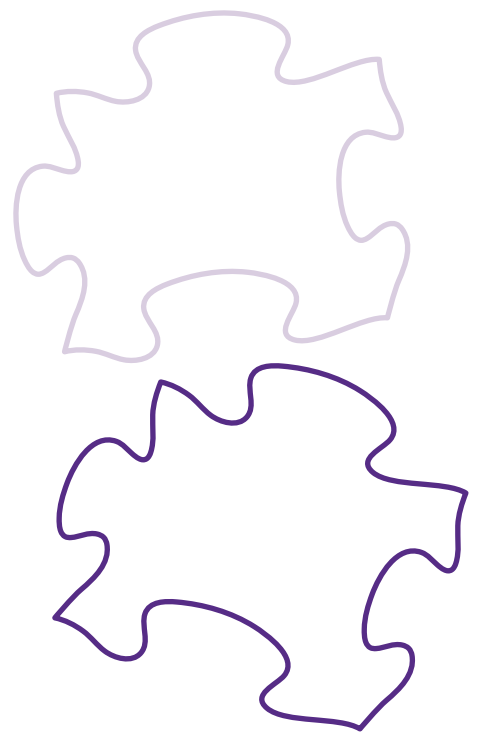# In the last decade, **NYU Tandon** moved up **39 spots** in USNews

Since 2008, NYU Tandon has moved from #80 to #41 in the U.S. News & World Report Rankings.

See how we are putting the puzzle together.

Dear friends,

Since arriving at the NYU Tandon School of Engineering, I have been like a kid in a candy store – delighted to meet many of our amazing students, faculty, staff, alums, and board members and to discover the many impressive programs and initiatives that are taking place here. Over the last several years, Tandon has made huge strides – marked by significant research advances in our labs and centers, stellar academic achievement, and increased gender diversity in our student body and faculty (with an impressive *43 percent of the Class of 2022 made up of women*). I look forward to building on that momentum and showing the world that you can be born anywhere and make it right here in Brooklyn.

Many of those strides have been the result of collaborative effort; indeed, I have found that entrepreneurial thinking and multidisciplinary collaboration and research are among the hallmarks of NYU Tandon. If a school can be likened to a jigsaw puzzle, each member of the Tandon community has helped *put the pieces together*, the theme of this publication. I am looking forward to working with the entire Tandon community on creating an even more impressive puzzle.

I have no doubt we will be successful in that endeavor. As some of you already know, I have come to NYU Tandon from a post at Carnegie Mellon, a university widely recognized for its world-class, interdisciplinary programs and engineering excellence. I see in Tandon an institution with similarly stellar qualities, as well as unlimited potential and an unquenchable drive to grow and evolve.

 Erno Rubik, creator of the eponymous cube, once reportedly said, "If you are curious, you'll find the puzzles around you. If you are determined, you will solve them." As a true mathematician I will express what I learned about Tandon through an equation:

$$\text{Tandon community} = \text{exceedingly curious} + \text{exceptionally determined}$$

Whether our faculty and students are solving the puzzle of providing wireless service to underserved communities, creating technology that will enable the smart cities of the future, or discovering new methods of harnessing clean energy, they are doing it together, as teammates.

In this publication, you'll read about just some of the people, places, and projects that make NYU Tandon an incredible transformation story; I hope that you'll find it inspiring, as I have.

 Looking forward to new puzzles!

Warmly,
Jelena

DEAN
JELENA
KOVAČEVIĆ

Facts about Dean Jelena...

#MeetDeanKovačević

Earns undergraduate degree in electrical engineering from the **University of Belgrade** in 1986 and M.S. and Ph.D. in electrical engineering from **Columbia University** in 1988 and 1991, respectively

Member of the **technical staff at Bell Labs** from 1991 to 2002

Joins the **faculty of Carnegie Mellon University** in 2003 and subsequently named David Edward Schramm Memorial Professor

Becomes **Carnegie Mellon's Hamerschlag University Professor** in 2016

Co-author of the books *Wavelets and Subband Coding* (1995) and *Foundations of Signal Processing* (2014)

Holds **21 patents**

Loves math, music, languages, students, teaching, running, puzzles

Fellow of the **Institute of Electrical and Electronics Engineers** (IEEE) and the **European Signal Processing Conference** (EUSIPCO)

Recipient of the **Belgrade October Prize** (1986), the **E.I. Jury Prize at Columbia University** (1991), the **CIT Philip L. Dowd Fellowship** (2010), and the **IEEE SPS Technical Achievement Award** (2016), among other honors

Research interests include **multi-resolution techniques** and the **application of data science** to a number of domains, such as biology, medicine, and smart infrastructure

Becomes the **first female ECE department head at Carnegie Mellon University** in 2014

Becomes the **first female dean in the history of the NYU Tandon School of Engineering** on August 15, 2018
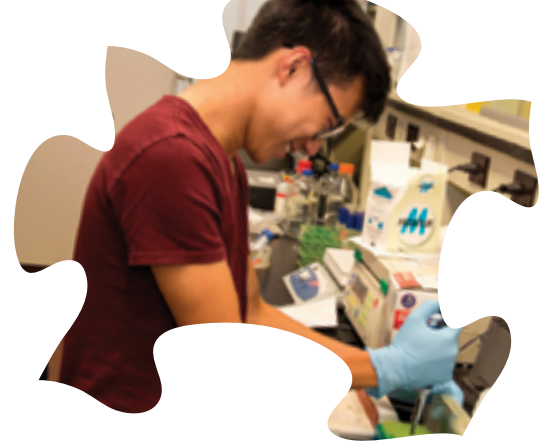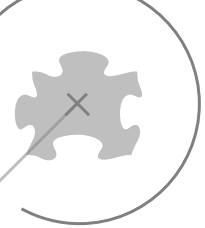
OUR NEW MULTIDISCIPLINARY DEPARTMENT

BIOMEDICAL ENGINEERING

Engineers are used to understanding complex systems, and few systems are more complex than the **human body**. Accordingly, Tandon researchers have long worked at the intersection of engineering, healthcare, and the life sciences to find ways to make the world's population a healthier one.

In July 2018, the school made a major commitment to that pursuit and established a new Department of Biomedical Engineering, where students and faculty members are creating new approaches and tools that touch upon such vital areas as medical imaging, tissue engineering and repair, biosensors, bio-optics, prosthetics, computational medicine, systems genetics, and more.

Members of the new department are engaging in increased collaborative research with the NYU School of Medicine, NYU College of Nursing, NYU College of Dentistry, and others, and several exciting projects are already underway. Tandon's biomedical engineers are working, for example, with researchers from the Orthopedic

Surgery Department for novel cartilage and bone repair biotherapeutics and joint implants and collaborating with counterparts in radiology and radiation oncology on new signal processing and data management protocols for medical imaging and radiotherapy. They work with neurologists on devices and approaches for on-site detection of mild traumatic brain injuries, with cardiovascular specialists on the development of new stent delivery devices, and with physical therapists on ways to speed rehabilitation and recovery. And that's just a glimpse of the possibilities that arise when engineers set their sights on helping advance human health.
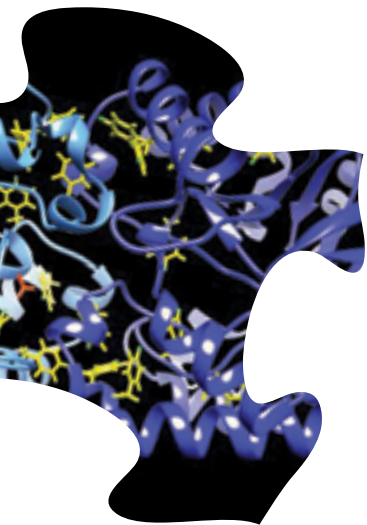
OUR COLLABORATIVE
RESEARCH INITIATIVES

Tandon researchers are making inroads in a wide variety of fields, from the traditional engineering disciplines to the unexpected. From the development of the transportation systems of the future to helping municipalities govern more transparently, our faculty and students are answering tomorrow's questions today.

NYU WIRELESS

Prof. Theodore Rappaport with students

The next generation of wireless, 5G, promises far more than lightning-fast movie downloads to smartphones and tablets. It opens the door to such remarkable scenarios as surgeons operating on patients from thousands of miles away, autonomous cars delivering terabits of real-time data to each other and the cloud, and artificial intelligence-driven antenna technologies that allow networks to modify cell transmissions on the fly to a new generation of phones.

NYU WIRELESS, a world-class research center that pioneered telecommunications in the millimeter wave (mmWave) spectrum, is now setting a course for innovative research in terahertz (THz) frequencies, where possibilities abound for nano-sized sensing devices, new kinds of networks, and an entirely new generation of technology.

Thanks to a major collaboration called COSMOS, funded by the National Science Foundation, the center is also a leader of a program that makes New York City one of the first testbeds for next-generation communications and IoT technologies. COSMOS will give researchers real-world data — and citizens the real-world experience — of blazingly fast wireless for robotics, immersive virtual reality, traffic safety, connected devices, education and much more.

AI NOW

Artificial intelligence (AI) is now being used in many of the systems underpinning society, and that trend is rapidly accelerating. There may come a day, for example, when parole boards make widespread use of such systems to analyze prisoners for their risk of recidivism or doctors call upon AI to diagnose patients with pinpoint accuracy.

However, news stories have described voice recognition systems that can't accurately decipher women's higher tones and automated photo-tagging systems that are stymied by certain ethnic traits.

Because human beings are responsible for the training data, algorithms, and other design choices that shape AI systems, those systems can reflect existing prejudices and inequalities. When AI is deployed in social systems like criminal justice, health diagnoses, academic admissions, and hiring, problems of bias can arise, regardless of the good intentions of the technical developers.

Researchers at AI Now are studying the effects of bias in AI systems, as well as examining the other complex societal questions machine-learning technology poses. (What might happen when the majority of the country's low-income jobs are eliminated because of automation? What are the safety repercussions when an airport's AI system fails?) Their goal is to help ensure that the AI systems affecting our daily lives are sensitive, fair, effective, and responsive.

Co-founders
Kate Crawford and
Meredith Whittaker

GOVLAB

Researchers at Tandon's Governance Lab (GovLab) — a "think-and-do-tank" aimed at creating new ways of using technology to make government more effective, efficient, legitimate, and transparent — believe that introducing more data and diverse viewpoints could help, an especially important proposition given that public trust in government is currently at historic lows.

This year GovLab founder and director Beth Simone Noveck, who was recently named the State of New Jersey's first chief innovation officer, arranged for a group of Tandon students to partner with the New York City Council to test that belief. They researched tech-enabled citizen participation in law and policy making throughout the world and discovered how the initiatives could be useful if applied in the context of New York City.

It was an ambitious project for the undergraduates, who got a look at the inner workings of a large, urban governing body; formulated potential ideas for how to improve it; and became better citizens and civic innovators in the process.

Prof. Beth Simone Noveck

ABILITY PROJECT

When curators at the Cooper-Hewitt, the Smithsonian Institution's New York City-based design museum, wanted to become more accessible to all visitors, including those with disabilities, they turned to the Ability Project, a far-ranging interdisciplinary, multi-school effort that encourages Tandon's aspiring engineers and technologists to consider human-centered design and the ways in which their work can affect those living with disabilities. In response to the museum's needs, the Ability Project launched a client-centered course that proved popular with Tandon's Integrated Digital Media students and that resulted, this past year, in new signage and exhibits, accompanying audio and visual components, accessible navigation within the historic building, an improved website, and more diverse multimodal options for interacting with exhibits.

Prof. Luke DeBois

VIDA

Big data is everywhere, and Tandon's Visualization and Data Analytics (VIDA) Research Center is harnessing its power to change the world.

Under the guidance of Department Chair and Institute Professor of Computer Science and Engineering Guido Gerig, who is renowned for pioneering research that has led to new insights into schizophrenia, autism, multiple sclerosis, Huntington's disease, and other conditions, doctoral candidate Sungmin Hong is examining how the shapes of the human brain changes over time and disease progression, and another of Gerig's students, Neel Dey, works to understand compounds associated with age-related macular degeneration, a blinding disease of the eye.

Cristian Felix, who is earning his Ph.D. under Associate Professor Enrico Bertini, has been working with a security company and a government agency to create interactive visualization tools that help them to identify different types of email scams, better understand and identify scammers, and create new protective measures to thwart them, while Nabeel Abdur Rehman, who is advised by Assistant Professor of Computer Science and Engineering Rumi Chunara, used detailed geo-located data to conduct a first-of-its-kind study of the spread of the dengue virus, which results in over 96 million infections each year; his results will guide recommendations for future deployment of resources during dengue outbreaks — especially important in resource-poor urban settings.

Prof. Claudio Silva and Prof. Juliana Freire

C2SMART

Americans spend an average of 17 hours searching for parking each year, wasting a cumulative $72 billion in time, fuel, and emissions. And anyone who has ever driven in a city knows the frustration of encountering double-parked cars. Leaning on the horn might alleviate some of that frustration but does little to solve the problem. More effective ticketing might discourage the practice, but parking officials must target which blocks and neighborhoods would benefit most from their efforts. They have plenty of data to draw upon: Every year, over 10 million parking violation tickets are issued in New York City alone, and these citations provide valuable datasets for researchers.

Helping make sense of that data is Jingqin Gao, the president of the NYU student chapters of both the Institute of Transportation Engineers and the Intelligent Transportation Society, who conducts her research under the auspices of C2SMART (Connected Cities for Smart Mobility Toward Accessible and Resilient Transportation Center), the Tandon-led U.S. Department of Transportation Tier 1 University Transportation Center. Using real-time information from Bluetooth devices, traffic cameras, crowdsourcing, and social media, she has developed a framework that could allow transportation agencies to identify promising locations for efficient enforcement while reducing the chances of selection bias. The result could be a better ride for all.

Prof. Kaan Ozbay

CUSP

New York City's 311 system, which allows callers to ask questions or complain about everything from rodent infestations and crime incidents to road conditions and water quality, can help researchers measure the pulse of the city. It provides a rich trove of data, free online on NYC's Open Data Portal to anyone interested, but the massive dataset can be hard to use and challenging to interpret.

Center for Urban Science and Progress (CUSP) Fellow Sarah Schoengold and her teammates have helped find a way to make that information more accessible and useful: They've built an online tool to quickly and efficiently cull the data that

will be most relevant to researchers. Need to compare weekday noise complaints to those that occur on the weekend? Need access to all complaints dealing with heating and the home? The filters on the NYC311 One Stop Shop, as they call their project, allow for those types of queries and much more.

CUSP's mission is to use New York as a living laboratory and classroom to help cities around the world become smarter, cleaner, and more livable, and Schoengold's work is on course to aid policy makers and others in reaching those goals.

Prof. Juan Bello

311

CSAW Competition

CYBER EXPERTS

Bridge Program

When NYU Tandon's Bridge Program first launched in 2016, it provided a diverse group of non-computer science majors with a way to make the leap into a master's program — without the year of study and $20,000 that would be required to keep up with students who had spent four years earning B.S. degrees in that field. The online course covered the needed material in a matter of weeks,

for just $1,500. (As a bonus, anyone finishing the Bridge with a B+ or better average was eligible for admission to a select Tandon's master's program.)

This year saw the first two master's degree recipients to get their start through the Bridge Program. Lucia Yu, a former economist/anthropologist, is now at the iconic financial-services

firm JP Morgan Chase, working in a newly established machine-learning division. Meredith Mante, a former psychology major, decided to pursue teaching computer science as a career. And while the Bridge Program is designed to take its graduates far, that's not the case for Mante – at least not in the geographic sense: she has been named a visiting assistant industry professor right here at Tandon.

Cyber Fellows

In January 2018, Tandon announced the launch of its New York Cyber Fellows initiative, a first-of-its-kind online master's degree program, designed in collaboration with New York City Cyber Command (NYC3) and other elite employers to address the acute shortage of highly trained technical professionals in the cybersecurity field. With the Fellowship providing up to 75% towards the cost, the program allows access to a hands-on virtual lab, industry mentors, curriculum designed by industry, exclusive speaker events, and corporate and peer mentors. The very first Cyber Fellow, Caitlin Quintero Weaver, a Bridge Program alum whose undergraduate degree was in cognitive linguistics, is now one of 120 Cyber Fellows in the first cohort eagerly working to advance their technical skills.

CSAW

The world's largest student-run set of cybersecurity competitions, founded 15 years ago at NYU Tandon, has drawn nearly 100,000 high-school, college, graduate and post-graduate students to compete since its inception.

Cyber Security Awareness Worldwide (CSAW) events, which are designed by students under the mentorship of information security professionals and faculty, call upon competitors' skills in digital forensics, measure their prowess in software and hardware penetration testing and protection, and much more.

Launched locally in Brooklyn, CSAW has now expanded to global sites including Mexico, Tunisia, France, Israel, and India.

Our Faculty Cyber Experts

Since the start of his academic career, Associate Professor **Justin Cappos** has focused on practical applications of security, notably including Linux, the open-source operating system of choice for supercomputers, enterprise networks, and software embedded into the ubiquitous chips of the 21st century. This year, his methods to protect software updates — a notorious vulnerability — for automobiles, computers, and networks were adopted by the Linux Foundation and are being accepted into industry standards.

Assistant Professor **Brendan Dolan-Gavitt's** research focuses on developing techniques to ease or automate our understanding of large, real-world software systems, in order to develop novel defenses against attacks. He recently helped devise an innovative approach to thwarting hackers: scattering harmless, non-exploitable "decoy" bugs into software, so attackers waste time and effort trying to exploit those instead of actual vulnerabilities.

Assistant Professor **Siddharth Garg**, principal investigator of a Tandon research group dedicated to Energy-Aware, Secure and Reliable Computing, is an expert in microchip security. He is now also part of a National Science Foundation-supported team exploring new territory: technologies for securing AI systems. His work involves developing ways of detecting the presence of "backdoors" that can be exploited, as well as diagnosing unintentional flaws in AI systems that could have safety impacts.

Professor **Ramesh Karri**, the co-founder and co-chair of the NYU Center for Cyber Security, has achieved many "firsts" over the course of his career, including generating the world's first research on attack-resilient chip architecture; demonstrating before anyone else that integrated circuits' test and debug ports could be used by hackers; and presenting the first research paper on split manufacturing, a means of thwarting counterfeiting by an untrusted foundry by dividing a chip's blueprint into several components and distributing each to a different fabricator.

Assistant Professor **Damon McCoy's** research often delves into the shadowy worlds of online payment systems, the economics of cybercrime, and other such topics. He has traced the trail of fake luxury goods, studied how online real-estate sites deal with fake listings, and recently made waves in the media for his data-driven look at Facebook political ads (see pg. 22 for more).

Professor **Nasir Memon**, former head of the Department of Computer Science and Engineering and now Associate Dean for Online Learning, has played a large part in making NYU Tandon a major hub for the study of cybersecurity. The creator of the Bridge Program and one of the founders of CSAW, he has also led efforts to attract greater numbers of women and other underrepresented minorities to the field.

Dean Jelena with Cyber Fellows Scholars

OUR SPACES

370 JAY

This past year NYU, in partnership with the City of New York, completed the transformation of the long-empty 500,000-square-foot Metropolitan Transit Authority (MTA) building into an innovation hub for engineering, applied science, urban science, digital technology, and digital media.

Five years in the making, the new facility welcomed its first tenant, the Center for Urban Science and Progress (see pg. 9), and is expected to soon be fully occupied, as home to a media commons, audio labs, motion capture labs, Virtual Reality rooms, black box theaters, a performance space, an exhibit hall, workshop spaces, and classrooms. Tenants will include Tandon's Computer Science and Electrical and Computer Engineering departments and the Integrated Digital Media (IDM) program, the Media and Games Network (MAGNET), and three departments from the NYU Tisch School of the Arts: the Clive Davis Institute of Recorded Music, the Interactive Telecommunications/Interactive Media Arts programs (ITP and IMA), and the Center for Game Design.

THE MAKERSPACE

There's never a dull moment at the
NYU Tandon MakerSpace, housed at
6 MetroTech Center in Brooklyn. Visit
the bi-level, 10,000-square-foot facility
on any given day of the year and
you might see orthotic devices being
manufactured, an autonomous vehicle
being assembled, or a lively workshop
on Raspberry Pi being conducted.

A haven for Tandon's aspiring inventors
and entrepreneurs, the MakerSpace,
which boasts numerous pieces of high-
end equipment, recently celebrated its
second anniversary.

OUR
CONFERENCES & SERIES

*Speaker
Anima Anandkumar*

*Speaker
Josh Jornet*

*Speaker
Kai-Fu Lee*

*Speaker
Hossein Hashemi*

Circuits: Terahertz (THz) and Beyond

A Special Joint Seminar Series from the Department of Electrical and Computer Engineering and NYU WIRELESS

NYU WIRELESS was ahead of the curve with its groundbreaking work on the millimeter-wave spectrum. The center is stepping ahead once again with a new focus on the terahertz (THz) electromagnetic spectrum. This series examines the many remarkable applications made possible by the unusual behavior of THz spectrum transmissions, including their ability to wirelessly charge tiny nano devices including electronic implants and smart tracers, "see" the motion of water and other fluids in geologic formations, and allow swarms of tiny smart chips to communicate with one another.

Subject experts from around the world have been flocking to Brooklyn to present their work, learn of the latest advances in their fields, and build their network of colleagues. This past year our school has been the site of several successful gatherings.
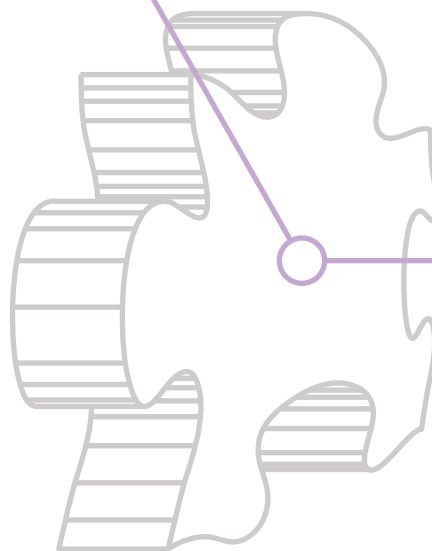
ARO Workshop on Secure & Trustworthy Biochips

Co-organized by Professor of Electrical and Computer Engineering Ramesh Karri

The world's first-ever conference to examine the threats and security vulnerabilities unique to biochips, the event focused on innovative systems employing biochips and microfluidics and explored the threat landscape for such processes as digital microfluidics — the manipulation of microscopic drops of fluid in tiny capillaries etched onto silicon chips. (With healthcare driving microfluidics deployment, a segment analysts say could hit $4 billion by 2020, the topic is more vital than ever.)

ASME Comes to Tandon

Hosted by the Department of Mechanical and Aerospace Engineering

Curated by the American Society of Mechanical Engineers (ASME) and the group Engineering for Change, **Impact. Engineered**, a day-long event for innovators and influencers, celebrates the role of engineering rigor in solving the global challenges identified in the UN Sustainable Development Goals. Another compelling ASME event, **Additive Manufacturing: State of the Art and Trends**, is aimed at providing an overview of the fundamentals of 3D printing, its impact on industry, and the possibilities it could present in the future.

The International Conference on Organized Molecular Films (ICOMF)

Overseen by NYU Tandon Professor of Chemical and Biomolecular Engineering Avi Ulman

Given that organized molecular films have become one of the cornerstones in many research fields, such as fundamental chemistry and physics, nanoscience and technology, and biomimicking systems, the multidisciplinary nature of their study requires scientists to collaborate closely, making the biennial ICOMF an excellent forum for chemists, physicists, biologists, material scientists, polymer scientists, chemical engineers, and researchers from the academy, national institutes, and industry to discuss their latest results.

The NYU Biomedical and Biosystems Conference

Jointly organized by Tandon and NYU Abu Dhabi

The goal of the event, held in alternating years in Brooklyn and the Middle East, is to bring together engineers, medical researchers, and practitioners and address conceptual, theoretical, methodological, and translational frameworks and innovations beyond discipline-specific approaches. The roster of presenters includes several researchers from around the globe making their marks in such areas as microsystems and biosensors, bio-imaging, assistive and rehabilitative robotics, mechano-biology, and biomaterials.

Modern Artificial Intelligence

The seminar series organized by Professor Anna Choromanska and hosted by NYU Tandon's Department of Electrical and Computer Engineering

The series brings to the MetroTech Center such high-profile speakers as Vladimir Vapnik, widely regarded as the father of machine learning and Yann LeCun, director of Facebook AI Research.

NYU Biomedical and Biosystems Conference

OUR VIP PROGRAM

Tandon students can attest that they accomplish a lot over the course of a single semester. It can be hard, however, to move on from an exciting topic or favorite professor once the semester is over. What if there were a way to work on a real-world project so big and so important that it spanned almost your entire academic career?

At Tandon, students now have the chance to find out, thanks to the new **Vertically Integrated Projects (VIP) Program**. Students who take part collaborate on a project for up to three years, earning a credit each semester, and because the projects are multidisciplinary, the teams include those from a mix of departments. This gives people from electrical engineering, computer engineering, integrated digital media, and other departments a chance to work alongside one another, just as they'll be expected to do when they collaborate on large multidisciplinary projects out in the work world.

Participants take on increasingly responsible roles on the team as they progress, so new members are mentored by faculty and grad students. They, in turn, then mentor newer students and ultimately step into leadership roles as older students graduate — tracing the trajectory they might take over the course of their professional lives.

Under the directorship of Industry Assistant Professor Jack Bringardner, the recent recipient of the 2018 Jacobs Excellence in Education Award, the VIP Program, now in its second year at Tandon, has grown to include 19 projects.

## iGEM (International Genetically Engineered Machine)

We aren't yet at that Blade Runner moment in which you can buy a genetically engineered snake from a street vendor. But thanks to gene-splicing technologies like CRISPR, the application of engineering to biology has opened the door to myriad possibilities for improving our world, curing diseases, and more. As they gear up for the massive annual iGEM Giant Jamboree in Boston in October, students in this program are designing, building, testing, and measuring ways to use interchangeable biological parts and standard molecular biology techniques to solve real-world problems. At the Jamboree, the largest competition of its kind, they will vie against hundreds of teams from around the world for medals and prizes.

NYU Rogue Aerospace

The rocket industry, including more and more private companies like SpaceX, Blue Origin, Firefly, Astra Space, and Virgin Galactic, has long since cleared the gantry; its future engineers are at NYU Tandon now. Students at Rogue Aerospace are on the flight line with model rockets, flight computers, launch simulations and other applications. They plan to attend IREC, an international competition where participants aim to reach an altitude of 10,000 feet with one of the rockets they have designed and built. Several current members hold official High-Powered Rocketry certifications (HPR 1) from the National Association of Rocketry (NAR).

NYU Tandon Motorsports

You could say engineering students on the motorsports team are driven, but they might disagree. After all, they are the ones driving when it comes to designing, building and racing in a prototype single-seat, all-terrain vehicle designed to compete in events like the annual Baja SAE competition. In it to win it, the students are making the vehicle reliable, maintainable, ergonomic, and capable of handling heat, sand, rugged hills, and nature's slings and arrows. And it must be economical to produce, and suitable for everyday recreational users. The prototype vehicle is tested to the limits, pitched for production, and each year goes to the dirt against other teams on the famed Mexican peninsula.
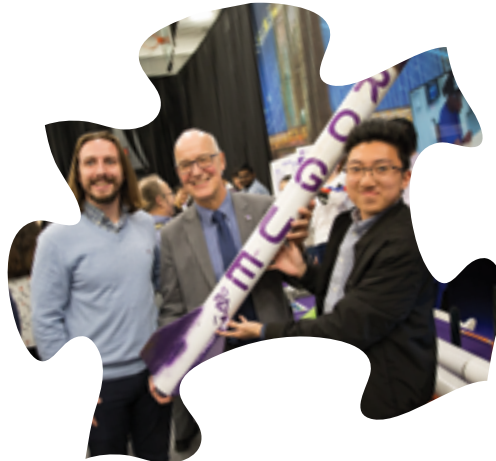
Smart Cities Technology

The Earth is becoming increasingly urbanized: U.N. officials predict that by the middle of the 21st century, some 68% of the world's people will live in cities. It's important, then, for those cities to be smart: clean, livable, sustainable, and connected.

To that end, students in the Smart Cities project explore low-cost pollution sensors, transportation solutions, Internet-of-Things devices, clean energy technologies, and more — using New York City as a dynamic, real-life laboratory.

Vertical Farming

By the year 2050, experts are predicting that the earth's population will increase by about 3 billion people, and if farmers continue using conventional methods, much more land (equivalent to about the size of Brazil) will be required to feed them. With more than 80% of the world's suitable land already being farmed, trouble looms. Vertical farming presents a solution.

Vertical farmers grow produce in urban areas in a controlled environment, allowing for year-round growing without the environmentally costly effects of conventional farming. Students in the project aim to refine an energy efficient, minimally wasteful, scalable system, using their knowledge of automation, biology, and waste-derived energy generation, and their contributions may be helping avert a crisis of global proportions.

Concrete Canoe Team

Can concrete float? It had better. Students design, build and race a vessel in the annual American Society of Civil Engineers challenge, giving them hands-on experience in design, innovative building materials, and fabrication. (Last year's team aced the ASCE regionals and made it to the top 10 in the nationals.)

InterCEP

At Tandon's International Center for Enterprise Preparedness (InterCEP), students help design and prototype such data-monitoring systems as the situational awareness platform that the city, the Port Authority of New York and New Jersey, and many companies now use to monitor and respond to emergencies.

Mixed Reality Engineering

The team is investigating how Augmented Reality (AR) technology can be used to substitute for the expensive and inconvenient test instrumentation required in typical engineering curricula, while still providing the student with a laboratory experience similar to that of a physical lab.

Music Experience Design Lab

Participants attempt to lower the barriers to interactive music and media, while creating technologies for promoting creative expression and learning in a variety of subjects.

Hyperloop

Tandon's Hyperloop team is helping to shape the ground transportation system of the future by designing and constructing a pod capable of traveling over 600 mph. They'll test and race their prototype on the mile-long SpaceX Hyperloop track, erected near the company's California headquarters.

SAE Aero Design

These are not the basic model airplanes hobbyists might build in their basements: participants in the project compete in the annual SAE (originally founded as the Society of Automotive Engineers) Aero Design Competition, compressing a typical aircraft development program into one calendar year and being exposed to the nuances of conceptual design, manufacturing, and system integration and testing.

NYU-X Holodeck

On the fictional *Starship Enterprise*, the Holodecks allowed crew members to explore virtual-reality (VR) versions of their home planets when they felt homesick. The NYU-X Holodeck has a timelier purpose: working with the NYU Rory Meyers College of Nursing, students in the project investigate the use of emerging technologies like VR for innovation in healthcare.

RePrint Bot

3-D printing and recycling plastic bottles: two useful pursuits that are more efficient when combined. Students in the project collaborate to design, prototype, and refine an innovative standalone system that recycles used plastic bottles in order to use the material for 3D-printing purposes, instead of costly ready-made filament.

Smart Internet of Controlled Things

The Internet of Things (IoT) foresees a highly networked future, where objects interact with one another, and intelligent systems improve our daily lives. Participants in this project aim to design and prototype resilient and secure IoT technologies for the smart homes, smart healthcare, smart grids, and smart buildings of a new era.

Soft Robotics

It's one thing for robots to move shipping containers, weld car doors, assemble products, and even mangle each other in battles royale. But how about robots made of pliable materials that can be used in invasive surgery, or as flexible exosuits for rehabilitation? Team members use unconventional materials, tools, and methods to design, build, and prototype their own soft robotic components and systems.

U•START

U•START was developed to encourage and facilitate connections across different disciplines. The team aims to give aspiring entrepreneurs the ability to simultaneously recruit collaborators and showcase their venture's progress for all to see, and their next goal is to advance the platform for a beta release.

Urban LiDAR and Remote Sensing

Light detection and ranging (LiDAR) data allows scientists to compile exceptionally high-resolution views of dynamically changing locales. Among the issues the VIP participants have studied while collecting and analyzing their data are the measurement of glacial cracks, traffic marking detection, and object detection in submerged conditions.

Wearable Technology

It may one day be common for our running shoes to automatically measure our heart rate and our jewelry to admonish us it's time to meditate. Participants in the wearable-tech project design and prototype sensors and technological innovations embedded in clothing or otherwise worn on the human body, with the ultimate goal of advancing healthcare and quality of life, material science research, wireless communications, and more.

3D-Printed Biomedical Devices

Orthotic devices can help those with cerebral palsy and other movement disorders tackle everyday activities and gain independence, but custom orthotics are often clunky, expensive, and — in the case of children — quickly outgrown. Students in this project design and prototype low-cost, highly adaptable, 3D-printed devices for patients, getting valuable feedback from medical practitioners and end users thanks to a partnership with NYU Langone.
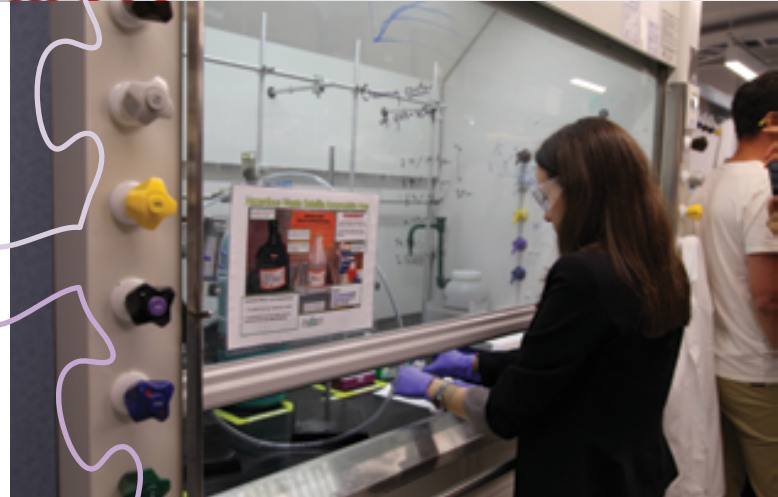
OUR NEW FACULTY

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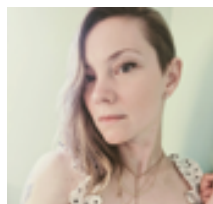
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OUR
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RESEARCH

Stronger, Safer Medical Implants

For years, titanium has been the preferred material for surgical procedures ranging from knee replacement to jaw implants, but it can cause serious complications like infection. In fact, procedures to remove hardware that has been rejected or caused infected are among the most common surgeries worldwide and a major cost for hospitals and patients. Now, Associate Professor Nikhil Gupta, in collaboration with Dr. Paulo Coelho of NYU School of Dentistry and Dr. Andrea Torroni of NYU School of Medicine, is exploring a solution: using treated magnesium alloys instead. Their work, which was recently published in the *Journal of Cranio-Maxillofacial Surgery*, could lead to safer, stronger medical implants and improved outcomes for countless patients.

Building a Better Solar Cell

Conventional solar cells made of silicon now have only limited competition; perovskite solar cells are a low-cost, increasingly efficient alternative, but manufacturers have been stymied by the difficulties posed in working with the material. Specifically, it's hard to effectively apply a uniform electron transport layer (ETL) — a vital component of any solar cell — over the crystalline surface of the perovskite.

Professor of Chemical and Biomolecular Engineering André Taylor has found a way to address that difficulty by spraying on the ETL — in contrast to the usual method of spin casting, which involves spinning the cell and allowing centripetal force to disperse the ETL fluid over the perovskite substrate. Because spray coating applies the ETL uniformly across a large area, it is suitable for manufacturing large solar panels, and it results in fewer defects and greater energy efficiency.

Concise, highly reproducible, and scalable, Taylor's discovery is poised to make a great impact of the solar cell industry.

Political Advertising Demystified

When Facebook announced to great fanfare earlier this year that it was releasing data about all of its political ads, it seemed to be a great step towards public transparency, but there was a major problem: the searchable database the company built to display the information was hard to access and analyze — even for savvy researchers like Assistant Professor of Computer Science Damon McCoy and doctoral student Laura Edelson.

With Facebook under fire for its role in helping spread disinformation during the 2016 presidential election, and contentious midterm elections approaching, McCoy realized that the database was not yielding a ready answer to one simple question: who, exactly, was spending the most money to advertise on the ubiquitous platform? To find out, he and his team scraped the raw data, following hard-to-decipher trails to identify ad sponsors. They discovered that during a three-month period in early 2018, Trump and

his PAC had spent $274,000 on ads seen by at least 37 million people. (Planned Parenthood came in second.)

The study, which was widely covered by such high-profile outlets as *The New York Times* and *Fortune*, not only provided a comprehensive picture of what was being spent ahead of the midterm elections but shed much-needed light on the often opaque machinations behind modern political advertising. Twitter and Google are their next pre-election targets.

Tracking Communicable Disease

Text messages aren't just a way to chat with family and friends — they are a viable method for rapidly gathering information during a public health crisis. A new study whose lead author is Rumi Chunara, an assistant professor of computer science and engineering at Tandon who is also affiliated with NYU's College of Global Public Health, used text message surveys to determine, in real time, how people reacted during an outbreak of Ebola in Liberia. They wondered, for example, whether laboring mothers would go to hospitals to deliver or stay in their own communities; such information could allow officials to quickly target affected regions with public health messaging or deploy appropriate interventions.

Because routine data collection systems, such as surveys of households or health facilities, can take months to collect and analyze and are often disrupted by emergencies in regions with weaker infrastructure, text messaging, as Chunara and her team have shown, has great potential to improve global health outcomes in outbreaks of any communicable disease.

Neutralizing Neurotoxins

A mere fraction of a drop of VX — one of the most deadly nerve agents known to humanity — absorbed through the skin is lethal. V-series nerve poisons were used in the Iran-Iraq War during the 1980s; in Japanese cities by the Aum Shinrikyo cult in the 1990s; by the Syrian government on its own citizens in 2013; on Kim Jong-nam, the half brother of North Korea's leader, in 2017; and in the U.K. on former Russian double agent Sergei Skripal and his daughter in 2018.

Jin Montclare, a professor in the Department of Chemical and Biomolecular Engineering, is participating in a U.S. government program to thwart these agents by improving upon compounds known to neutralize them. Montclare, the recipient of a $349,000 grant from the U.S. government's CounterACT (Countermeasures Against Chemical Threats) program under the National Institutes of Health, is focusing her research on phosphotriesterase (PTE), a compound that can deactivate the neurotoxic agent organophosphorus, the active ingredient in a number of pesticides and a rogue's gallery of chemical warfare agents like VX.

Treating Lymphedema

Every year more than 1.4 million women worldwide are diagnosed with breast cancer, and 90 percent of these patients are alive five years after diagnosis. But while major advances in surgical intervention, chemotherapy, and radiology have engendered these high survival rates, they can cause lymphedema, a painful condition affecting the lymphatic system.

Yao Wang, a professor of electrical and computer engineering, is using machine learning and video analysis to address the problem. In collaboration with colleagues from NYU's schools of nursing and medicine, she has helped develop a novel web-based, mobile health self-care system that combines clinical and diagnostic information for healthcare providers with self-care tools for the patient. While lymphedema may be incurable for now, thanks to Wang and her colleagues, it's becoming increasingly manageable.

Thwarting Counterfeiters

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; imagine the damage that could occur if flawed parts printed from stolen design files were used in medical devices, commercial airliners, or other vital products.

Noted Tandon materials researcher Nikhil Gupta and a team of colleagues have developed a way to ensure that a 3D-printed part is the real thing by including QR (Quick Response) codes in computer-assisted-design files as three-dimensional features. The code, hidden throughout a printed part, presents several false faces — dummy QR tags — to would-be counterfeiters, and only a trusted printer or end user would know the correct head-on orientation for the scanner to capture the legitimate QR code image. In high-risk industries like biomedical and aerospace, where the quality of even the smallest part is critical, the innovation could be, literally, life-saving.
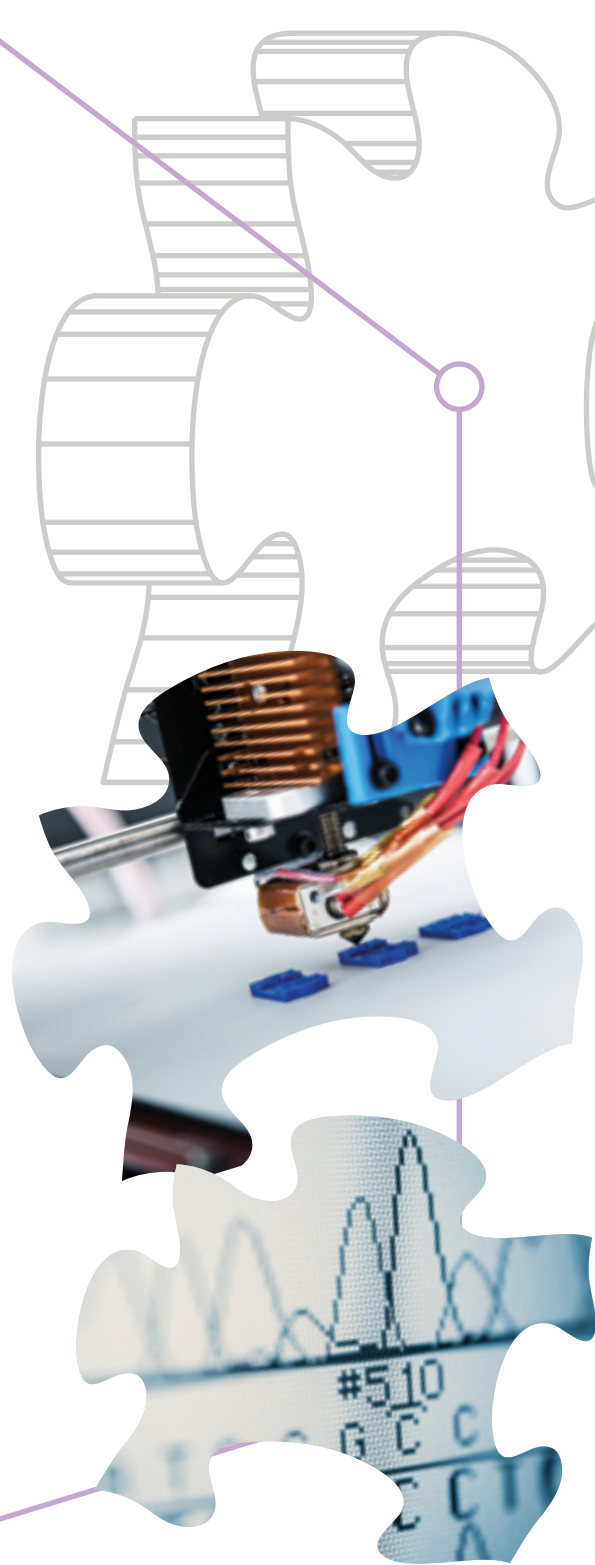
Making Sense of Home Medical Tests

Anyone who wants to trace their DNA or get personalized information about the bacteria in their gut can now simply buy one of the many in-home tests being marketed directly to the public. But what happens when a person with no medical background is faced with pages of hard-to-understand results? Scientific literature brims with examples of incorrect

or misinterpreted home test results that prompted expensive and unnecessary follow-up tests and caused undue emotional stress.

Associate Professor Oded Nov, an expert in computer-human interaction, is working with the Open Humans project to test volunteers' understanding of data presentation, with the goal of developing

tools that will enable the testing industry to present results in more comprehensible, layperson-friendly ways. He also plans to create a mobile app that will allow users to share curated medical news with others within their family or community. His project will result in better informed consumers, with heightened understanding of their medical data and its implications.

OUR **ALUMNI** IN THE NEWS

Arthur I. Bienenstock

In December 2017, **Paolo Nespoli ('88, '89)** returned to Earth after logging his 313th day in space. Nespoli has traveled to the stars three times, including a 159-day jaunt to the International Space Station back in 2010. With another Tandon alum as part of the space program, Charlie Camarda ('74), their extraterrestrial experiences are yet another example of our collective commitment to this planet and beyond.

The year after she graduated, **Nina Freeman ('15)** was named one of the most important young figures in the gaming world by *Forbes* magazine. This year the accolades mounted higher: her work appeared in a new exhibit at London's Victoria & Albert Museum, and CNN recognized her as one of the "bold, provocative, and inclusive new faces of game design."

Marking the second largest ever acquisition of an Israeli-based enterprise, chemical executive and majority stakeholder **John J. Farber ('57)** sold the company Frutarom for $7.1 billion in cash and stock to major manufacturer International Flavors & Fragrances.

Paolo Nespoli

Nina Freeman

Photon science pioneer **Arthur I. Bienenstock ('55, '57)** received the 2018 Philip Hauge Abelson Prize given by the American Association for the Advancement of Science, in recognition of his promotion of diversity and inclusion in STEM and his efforts to improve public understanding of science.

Judea Pearl ('65), who garnered the A. M. Turing Award from the Association for Computing Machinery for his fundamental contributions to artificial intelligence, has released a new volume – *The Book of Why: The New Science of Cause and Effect*. A reviewer for *The New York Times* praised him for delivering a valuable lesson on the history of ideas along with the conceptual tools needed to judge just what big data can and cannot deliver, and concluded with the hope that in the future "programmers with the humanity of Professor Pearl will be in charge."

Judea Pearl

Dan Guido

While still students, **Nicolas Vansnick and Carlos Ospina (both '13)** developed Squink, a tabletop machine that quickly and cost-effectively printed electronic circuit boards. Now their company, BotFactory, has announced an even more industry-changing product, the SV2, which boasts advanced hardware for printing, dispensing and assembly; stronger onboard computing power; quicker manufacturing time; and more.

Trail of Bits, a cybersecurity firm co-founded by former Tandon "hacker-in-residence" **Dan Guido ('08)**, recently launched a $100,000 fellowship aimed at supporting young researchers, with at least 50% of the awards reserved for minority and female-identifying candidates. (In other exciting news, over the summer the company sponsored a flavor at a popular ice cream truck, and matched every scoop sold with a donation to Girls Who Code.)

Newly incorporated Sunthetics, co-founded by alum **Myriam Sbeiti** (along with Ph.D. candidate **Daniela Blanco**), is causing a major stir with its new technology. The team has discovered a way of using water, plant waste, and solar energy to manufacture nylon, instead of the fossil fuel currently used, and the process is proving intriguing not only to the fashion industry — which produces millions of tons of petrochemical-based nylon each year, thereby generating significant emissions of carbon dioxide — but to anyone in the broader chemical-manufacturing world seeking greener production methods.

Bertha Jimenez

Bertha Jimenez, who earned a Ph.D. in Technology Management and Innovation in 2016, is gaining national attention in recent days. High-profile trade publications and business journals alike are taking notice of Rise, the company she founded as a student. Even *The New York Times* is praising Jimenez's idea to eliminate food waste by milling the spent grain produced by breweries into a nutritious and flavorful flour now being used in bakeries throughout the city. Chocolate, barley and dulce de leche poundcake; shortbread cookies; and fresh pasta are all on offer according to the *Times*, so you can indulge your gourmet side while helping to support more sustainable food practices.

Nicolas Vansnick and Carlos Ospina

Daniela Blanco

Myriam Sbeiti

AS ENTREPRENEURS

OUR TOP EMPLOYERS

OUR BOARD OF OVERSEERS

The past decade has seen **NYU Tandon** shoot up in the USNews rankings, and over the next decade, we expect to see that **monumental climb continue.**

I think you'll agree that we're "*putting the pieces together*" in exciting new ways to make that happen — including attracting a Class of 2022 made up of 43% women — but we realize we have even more work to do. (We're aiming, for example, for total gender balance, so while 43% is impressive, we don't intend to rest on our laurels.) Please follow us on Twitter, Instagram, and Facebook **@nyutandon** and bookmark our website **engineering.nyu.edu** to follow our progress and keep up with all our latest inventions, innovations, and successes.

Based in Brooklyn, New York, we are a school dedicated to being accessible to all, with a students-first, inclusive, fearless, and entrepreneurial attitude and a commitment to improving the world and solving tomorrow's issues today.

Jelena

BORN ANYWHERE
NYU TANDON
MADE IN BROOKLYN