BORN ANYWHERE

NYU TANDON

MADE IN BROOKLYN

2018–2019

Meet NYU Tandon's

SIX CAREER AWARD WINNERS

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Online at NYU Tandon

BRIDGES TO THE FUTURE

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At NYU Tandon...

We focus on fields in vital research areas, particularly at the intersections between them in AI, cybersecurity, communications and information technology, data science, emerging media, health, robotics, sustainability, and all things urban. Building upon a rich history in which opportunity and diversity are keys to success, NYU Tandon proves you can be born anywhere but made right here in Brooklyn

#NYUTandonMade

Greetings from Brooklyn

Over the course of the past year (my first as dean), I have been inspired to watch the accomplishments of my colleagues, see the achievements of our students, embrace the diversity and culture of our campus, and reap the benefits of working and living in the greatest city in the world.

NYU Tandon is already a demonstrated leader in fields as diverse as cybersecurity, wireless communications, and chemical and biomolecular engineering. Now we are redoubling our efforts on new, increasingly vital areas of inquiry through faculty appointments and exciting research. We are creating an academic environment that fosters possibilities at the nexus of fields such as AI, data science, emerging media, health, robotics, sustainability, and all things urban *(see pages 4-5)*, in the greatest living urban lab in the world.

I arrived just a year ago knowing that although our faculty and students come from every corner of the world, it was our collective goal to help them become the engineers and innovators they were always meant to be right here in Brooklyn. We call that NYU Tandon Made, and it requires equal parts determination, street smarts, innovation, and entrepreneurship — as well as a healthy measure of heart. The Tandon Made ethos encompasses the history of two strong institutions: Brooklyn Poly and New York University. We're the perfect union of a university in and of the city and an engineering school proud to graduate the father of the phrase "American Dream" — a foundational idea and polestar for people born anywhere looking to make it in Brooklyn.

I am proud that NYU Tandon has made the impressive leap from 80 to 40 in just a decade in the *U.S. News* rankings *(see page 23)*, and I am honored that six of my young colleagues have received 2019 NSF Career Awards, resulting in close to 50% of our current faculty having received a CAREER *(see pages 14-17)* or other young investigator award. I feel great joy when I reflect that many of our students spent their summer engaged with local New York City middle and high school students and teachers, spreading their knowledge and love of STEM through our *#STEMnow* initiative; that NYU WIRELESS, our world-renowned research center, continues to influence the way that we process and share information today and tomorrow; and that a cohort of faculty is working to protect every one of us from the protean threat of cyber fraud.

We are busy at Tandon, and we wouldn't have it any other way; our focus and drive has allowed us to create 10 academic research centers *(see page 22)* devoted to areas of world-changing importance and attract the largest cohort of women students in our history. I like to think we're just getting started. We operate like a startup but with a long and storied history.

I hope you enjoy this brief summary of our past year here at NYU Tandon and hope you can visit us in Brooklyn in the coming year!

Dean Jelena Kovačević
NYU Tandon School of Engineering

DID YOU KNOW?

Jelena Kovačević is the first woman dean since the school's founding in 1854.

Our Areas of Research Excellence

NYU Tandon is engineering creative and smart, connected and secure, sustainable and healthy urban communities. We're doing so by focusing on fields in vital research areas and the intersections between them. That focus allows us to build upon our rich history, chart a path to a better future for the entire planet, and prove you can be born anywhere but made right here in Brooklyn.

Cybersecurity

From improving the transparency of online political advertising and combating the sale of counterfeit goods on the Internet to making sure that the software used in automobiles is impervious to hacking and that the computer-chip supply chain is free of piracy, NYU Tandon cybersecurity experts are working on it. With every aspect of our lives now affected by online systems, they're finding the keys to keeping personal data private, power grids impregnable, national defense infrastructure safe from malefactors, and much more.

Emerging Media

NYU Tandon's Integrated and Digital Media program is a STEAM engine, driving creative practice, experimentation, media design, and engineering. Our projects include using motion capture technology to reimagine theatrical performance; harnessing AR/VR to radically change the way people engage with information, entertainment, the environment, and one another; creating citizen science tools to empower New York City residents; and helping NASA develop next-generation user interfaces for space exploration. We are constantly modifying industry-standard technologies and creating new ones, and we're doing it across multiple sectors including media and entertainment, health, training and education, tourism, commerce and retail, engineering and design, architecture and construction, and civic technology and smart cities.

DID YOU KNOW?

In the last 5 years, we increased research expenditures by 100%. Our goal for the next 5 years is another 50%.

Data Science/ AI/Robotics

At NYU Tandon, we're making enormous inroads in the growing fields of AI and robotics, creating drones controlled with a simple gaze, making it easier for surgeons to perform delicate operations, developing algorithms that make financial investing more secure, and other such improvements.

Our AI experts and roboticists are working in concert with our data scientists, who are discovering new ways to analyze, visualize, and use the 2.5 quintillion bytes of data the world generates each and every day in the form of GPS signals, shopping transactions, taxi rides, social media posts, online videos, and digital photos, among other sources.

It's a collaborative ecosystem with a single goal: to harness the collective power of data, machine learning techniques, and autonomous systems to address the issues facing the world.

Communications/IT

It isn't hyperbole to suggest that everyday reality might soon include airborne drones using computer vision and cloud-based AI to identify and avoid obstacles, ultra-fast communications between smart vehicles to avoid collisions, teams of robots "talking" to each other to perform complex tasks, physicians doing surgery remotely and wirelessly, and AR/VR experiences delivered to your mobile screens and smart glasses. NYU Tandon research is making these and other revolutionary advances in telecommunications happen.

Sustainability

The world is facing serious challenges due to global warming and other environmental threats; with sea levels rising and natural habitats being destroyed, scientists must find ways to meet the needs of the Earth's current inhabitants without compromising the well-being of future generations. NYU Tandon researchers are addressing the complex issues involved — exploring renewable fuel sources, helping reduce carbon emissions, making our power grids more efficient, and finding innovative ways of keeping the world's ecosystems in balance.

Health

Tandon researchers work at the intersection of engineering, healthcare, and the life sciences to discover powerful new treatments and medical devices, develop methods to deliver care to underserved communities, create assistive technology to increase accessibility and livability for all, and find ways to make the world's population a healthier one. From engineering proteins to treat disease to creating nano-scale "labs-on-a-chip" and biosensors, we're partnering with clinicians to save lives and open up new frontiers in healthcare.

Prof. Luke DuBois co-leads the SONYC (Sounds of New York CIty) program.

Urban

With more than half of the world's population now residing in urban areas and that figure expected to rise to more than 70% by mid-century, NYU Tandon is innovating ways to make the cities of the future smart and resilient. Whether it's designing earthquake-resistant buildings, advancing autonomous vehicles to revolutionize commuting, developing cutting-edge processes to disinfect wastewater, using virtual and augmented reality to create human-friendly spaces, maximizing the efficiency and safety of the construction industry, or myriad other vital components of urban environments, NYU Tandon researchers have the entirety of New York City as a living lab.

Putting our students first

At NYU Tandon, our students work right alongside our faculty members, conducting their own important research, founding companies, taking on leadership roles in national organizations, and encouraging others to follow in their footsteps. From the time they enter our doors, they're making major strides on their paths to becoming the engineers, innovators, makers, and doers the world needs.

Recent graduate Marcus Chung, founder of NYU Motorsports, is interviewed at the 2019 NYU Commencement in the vehicle the student team built.

The dentist will see you now

There are an estimated 950,000 people in New York City with some form of disability, and an enormous number of them face steep barriers to getting adequate dental care: those with autism spectrum disorders or sensory issues, for example, can find the harsh lighting and cacophony of sounds in a conventional office disturbing. NYU's recently opened Oral Health Center for People with Disabilities (OHCPD) was designed to provide state-of-the-art dental services with dignity, respect, and patient comfort foremost in mind, and thanks to Tandon's **Integrated Digital Media (IDM) students**, it also features an innovative waiting room, designed specifically to calm anxious patients, especially those on the autism spectrum. Among their creations are an enclosed "egg" chair, which cocoons nervous patients and bathes them in lights that gently change color; color-changing "cloud" light fixtures; and a projection wall that provides visual stimulus.

It's magnetic

A paper by **Arun Parthasarathy**, a doctoral student in Tandon's Department of Electrical and Computer Engineering, recently made the cover of the *Journal of Applied Physics*. In his peer-reviewed piece he details a method of modeling thermal effects in magnetization dynamics — important because silicon-based complementary metal oxide semiconductor (CMOS) technology, which has thus far experienced incredible exponential growth, is approaching its fundamental limits, and finding other building blocks for computing is vital.

The journal also recently published a second paper by Parthasarathy in which he analyzes the speed and energy limits of the spatial mechanisms governing electrically controlled domain switching in antiferromagnetic insulators and provides valuable insight into their performance. While the average computer user may not grasp the physics involved in his work, everyone benefits from increasingly more efficient and cost-effective methods of computing.

DID YOU KNOW?

NYU Tandon has the only nanotechnology cleanroom in Brooklyn.

See you at CSAW

CSAW, among the world's largest student-led cybersecurity competitions and held every November at NYU Tandon and in six global hubs, including France, Israel, India, and Canada, features a wide range of events including competitions in areas that only recently became part of the threat landscape.

Detoxing your grass and grapes

Doctoral candidate **Andrew Olsen** is a co-founder of Brooklyn Bioscience, a start-up company that is engineering proteins to remediate and detoxify organophosphates (OPs), which cannot easily be removed by conventional means.

Brooklyn Bioscience's work is of particular interest to cannabis farmers, because OPs, when vaporized and inhaled, are exponentially more toxic than when ingested by mouth, and with the domestic wine industry now worth more than $20 billion annually — and with enzymes already ubiquitous to the wine-making process — it also counts vintners among its early adopters. Tea farmers, as well, have expressed interest, since the prevalence of excessive OPs has negatively impacted the $46 billion global tea market in recent years, particularly in the highly lucrative green tea sector.

Olsen and his co-founders, who include Professor of Chemical and Biomolecular Engineering Jin Kim Montclare, recently won a $250,000 grant from the National Science Foundation's Partnership for Innovation program.

Robot swarms to Mars and beyond!

NASA's Mars Exploration rovers *Spirit* and *Opportunity* proved the vast capabilities of robots in hostile environments, including those far from Earth. But could there be a less costly, more efficient means of deploying robots to extraterrestrial realms that could also lower the risks involved with surface activities while eliminating the need for time-intensive human supervision from Earth? The answer could lie with multi-robotic systems using so-called "swarm intelligence," a form of artificial intelligence (AI) that focuses on the collective behavior of decentralized, self-organized systems. **Sai Prasanth Krishnamoorthy**, a doctoral student in mechanical and aerospace engineering, has found a route to swarm intelligence via blockchain-inspired ledgers that would allow teams of robots to divide and conquer, enabling them to perform such tasks as surface mapping on, say, Jupiter's moon Titan, which is nearly an hour away from Earth at light speed, making human intervention in real time impossible.

Greener chemical manufacturing

Daniela Blanco, a Ph.D. candidate and co-founder of a startup dedicated to greener chemical manufacturing processes, recently won the top prize in the Global Student Entrepreneur Awards (GSEA) Competition in Macau, China, besting dozens of fellow students from universities around the world.

Her company, Sunthetics, which she founded with Tandon alum Myriam Sbeiti ('18) and the help of NYU Tandon Professor of Chemical and Biomolecular Engineering Miguel Modestino, offers a way to make one of the most-often-used synthetic materials, nylon, in a clean, sustainable way: Sunthetics uses water, plant waste, and solar power to create a nylon intermediate that takes 50% less energy and smaller amounts of raw material, while producing less waste and removing 20% of carbon emissions.

Sunthetics has proven to be an entrepreneurial juggernaut; in addition to Blanco's GSEA prize, it took first place in the hotly contested University Startup World Cup.

Prof. Miguel Modestino and Ph.D. Candidate Daniela Blanco

DID YOU KNOW?

Women make up 46% of the Class of 2023.

This year the event added two brand-new challenges:

HackML
The HackML competition, the first of its kind, challenges teams both to design new, powerful backdoor attacks on machine learning systems and to develop novel defenses and detections.

Logic Locking Conquest
This National Science Foundation-funded competition centers on a revolutionary technique for protecting the Intellectual Property of integrated circuits from myriad security threats, such as reverse engineering, overbuilding, piracy, and hardware Trojan insertion.

Forward-thinking, problem-solving research

Our research doesn't just result in new technology; it results in a better world because we're focused on solving tomorrow's problems today. Whether we're pushing the boundaries of AI and robotics, using big data to better understand the challenges facing society, making mobile networks more powerful, keeping cyber-systems safer, exploring the possibilities of augmented and virtual reality, partnering with medical clinicians for a healthier populace, addressing vital issues of sustainability, or making an impact on all things urban, Tandon researchers are on it.

Prof. André Taylor with Tandon students at his lab

Keeping nanomagnetic computing cool

Logic and memory devices, such as the hard drives in computers, now use nanomagnetic mechanisms to store and manipulate information. Unlike silicon transistors, which have fundamental efficiency limitations, they require no energy to maintain their magnetic state: Energy is needed only for reading and writing information. One method of controlling magnetism uses electrical current that transports spin to write information, but this usually involves flowing charge. Because this generates heat and energy loss, the costs can be enormous, particularly in the case of large server farms or in applications like artificial intelligence, which require massive amounts of memory. Spin, however, can be transported without a charge with the use of a topological insulator — a material whose interior is insulating but that can support the flow of electrons on its surface.

In a recent *Physical Review Applied* paper, **Shaloo Rakheja**, an assistant professor of electrical and computer engineering, and her team introduce a voltage-controlled topological spin switch (vTOPSS) that requires only electric fields, rather than currents, to switch between two Boolean logic states, greatly reducing the heat generated and energy used.

There's a simple analogy to explain the impact of switching between two states more effectively: Imagine if you were preparing a recipe and had to go into a different room anytime you needed an ingredient before returning to the kitchen to add it. It's just as inefficient when the portions of computing hardware needed to do a calculation and the portions needed to store it are not well integrated.

DID YOU KNOW?

Alum Eugene Kleiner co-founded the company that produced the silicon transistors that gave Silicon Valley its name.

Prof. Maurizio Porfiri in his lab

Fishing for solutions to invasive species

Soaring mosquitofish populations have decimated native fish and amphibian populations, and attempts to control the species through toxicants or trapping often fail or cause harm to local wildlife. **Maurizio Porfiri**, a professor of mechanical and aerospace engineering at NYU Tandon, and his collaborators revealed insights that could lead to a novel solution: use robotic fish to make mosquitofish too stressed to reproduce.

No fooling!

Determining whether a photo or video is authentic is becoming increasingly problematic. Sophisticated techniques for making misleading alterations have become so accessible that so-called "deepfakes" — AI-manipulated photos or videos that are remarkably convincing and often include celebrities or political figures — have become commonplace.

Pawel Korus, a research assistant professor in the Department of Computer Science and Engineering, pioneered an approach that replaces the typical photo development pipeline with a neural network — one form of AI — that introduces carefully crafted artifacts directly into the image at the moment of image acquisition. These artifacts, akin to "digital watermarks," increase the chances of detecting manipulation from approximately 45% to over 90% without sacrificing image quality.

Shedding light on political advertising

A team led by Computer Science and Engineering Assistant Professor **Damon McCoy** and Ph.D. student **Laura Edelson** created easy-to-use tools to collect, archive, and analyze political advertising data — an increasingly important development as November 2020 approaches.

Although Facebook became the first major social media company to launch a searchable archive of political advertising, for both Facebook and Instagram, in 2018, it was difficult to use and required time-consuming manual searches. The team applied versions of the data scraping techniques McCoy had previously deployed against criminals such as human traffickers advertising on the more shadowy realms of the Internet.

The new tools give voters the ability to understand who is advertising, what they are pushing, who they are targeting, and how much is being spent to influence votes.

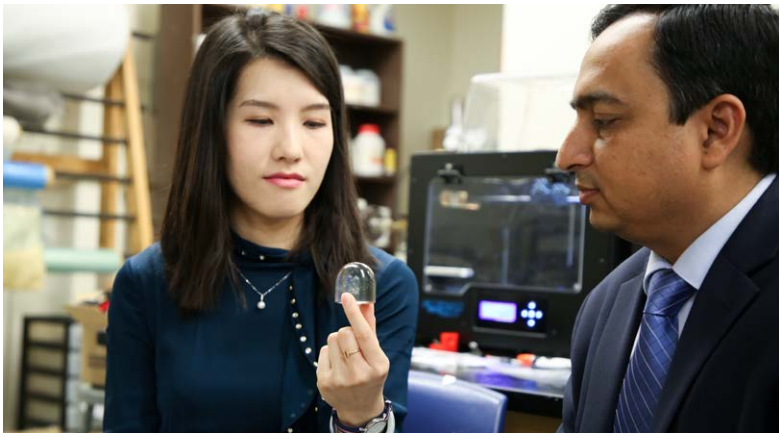
Porfiri led an interdisciplinary team at NYU Tandon and the University of Western Australia that demonstrated how robotic fish can be deployed against this species, which has spread from Spain to the rest of Europe.

In brief, the team has discovered that robotic fish predators can quickly stress invasive fish species to curb their reproduction. The research is published as the cover story in the Royal Society journal *Interface*.

Protecting printing from piracy

The worldwide market for 3D-printed parts is a $5 billion business with a global supply chain involving the Internet, email, and the cloud — creating a number of opportunities for counterfeiting and intellectual property theft. Flawed parts printed from stolen design files could produce dire results: experts predict that by 2021, 75% of new commercial and military aircraft will fly with 3D-printed components, and the use of 3D printing in the production of medical implants will grow by 20% per year over the next decade.

A team that includes **Nikhil Gupta**, a professor of mechanical engineering, and his doctoral student **Fei Chen** ('19) has found a way to prove the provenance of a part by employing QR (Quick Response) codes in an innovative way for unique device identification. Their method involves converting QR codes, bar codes, and other passive tags into three-dimensional features hidden in such a way that they neither compromise the part's integrity nor announce themselves to counterfeiters who have the means to reverse engineer the part.



Ph.D. student Fei Chen (L) and Prof. Nikhil Gupta (R)

Better solar cells

It's no wonder that the market for organic solar cells is expected to grow more than 20% between 2017 and 2020. These super-flexible cells can be mass produced, use renewable materials and green chemistry, and can be semitransparent and therefore less visually intrusive. But they are also highly vulnerable to moisture, oxygen, and sunlight itself. Researchers led by **André Taylor**, an associate professor in the Department of Chemical and Biomolecular Engineering, have discovered a remarkable means of making organic solar panels more robust, including conferring resistance to oxygen, water, and light, all by removing a layer of material instead of adding one, which is the traditional, more costly approach.

Our wide-ranging community

The borough we call home attracts some of the planet's most forward-thinking people and companies, and at NYU Tandon we're happy to partner with them to grow Brooklyn's Tech Triangle into an expansive Innovation Coastline. But to us, community means far more than just a specific geographic locale. We're a dynamic part of the city, the nation, and the world, and we believe that when we forge partnerships between academia, government, and private enterprise, great things happen.

The RLab has over 16,500 square feet of co-working labs, classrooms, studios, and more. © Kreg Holt Photography

A driven community

Cars and trucks are the stars at the New York International Auto Show, but — thanks to a first-ever tech talk event co-hosted by NYU Tandon and co-sponsored by C2SMART (Connected Cities with Smart Transportation), our Tier 1 University Transportation Center — bikes, scooters, autonomous car-sharing, and the future of smart-cities mobility shared the spotlight this year.

The inaugural event, which featured C2SMART professors **Joseph Chow** and **Kaan Ozbay**, went beyond traditional four-wheeled conveyances to explore apps, data streams from vehicles and other sources, and corollary technologies that, combined with self-driving vehicles, electrification infrastructure, and emerging social trends, promise to change how we commute and travel.

Joseph Chow (far right) moderated a panel on disruptive technologies that are redefining urban mobility at the New York International Auto Show. Photo credit: A.J. Sanon

A healthier community

As physicians strive to better diagnose conditions, predict disease progression, and formulate treatment plans, there are still many medical mysteries yet to be solved. Advances in imaging techniques and improvements in how those images can be visualized and interpreted are proving to be key, and Tandon is making contributions in that arena. Our faculty members work hand-in-hand with clinicians to apply research from their labs directly to patients. For one important example, look to Department of Electrical and Computer Engineering Chair **Ivan Selesnick**, an expert in digital signal processing. He and his colleagues are developing new algorithms to improve biomedical technologies like near magnetic resonance imaging (MRI), digital x-ray imaging, electrocardiography, and electroencephalography and are applying them to clinical projects with the potential to benefit the lives of countless patients.

A better-connected community

Our sixth annual Brooklyn 5G Summit came at a linchpin moment: The deployment of 5G networks is set to more than triple by the end of 2019, and researchers at **NYU WIRELESS**, a research center at the forefront of recent advancements in mobile communications, are now exploring the next frontier — the fundamental research and applications that will usher in 6G and the promise of data transmission speeds 1,000 times greater than 5G.

A more sustainable, robust community

This year Tandon helped create the Institute of Design and Construction (IDC) Innovation Hub, chaired by Professor of Urban and Civil Engineering **Michael Horodniceanu**, an internationally prominent transportation and construction executive who previously served as President of New York's MTA Capital Construction, America's largest transportation construction program. (Among the projects he oversaw in that capacity were the $12-billion East Side Access project, the $4.5 billion Second Avenue Subway, the $2.4 billion Number 7 Line Extension, and the $1.4 billion Fulton Street Transit Center.)

Now, Horodniceanu and the IDC, whose members include major industry leaders, are playing an instrumental role in creating vibrant and sustainable communities where people want to live and work — while grooming a new generation of engineers to take on emerging challenges facing the construction industry.

DID YOU KNOW?

We pledged to educate 500 New York Schools teachers and 50,000 students within a decade, and in 2019 we exceeded those goals — in half the time.

An immersive community

Last year NYU Tandon staked out territory in the Brooklyn Navy Yard, a hotspot on Brooklyn's Innovation Coastline, to accelerate its commitment to cultivating new research, startups, and talent in emerging media technologies. **RLab**, the nation's first city-funded center for research, entrepreneurship, and education in augmented and virtual reality, spatial computing, and related technologies, is at the heart of New York City's drive to be a global technology leader and create hundreds of new jobs.

Launched with the help of a $5.6 million investment by the New York City Economic Development Corporation and the Mayor's Office of Media and Entertainment, the RLab advances cutting-edge emerging media technologies and new business models, and offers myriad opportunities for faculty and students at NYU Tandon and participating universities including Columbia, The City University of New York, and The New School. Led by **Justin Hendrix**, adjunct professor of integrated digital media at NYU Tandon and executive director of the NYC Media Lab, the RLab is also home to the RLab Accelerator, a collaboration with investment firm Super Ventures.

A quieter community

The **Sounds of New York City** (SONYC) is a first-of-its-kind project addressing urban noise pollution, and its researchers have launched a citizen science initiative to train artificial intelligence (AI) technology to understand exactly which sounds are contributing to unhealthy levels of noise in New York City. SONYC—a National Science Foundation-funded collaboration based at NYU Tandon's **Center for Urban Science and Progress** (CUSP) — leverages big data and technology to more effectively monitor, analyze, and mitigate noise pollution.

The citizen science initiative, recently launched in the Zooniverse citizen science web portal, enlists the help of volunteers to identify and label individual sound sources — such as a jackhammer or an ice cream truck — in 10-second anonymized urban sound recordings transmitted from acoustic sensors positioned in high-noise environments in the city, and machine listening models are now learning to recognize these sounds on their own. The results will provide city enforcement officials with a more accurate picture of noise — and its causes — over time, and ultimately, the SONYC team aims to empower city agencies to implement strong, targeted data-driven noise mitigation interventions.

NYC teachers build sensors while they learn about the science of sounds as part of the SONYC program.

A safer community

NYU researchers have shown, for the first time, a causal link between print news media coverage of U.S. gun control policy in the wake of mass shooting events and increases in firearm acquisition, particularly in states with the least restrictive gun laws. The study, led by Professor **Maurizio Porfiri**, was rooted in a data science-driven approach that reveals causal relationships, rather than mere correlations. Featured on the cover of *Nature Human Behaviour*, it is the first-ever study to quantify the influence of news media stories on firearm prevalence and to empirically examine — and confirm — the link between news stories specifically about gun policy and increased acquisition of firearms.

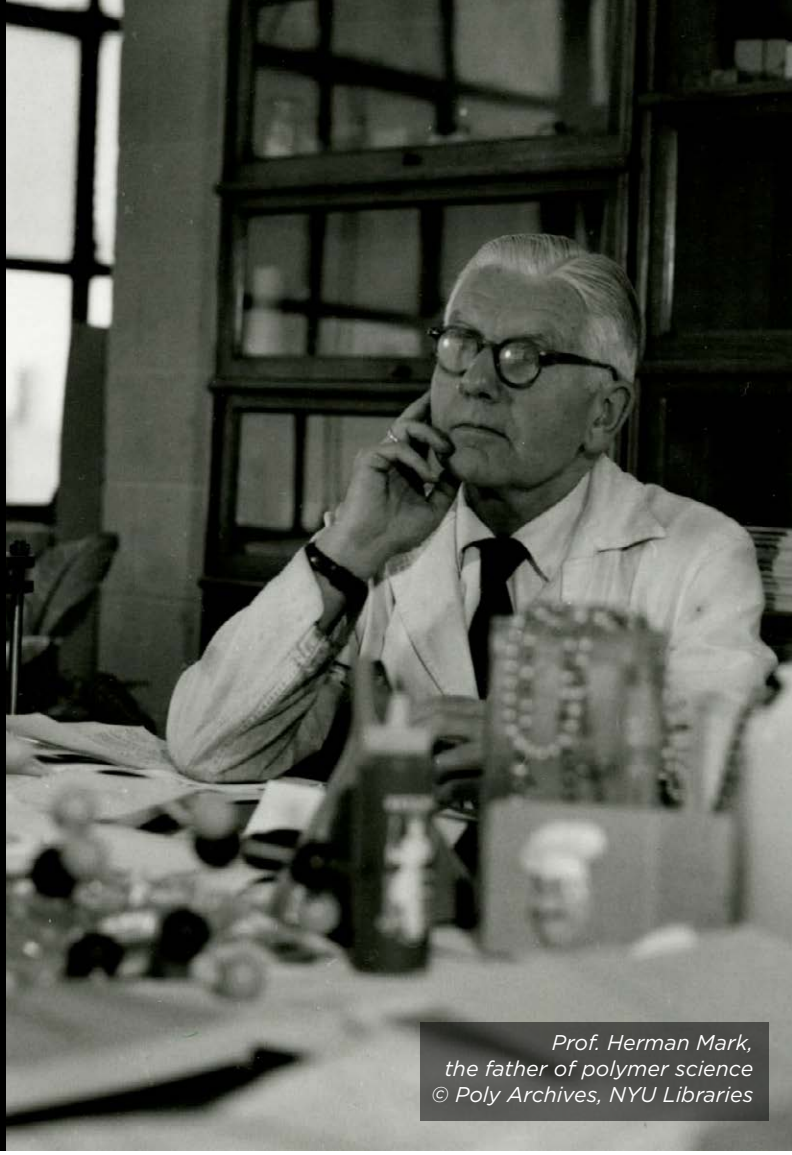
Our foundation

It's a new era at the NYU Tandon School of Engineering — one in which the school is being led by our first woman dean, attracting the most diverse group of students we've ever had, and positioning ourselves as a force in a host of highly cross-disciplinary fields like AI, robotics, and biomedical engineering.

We'll never lose sight, though, of our long and storied history, which stretches back to 1854 — the founding date for both the New York University School of Civil Engineering and Architecture and the Brooklyn Collegiate and Polytechnic Institute (widely known as Brooklyn Poly).

In 2014 an official merger between Poly and NYU was completed — an event that brought the discipline of engineering back to the university for the first time in 40 years — and the following year, thanks to a transformative gift by Chandrika and Ranjan Tandon, we became the NYU Tandon School of Engineering.

No matter what name we've gone by and what institutional changes have occurred, one thing has always remained the same: our promise to push the envelope of science and technology to solve the pressing problems facing the world.



Prof. Herman Mark, the father of polymer science
© Poly Archives, NYU Libraries

A legacy in wireless communications

NYU WIRELESS is well known for influencing policy and driving innovative research for 5G and beyond, but those not familiar with the history of the school might not realize that it has long been at the forefront of wireless (which refers to any communication that uses electromagnetic or acoustic waves as a medium, rather than a wire connection) and that decades before NYU WIRELESS was founded, another pioneering research center was bringing renown to the School of Engineering. Our highly regarded **Microwave Research Institute** had its genesis during the early days of World War II, when Professor **Ernst Weber** organized a research group to develop, among other things, the precision microwave attenuator, sorely needed for the accurate calibration of radar systems used by the military. Launched in 1946, it ultimately grew into the country's foremost center of electronic research, and even long after the war, its researchers were breaking new ground in electromagnetic theory and other related fields.

DID YOU KNOW?

NYU WIRELESS created one of the first free and open test-beds for the mmWave radio spectrum, a key to 5G telecommunications.

The epicenter of polymer science

Professor **Herman Mark**'s influential research made possible such useful fibers as Kevlar and polyester. Soon after joining our faculty in 1942, Mark founded the **Polymer Research Institute** (PRI), which drew students and postdoctoral fellows from around the globe. (In addition to creating the Institute, Mark also founded the first American polymer journal, the *Journal of Polymer Science*, in 1946.)

When private companies or other universities launched their own polymer centers or programs in later years, chances were good that a scientist who had been affiliated with the PRI — which was designated as a National Historic Chemical Landmark in 2003 by the American Chemical Society — was involved.

Mark's legacy remains strong at Tandon, with the recent creation of the Biomedical Engineering Department and work across our campus by faculty and students, who are modifying proteins to fight cancer, developing innovative new biomaterials, finding ways to manufacture synthetics without fossil fuels, making possible efficient new sources of sustainable energy, and much more.

DID YOU KNOW?

In 1879 alum Robert G. Brown (1868) revolutionized communication by combining the receiver and mouthpiece of the phone, moving away from the crank generator and candlestick models then in use.

A dream to live by

Our institution has long been home to the American Dream — and our alum James Truslow Adams created that phrase back in 1931:

"that dream of a land in which life should be better and richer and fuller for everyone, with opportunity for each according to ability or achievement... a dream of social order in which each man and each woman shall be able to attain to the fullest stature of which they are innately capable, and be recognized by others for what they are, regardless of the fortuitous circumstances of birth or position."

We have long been committed to ensuring that aspiring engineers and technologists of all cultures, ethnicities, genders, and socioeconomic levels have a chance to bring their own dreams to fruition, whether that means providing a pathway to the middle class and beyond for less economically advantaged students, working with New York City's K-12 school children to introduce them to the possibilities of higher education, or researching ways to bridge the digital divide.

DID YOU KNOW?

In 1911 Charles R. Flint (1868) formed the Computing-Tabulating-Recording Company, which was later renamed IBM.

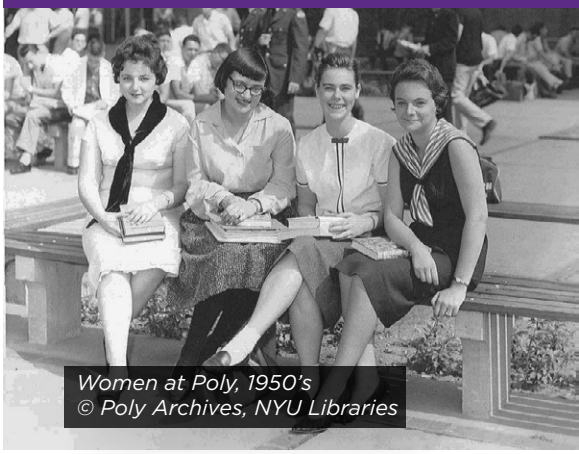
Women at our school

In 1907 the first woman, Anna Erdmann, received a bachelor's degree from Poly.

In 1984 Eleanor Baum ('64) became the first female dean of an engineering school in the United States, at Pratt Institute in Brooklyn, and she later was elected as the first woman president of the American Society for Engineering Education (ASEE).

In 2009, when she was appointed CEO of Xerox, Ursula Burns ('80) became the first African-American woman ever to head a Fortune 500 company.

Women constitute 46% of the NYU Tandon Class of 2023, roughly double the average for U.S. engineering schools.



Women at Poly, 1950's
© Poly Archives, NYU Libraries

DID YOU KNOW?

Pfizer's process for the mass production of penicillin was developed by alum Jasper Kane.

Six CAREER Awards

This year alone, six young principal investigators from NYU Tandon garnered prestigious National Science Foundation (NSF) CAREER Awards, given in support of early-career faculty members who demonstrated potential to serve as academic role models and to lead advances in the mission of their department or organization. That's an especially noteworthy feat considering that the school's engineering faculty has just 87 members. Now, fully 50% of our faculty members are winners of CAREER or other young-investigator honors.

Rumi Chunara

Assistant Professor of Computer Science and Engineering

If you've ever worn a FitBit or other such tracker, you know how valuable the information it generates can be for evaluating your personal progress. New data sources like this offer unprecedented potential to study lifestyle, environmental, and social factors that can improve our understanding of well-being and health. Proactive use of such data could dramatically change the healthcare paradigm in this country and significantly reduce costs and illnesses, more so than a solely reactive focus on disease diagnosis and treatment. However, inconsistencies between how people use these tools, when people use them, and who uses them, challenge public health researchers' abilities to make inferences, draw comparisons, and evaluate change.

The NSF has honored Rumi Chunara, an assistant professor of Biostatistics at NYU's College of Global Public Health in addition to her post at Tandon, for her work with person-generated data (PGD) from Internet and mobile data sources such as social media sites and wearables. This award builds on her existing work, which demonstrates how information from these tools opens a window into how people respond to local crises, such as epidemics, as well as provides low-cost views into other health risk factors and outcomes — enabling precise and focused interventions. By addressing inconsistencies of how, when, and by whom the data is generated, her project will improve the validity and reliability of measures extracted from PGD and enable improved understanding of high-granularity health risks and outcomes for augmenting public health research and practice.

Yury Dvorkin

Assistant Professor of Electrical and Computer Engineering

Thanks to recent advances in smart grid technologies, the U.S. power system is undergoing much-needed nationwide modernization, and that turn of events is giving consumers a high level of autonomy, freeing them from their utility companies and allowing them the freedom to choose an alternative supplier or deploy their own solar panels and energy storage units. This customer-driven exodus toward what are called distributed-energy resources (DER) reduces the utility companies' revenue streams and undermines their financial viability. In response, utilities in many regions are increasing electricity tariffs, pushing even more consumers to defect to other options — a death spiral for major utilities. This spiral scares a vast majority of power executives who anticipate a complete transformation of their business model by 2030.

Yury Dvorkin aims to fundamentally rethink and re-engineer the current U.S. power grid to accommodate a high penetration level of DERs, while improving the overall reliability, resiliency, and energy efficiency of the power sector. He is designing a peer-to-peer platform that will manage customer-end DERs using the utility's own network infrastructure and control policies. Coupled with a system to calculate appropriate network usage charges, it would be a winning situation for both electricity consumers and utility companies, made possible by Dvorkin's expertise and the NSF's generous support.

DID YOU KNOW?

NYU Tandon has a robust CAREER Awards mentorship program that thoroughly prepares our young faculty.

Damon McCoy

Assistant Professor of Computer Science and Engineering

Cryptocurrencies such as Bitcoin offer the promise of increased efficiency in the financial system along with decreased fees and costs for processes like making international money transfers and raising investment capital. Unfortunately, they are also misused as a way of facilitating a rogue's gallery of illegal activities, including extortion, drug dealing, human trafficking, and cybercrime. Improved forensic tools could go a long way toward identifying wrongdoers and capturing valuable information about nefarious transactions, but much of the research into advanced cryptocurrency forensic techniques is performed by companies and integrated into their own closed platforms. As a result, law enforcement officials, non-profit organizations, and the general public are left largely in the dark, with little knowledge of how to detect, understand, and guard against the illicit activities occurring within these shadowy cryptocurrency ecosystems.

Damon McCoy has embarked on a research project that uniquely blends improvements to data collection and archiving with advanced machine learning-based algorithms in order to devise a set of open and improved tools that can be used on a broad range of cryptocurrencies, making both the online world and the physical world much safer places.

Andrea Silverman

Assistant Professor of Civil and Urban Engineering

First came word that Andrea Silverman and her colleagues had garnered a grant from the Marron Institute of Urban Management for their study on the impact of flooding on the urban microbiome (as scientists call the community of micro-organisms living together in a particular habitat) and city residents' exposure to sewage pathogens (which can include disease-causing bacteria and viruses). Following close on the heels of that good news came her CAREER Award, given for her study of the degradation of antibiotic resistance genes in the environment when exposed to sunlight.

Antibiotic resistant bacteria constitute a global public health crisis. What's more, the genes within them that confer resistance have been found to pass through wastewater treatment facilities and enter environmental waters unscathed, heightening the concern that the environment is a transmission route for antibiotic-resistant bacteria. The goal of Silverman's research is to evaluate the persistence and decay of antibiotic resistance genes in the environment, to help fill critical gaps in our understanding of the role of the environment in the risk of disease transmission. This work builds upon her previous research investigating disinfection processes in natural wastewater treatment systems, such as manmade treatment ponds and wetlands designed specifically to treat sewage.

Silverman, who holds a joint appointment with NYU's College of Global Public Health, has explained that engineers who design water and wastewater treatment systems need to understand the genesis and behavior of waterborne microbial and chemical contaminants that present public health risks, and how those characteristics affect treatment efficiency.

"Similarly," she added, "public health professionals who focus on water-related illnesses should have a good understanding of the benefits and limitations of technologies used to treat water and assure its safety." With the support of organizations like the NSF and the Marron Institute, she is successfully straddling both of those worlds.

DID YOU KNOW?

Andrea Silverman is also a mentor for ARISE, a #STEMnow program that includes training in presentation and public speaking skills for high school students.

Julia Stoyanovich

Assistant Professor of Computer Science and Engineering

Graphs are used to represent a plethora of complex phenomena, including the Web, social networks, biological pathways, transportation networks, and semantic knowledge bases. Many interesting and important questions about graphs concern their evolution: Which Web pages are becoming increasingly popular? How does influence propagate in social networks? How do the utilization of transportation options and the cost of ridership in a city change during the day and throughout the week?

Formulating these questions as software is currently beyond the skills of most data scientists, and executing those programs poses tremendous efficiency challenges, especially for graphs with billions of edges or significant evolution rates.

Julia Stoyanovich, who has a joint appointment with NYU's Center for Data Science, is focused on the querying and analysis of evolving graphs — functionality that she explains is urgently needed. The initial results of her work are available in an open-source platform called Portal at portaldb.github.io. A prominent set of use cases for her work will come from data science for social good applications, including urban homelessness and analysis of transportation utilization and cost in cities — areas that have long been important to Stoyanovich, who was appointed by Mayor Bill de Blasio to New York City's first-ever Automated Decision Systems Task Force.

Quanyan Zhu

Assistant Professor of Electrical and Computer Engineering

Cyber-physical systems (CPS) can be exceedingly complex, with multiple layers of interacting components. Because the layers can be tightly integrated and highly interdependent, traditional analytic tools are insufficient to cope with their full complexity. That spells bad news for those defending these systems against cyberwarfare.

Quanyan Zhu explains that it is essential to develop a multi-disciplinary approach to working with CPS — which include smart grid utilities, medical monitoring devices, and autopilot avionics, among other vital systems. Such systems are particularly vulnerable to hacking by malefactors seeking to harm our infrastructure.

He points to the infamous Stuxnet attack, which caused billion-dollar losses, as something of a poster child for how failure of a component at one layer can lead to the failure of another layer. An attack could start with social engineering (targeting human vulnerabilties) to gather information and obtain unauthorized credentials before exploiting the cyber system and, ultimately, damaging the physical components. That type of advanced persistent threat highlights the fact that perfect security is not always possible, making it imperative that a system be as resilient as possible in the wake of an attack. Using electric power systems and cloud-enabled autonomous systems as his case studies, Zhu aims to establish an integrated game-theoretic framework to engineer resilient, high-confidence CPS.

DID YOU KNOW?

NYU Tandon faculty members also hold young investigator awards from DARPA, the U.S. Air Force, and General Motors, among other organizations.

Our new faculty

With several new faculty members now in Brooklyn, NYU Tandon is becoming a more dynamic and diverse place than ever. They hail from all over the world, have a wide variety of research interests, and are finding the answers to some of the most fascinating questions in the world. How can we develop more power-efficient computer architecture? What kind of digital art results by crossing Hieronymus Bosch paintings with emojis? Is it possible to model the cognitive changes that occur with aging so that clinicians can mitigate them? How do design decisions impact not just how an interface looks, but how it functions and guides our behavior? NYU Tandon students are finding out for themselves, thanks to these and other new additions to our academic community. Read about them at **engineering.nyu.edu/new-faculty-2019**.

Victòria Alsina Burgués

Industry Assistant Professor
and Academic Director
Center for Urban Science and Progress

Ahmed Ansari

Industry Assistant Professor
Dept. of Technology, Culture,
and Society (Integrated Digital Media)

S. Farokh Atashzar

Assistant Professor
Dept. of Electrical and Computer
Engineering and Dept. of Mechanical
and Aerospace Engineering

Peter DePasquale

Industry Associate Professor
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Vikram Duvvuri

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Dept. of Applied Physics

Kadija Ferryman

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Donghong Sun

Industry Associate Professor
Dept. of Chemical and
Biomolecular Engineering

Bridges to the future

At NYU Tandon we are constantly working to create a better learning environment, whether it's inside the classroom, in the lab, through interactive learning spaces like our MakerSpace, or during internships with partners across the country that offer experiential learning opportunities to allow for post-graduation experience. In addition, NYU Tandon has an award-winning online learning platform. It's no surprise that online education is booming. It's a convenient, flexible, and affordable way for students to earn their degrees, and for several years running NYU Tandon Online programs have been recognized as among the best in the world by *U.S. News and World Report* and other outlets.

Bridge to Tandon

Cybersecurity may be the hot spot, but nearly every area of computer science offers attractive salaries and more empty seats than people with the skills to fill them. People with expertise in game design, artificial neural networks and machine vision, robotics, and predictive modeling are in high demand. Until recently, however, people without the right undergraduate degrees were locked out. The Bridge to Tandon opens the door: In as little as one semester, this intensive online program gives highly motivated students with a bachelor's degree in non-computer science fields the skills and tools to enter a rigorous master's program.

With tuition costs of just $1,500 for the entire program, students choose between a 24-week course (20-30 hours per week) or an accelerated 17-week version (30-40 hours per week); at the conclusion, those who finish with a grade of B+ or better and meet all other NYU Tandon admission requirements can be admitted to a qualifying master's program in fields like bioinformatics, cybersecurity, or computer engineering.

Nasir Memon, a professor of computer science and engineering and head of NYU Online, says he conceived the idea for the Bridge to Tandon program to help people transition into rewarding careers or refresh their knowledge. "Computer technology touches almost every arena one can think of today — from transportation, education, and medicine to entertainment, business, and public policy," he points out.

DID YOU KNOW?

Two-thirds of all Bridge alumni come from non-STEM backgrounds.

Cyber Fellows

Cybersecurity is a cat-and-mouse game where, according to security firm Symantec, the proverbial mice deployed some 317 million new pieces of malware last year alone, an average of a million new threats each day. If the mouse always seems to be a step ahead, it's partly because institutions and businesses are short on cybersecurity experts to the tune of some 200,000 unfilled cybersecurity jobs nationwide, a number that, by some estimates, will reach 1.8 million worldwide by 2022.

NYU Tandon's Cyber Fellows program, a partnership with New York City Cyber Command (NYC3) and elite business partners like Blackstone, Goldman Sachs, and IBM, is a fast-track solution to this challenge. It draws highly motivated students — many already in the workforce — attracted to the program by its affordability, flexibility, and opportunities to gain top-shelf experience beyond the laptop screen. A prime example is a hands-on virtual lab called the NYC Cyber Range, a cutting-edge training platform developed by NYC3 for its own defensive front line and available to Cyber Fellows.

An exemplar of how NYU Tandon is hacking higher ed, Cyber Fellows offers immersive academic environments, industry collaborations, industry-reviewed curriculum, exclusive speaker events, peer mentorship, and nationwide internships that supercharge the learning experience and put students into the lucrative STEM workforce faster.

An added bonus: Cyber Fellows grads get access to updated course materials for five years — a critical benefit because the threat landscape shifts rapidly and attackers constantly develop more sophisticated tactics.

New York City has taken notice, crediting Cyber Fellows for being a key resource in its plan to add some 10,000 cybersecurity experts to the local workforce within a decade. Geoff Brown, New York City Chief Information Security Officer and Head of NYC3, says, "We're proud to support a program that opens up a career in cyber defense to more students, allowing the next generation of cyber professionals to better resemble the diversity of the society they will be charged to protect."

"The Bridge Program provided me the opportunity to learn the fundamentals that are required for graduate study in the field, even though my undergraduate degree is in Psychology. Over the course of the program, I improved my knowledge of C++ and learned important concepts in Data Structures, Computer Architecture and Operating Systems. The small class size and supportive, excellent professors made the Bridge Program a very rewarding experience for me."

— Meredith Mante, Bridge student participant

"This is exactly the kind of program New York needs to attract companies in this fast-growing sector, and to help New Yorkers compete for those good jobs."

— New York City Mayor on Cyber Fellows

Our top employers

Accenture
AIG
Amazon
American Express
Apple
Arup
Bank of America
Bloomberg
BMW
BNY Mellon
Boeing
Capital One
Citibank
Con Edison
Credit Suisse
Datadog
Deloitte
Exxon Mobil
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General Electric
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Samsung
Scholastic
Siemens
Sikorsky
Shell
SpaceX
Tesla
Toyota
Turner
United Technologies
Viagogo
WeWork
WSP Global

Our Centers and Institutes

AINOW

C A T T CENTER FOR ADVANCED TECHNOLOGY IN TELECOMMUNICATIONS

Center for Urban Science + Progress

C2SMART CONNECTED CITIES WITH SMART TRANSPORTATION

GOVLAB

Institute for Invention, Innovation, and Entrepreneurship at Tandon

INTERCEP INTERNATIONAL CENTER FOR ENTERPRISE PREPAREDNESS

CENTER FOR CYBER SECURITY

NYU WIRELESS

VIDA VISUALIZATION IMAGING AND DATA ANALYSIS CENTER

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(TANDON '92, STERN '98)
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Founder and Managing Member
Libra Advisors and Tandon Family Office

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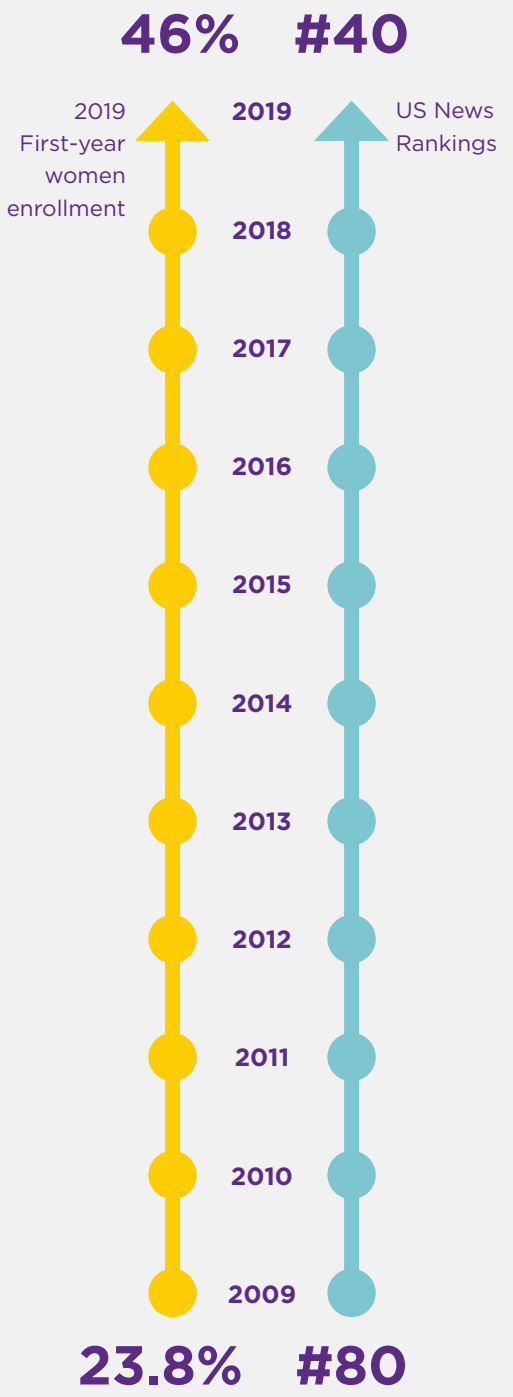
We're moving up



At NYU Tandon we're actively fostering the success of our women students — providing strong mentorship from accomplished woman faculty members and offering a wide range of programs and activities aimed at establishing a supportive and inclusive environment. People are taking notice; the percentage of women students in our incoming classes has been steadily increasing, and we're well on our way to achieving a gender balance representative of the general population.

NYU | TANDON SCHOOL OF ENGINEERING

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