no one has to face the same fate as Zac. We're committed to supporting research into CTE, the development of better concussion protocols, and advocacy and awareness efforts.

I was truly honored when National Jurist selected me as one of 25 Law Students of the Year for my work in the classroom at Case Western Reserve and outside with CTE Hope.

It was recognition not only for what I've managed to do, but also what Zac left behind.

Alison Epperson (LAW '18), co-founder and chief communications and marketing officer of CTE Hope



# REWARDS of **RESEARCH**

Recent honors stem from common commitment by university and alumni to deepen understanding

As a research university, Case Western Reserve exists to unravel mysteries and create solutions that reach beyond our campus to serve all of humanity.

Excellence in research is our mission and duty. It's also our legacy.

This year, Case Western Reserve was ranked 18th in the world for innovation—ahead of such institutions as Duke, Johns Hopkins and CalTech—by *Nature*, the highly regarded academic journal.

The honor highlights what makes our university exceptional by any standard: our research community of faculty, staff, students and alumni—including renowned neuropathologist Ann McKee (MED '79).

Named to *TIME*'s 100 Most Influential People list in 2018 for her discoveries regarding the devastating effects of brain trauma—in particular, on professional football players—Dr. McKee is changing the way sports are played across the globe.

Awards are a chance to reflect on how far we've come, but our work is never finished. Together, we're chasing the next breakthrough—and every advance along the way—with patience, passion and a belief in the promise of tomorrow.

Suzanne Rivera,

Vice President for Research and Technology Management



# PEAK **PERFORMANCE**

Softball team ends season with highest finish ever—for any CWRU team

I crouched and put my glove near the ground.

It was the bottom of the last inning. Two outs. Two strikes. One player on second.

What happened next could start a rally for them—or send us to the NCAA championships.

Our pitcher began her wind-up. The ball flew toward the plate.

The batter swung and ... missed.

Our fans screamed. We sprinted toward home plate for a massive team hug. The feeling was unbelievable.

Yet from the start, we knew this season could be special.

We had amazing new first-year players, strong leadership and that essential intangible: team chemistry.

We went 24-8 in the regular season and made it to the NCAA Division III tournament for only the second time in team history. We were the first team to reach the national championships round, tying for fifth in the country—the highest finish of any university athletic team, ever.

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From the start, we knew this season could be special.

We cemented our place in CWRU's sports legacy. We are part of that team forever, and no one can take that away.

Nicole Doyle, a senior studying accounting

# an ELEVATED CONCERN

Nursing students head to local schools to assess exposure to lead

As I pricked the finger of a pre-K student in a Cleveland school, I expected a shriek or a muffled sob. Instead, I got questions: What was I doing? Did I get enough blood? Did I need to check his other hand too? His little face was inches from his finger, inspecting what we were doing.

I am studying to be a nurse, I explained, and I was taking a little bit of blood from his finger to make sure he is healthy (specifically, that his lead levels aren't too high—though I didn't share that point with him). And yes, I assured him, I got enough of a sample; just the one hand was good enough!

While his reaction stands out, I was surprised by how well most of these pre-K and kindergarten students reacted to having their fingers pricked. I was relieved because, ultimately, what we're doing through a grant from the Prentiss Foundation will help us make sure Cleveland children are healthier in the long run.

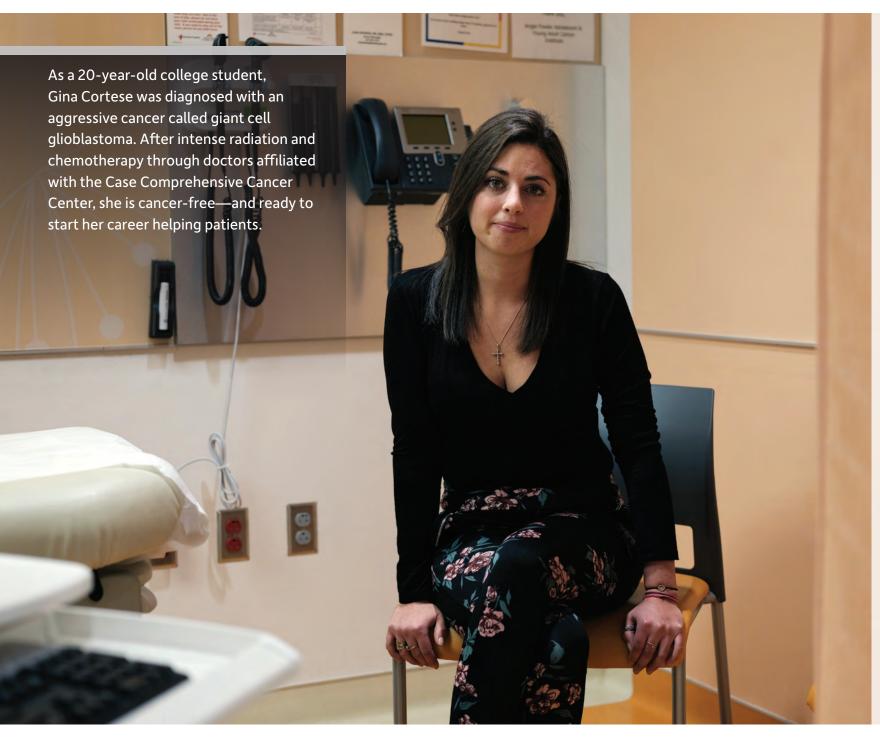
Lead poisoning can have so many troubling impacts on children—like lower IQs and slower physical growth. And Cleveland has one of the highest rates of childhood lead exposure in the country.

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By testing children early, we can identify who is at risk, and then refer their families to health professionals. We also can point them to other resources, such as lead abatement specialists for their homes, to help set them on a path toward a healthier future.

Elizabeth Adams, a junior studying nursing





# POWER of PARTNERSHIP

Multi-institutional collaborations are taking research from lab bench to the patient's bedside

Cleveland's title as a "medical capital" may be recent, but the region has reaped its benefits for decades.

The Case Comprehensive Cancer Center, for example, earned its first formal recognition from the National Cancer Institute in 1987. More than 30 years later, our collaboration has grown to include 370 scientists and physicians from Case Western Reserve University, Cleveland Clinic and University Hospitals.

This concentration of knowledge not only draws significant research funding to Northeast Ohio, but also enhances patient care in the moment. Combined, the two hospitals treat nearly 16,000 new cancer patients annually, and their doctors can consult with renowned experts located down the hall, or down the street. In addition, the federal designation means patients have more opportunities to participate in clinical trials of medicines so cutting edge they are not yet available to the public.

This summer, the NCI again awarded our center its highest rating, along with nearly \$32 million to continue our research and education efforts. Soon after, the university announced another shared victory: a \$46 million award for our Clinical and Translational Science Collaborative, which includes Cleveland Clinic and University Hospitals as well as MetroHealth Medical Center and the Louis Stokes VA Medical Center. Its mission also involves research and education, with a particular focus on bringing scientific breakthroughs more quickly to patient care.

In addition, both efforts connect us with community-focused research designed to improve the health of our region.

By working together, we make powerful progress for patients. I'm thankful every day for the partnerships that make it possible.

#### Stan Gerson,

Director of the Case Comprehensive Cancer Center and the Asa and Patricia Shiverick-Jane Shiverick (Tripp) Professor of Hematological Oncology

## EASING the PAIN

The most effective treatment for dental care is already in your medicine cabinet

No patient should go home in pain. Starting with my very first days in dentistry in the U.S. Navy nearly 20 years ago, I have been dedicated to helping those in my care heal in comfort.

Yet easing acute pain should not create new risks for patients.
Regrettably, our opioid epidemic continues to claim more than 100 American lives every day, according to the National Institutes of Health.



No patient should go home in pain.

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There is a better way. By looking anew at more than 450 published studies from the last 30 years, my collaborators and I found that the combination of drugs such as ibuprofen with acetaminophen or other nonsteroidal anti-inflammatory drugs is more effective for pain—and safer—than opioids.

Our findings were published in the Journal of the American Dental Association and became news worldwide, featured in The New York Times and other prominent media outlets.

Still, our work is not done. We hope health care providers and patients all over the world will act on the findings.

Together, we can reduce the pain our patients experience without creating new risks—and hopefully save lives in the process.

Anita Aminoshariae, Associate Professor of Endodontics



## ENVISIONING the VISIONARY

The combination of holograms and dance creates a high-tech, first-of-its-kind performance

Ideas can come in a flash.

I was walking in Brooklyn Bridge Park when a sculpture there sparked my imagination: a tornado consuming two journeymen at the end of a quest.

Years later, this vision became the finale of *Imagined Odyssey*, which merged real dancers with holograms for a performance unlike anything audiences had ever seen.

Dance is an ancient art form—communication through movement, images and ideas. Dance is also alive and changes with us.

I love testing the limits of new technology in performance. So when the university began piloting the use of Microsoft HoloLens, a mixed-reality headset, the possibilities seemed endless.

During *Imagined Odyssey*, each audience member wears a HoloLens, allowing them to see dancers performing with and in holographic landscapes—virtual forests, orbs, sparks and, yes, a swirling vortex.

Blazing a new path is never easy, but it's better (and more fun) with collaboration. Artists, programmers and network engineers from Microsoft and the university's Interactive Commons—we all navigated complexities and challenges together.

What started as a simple vision in a park became a journey—an odyssey—leading the performing arts into new territory.

Gary Galbraith, Professor of Dance

The university's Interactive Commons uses Microsoft

HoloLens in groundbreaking ways, such as a full mixed-

reality anatomy curriculum; an interactive, overseas art

museum experience; and a never-before-seen dance

performance, shown here.



# ENVISIONING the **VISIONARY**

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Gary Galbraith, Professor of Dance



## ROBOTS, TRANSFORMED

A childhood fascination inspires an invention that could change health care, manufacturing and more

As a child, I did a lot of origami. I'd fold (and fold ... and fold ...) until the flat sheets of paper became intricate 3D figures.

It's a hobby I neglected over the years, until I had children. As we built boats and airplanes together, I couldn't stop thinking about the origami structures that can move by themselves, like robots. One of my students and I came across the Twisted Tower, in which the paper structure can bend, contract, extend and twist. Then, I had an epiphany: This design could translate to robotics, providing a flexible yet structurally sound alternative to today's rigid robots.

So my students and I got folding, creating paper robotic models that could transform to fit the shape and space. Then, we used Sears think[box], the university's innovation center, to 3D print our designs using a more resilient material while also speeding up the process. We went from 20 hours to make the robots by hand to 10 minutes of human involvement (plus about 10 hours of machine printing). The experience proved that the elaborate technique could translate to large-scale production.

Right now, we're exploring the use of these robots in modern manufacturing. Our soft, flexible and durable robots can move efficiently and grasp items, and can work alongside people on the manufacturing line, unlike the rigid robots that present safety risks.

My goal, though, is two opposite applications: I want to miniaturize the robots for use in minimally invasive surgery, and then enlarge them for space travel. The possibilities for their use are as vast as the origami designs that inspire them.

#### Kiju Lee,

the Nord Distinguished Assistant Professor of Mechanical and Aerospace Engineering





# STEPPING UP for **SUCCESS**

New program, with support from the trustees and President Barbara R. Snyder, aims to improve student satisfaction

Starting college can be overwhelming, especially when accompanied by a cross-country move (I'm from Utah).

But a few weeks before I arrived, I got a call from Latasha Timmons, a staff member who introduced herself as my "navigator." She explained that every undergraduate now gets a dedicated support person—in addition to a faculty advisor—to talk through issues and suggest resources.

It's part of a new Student Success initiative that President Snyder championed, with support from the Board of Trustees.

In that first call, Latasha asked about my interests and what I wanted to get out of my college experience. She outlined the course selection process, and made sure I knew I could reach out to her any time.

Since I arrived, Latasha has explained study abroad opportunities, prerequisites, ways to access academic assistance and so much more. She's a database of knowledge, only in the form of a human who truly cares about me.

Latasha has been such a help that she's become a bit of a celebrity; at orientation, my mom tracked Latasha down to take a selfie with the woman who helped me feel at home before I even set foot on campus.

#### Maria Luisa Bates Domenech,

a first-year student studying political science

## CREATING INCLUSIVE COMMUNITIES

Research shows mixed-income developments aren't always inclusive—and points the way forward

Just down the street from my campus office, a historic apartment complex is getting a major renovation. My team is working with the owners and new management to make sure it succeeds—not just as a business investment or architectural restoration, but as an inclusive community where a mix of families can thrive.

Our research shows that mixed-income developments are highly successful at physically revitalizing inner-city neighborhoods, but fall short in creating full equity and inclusion for all of their residents. Often, we found, the tenants, especially those who are lower income, can't—or won't—stay in the apartment post-renovation. And those who do stay can feel stigmatized and unwelcome.

How can we help them stay and flourish in our community?

So how can we make sure our neighbors in this Cleveland apartment building—nearly three-quarters of whom are from federally subsidized, low-income households maintain strong connections to the building during the renovation process?

How can we help them stay and flourish in our community?

We're getting to work: conducting household surveys, leading community building and resident support work, and helping to develop a longer-term plan for a successful mixed-income community. Our team has even helped start a monthly "NeighborUp Night" for residents to connect with and support each other, and discuss topics of importance to them.

Over the past year, our center received more than \$1.8 million in funding for research and technical assistance in mixed-income communities around the country. Putting this work into practice in our own backyard can promote mixed-income success in our own community—and serve as a model for neighborhoods well beyond.

#### Mark L. Joseph,

Founding Director of the National Initiative on Mixed-Income Communities and the Leona Bevis/Marguerite Haynam Associate Professor in Community Development





# SOCIAL **NETWORKING**

A tweet to a role model led an MBA student to an unforgettable experience—and a lifelong mentor

Even in an age of social media, I have faith in human outreach.

Still, I can only say that something came over me in spirit when, one day, I tweeted to one of my heroes, Lisa P. Jackson, Apple's vice president of environment, policy and social initiatives.

I wrote that someday I would love to shadow her at work, never anticipating a reply.

But she gave me even more: an invitation to come visit.

We talked on the phone, and she flew me out to Apple headquarters in California. We spent the day together, meeting and strategizing with other senior VPs and even Apple's CEO, Tim Cook.

We still keep in touch.

In fact, Lisa's ongoing mentorship helps me pursue our shared passion: promoting environmental stewardship while generating economic growth.

This area has been a cornerstone of my studies at the Weatherhead School of Management and my decade-long career as an advocate for public green spaces and infrastructure.

Now I strive for something more, too: to help future leaders the way Lisa has helped me—a stranger on the other end of a tweet, with hopes and dreams all her own.

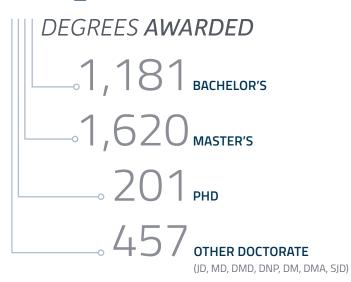
Shanelle Smith,

a full-time MBA student and state director of the Trust for Public Land, a national nonprofit land conservation organization

### **DEGREES + CAMPUS STATISTICS**

JULY 1, 2017 - JUNE 30, 2018

## 3,459



### ENROLLMENT (Fall 2018)

5,262 UNDERGRADUATE

6,629 GRADUATE + PROFESSIONAL

50 STATES REPRESENTED

91 COUNTRIES REPRESENTED

#### **DEGREES BY SCHOOL** (Undergraduate and Graduate)

Case School of Engineering	700
College of Arts and Sciences	665
Frances Payne Bolton School of Nursing	241
Jack, Joseph and Morton Mandel School of Applied Social Sciences	285
School of Dental Medicine	89
School of Law	227
School of Medicine	643
Weatherhead School of Management	609

### **CAMPUS**

3,615 FACULTY (full-time)

3,173 STAFF (full-time and part-time

### RESEARCH + TECHNOLOGY HIGHLIGHTS

### COMPETITIVE SPONSORED RESEARCH PROJECTS\*

Projects Awarded		Awarded, in Millions**
374 —	National Institutes of Health	\$192.2
29	Department of Defense	\$23.0
41	National Science Foundation	<b>\$9.8</b>
11	Department of Energy	<b>\$3.4</b>
10	NASA	<b>\$1.2</b>
92	Other Federal —	<b> \$15.7</b>
149	Industry —	<b>\$14.4</b>
563 ———	— Nonprofit, Foundations, Associations, Societies	
45	Other Government	\$10.2
1,314	Total	\$334.2

#### TECHNOLOGY TRANSFER

New Intellectual Property Deals with Industry

New Inventions

New Inventions

Licensing Revenue.

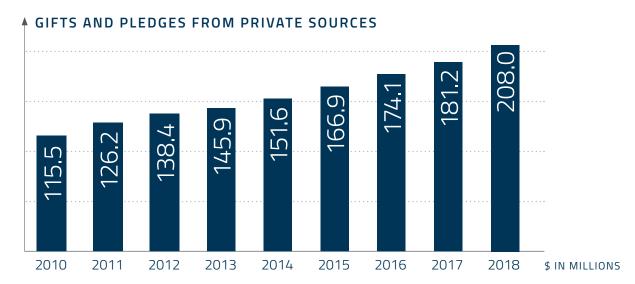
2017-2018 | CASE.EDU/**POINTOFVIEW** 

\* Does not include awards to Case Western Reserve faculty at Cleveland Clinic Lerner College of Medicine.

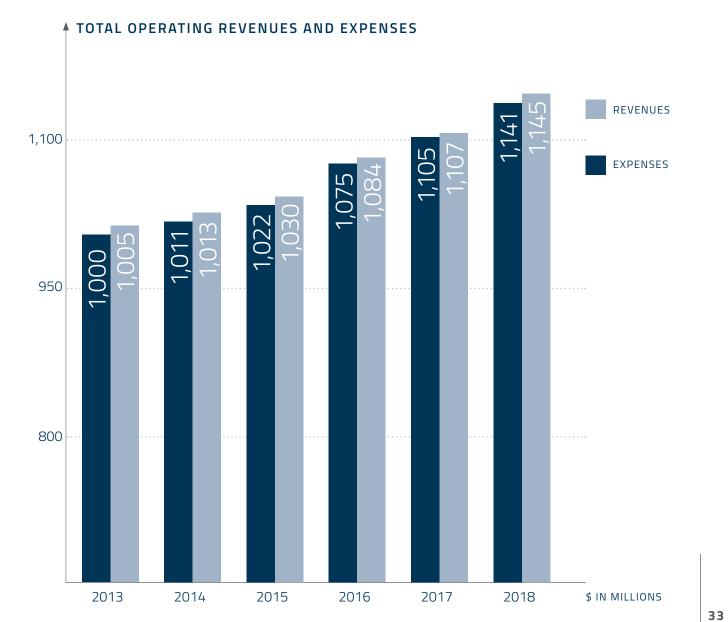
\*\* Numbers have been rounded.

### FINANCIAL **HIGHLIGHTS**

JULY 1, 2017 - JUNE 30, 2018







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Vice President, Marketing and Communications, and Senior Advisor to the President

Nord Hall, a main building of the Case School of Engineering, serves as a hub of activity for students of all majors.



