Columbia Engineering

WINTER 2025
MAGAZINE

Engineering × The Power of Partnership

A New Era for Women's Health Research

AI @ Columbia Engineering

Alumni Milestones & Memories

Engineering for Humanity

COLUMBIA
ENGINEERING
MAGAZINE

WINTER 2025,
VOL. 66 NO. 1

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COVER IMAGE:

THIS OPTICAL COHERENCE TOMOGRAPH IMAGE (SHOWN UNDER THE PHOTO) CAPTURES A UTERINE POLYP. THE RESEARCH WAS CONDUCTED IN COLLABORATION WITH DRS. HANINA HIBSHOOSH AND XIAOWEI CHEN FROM THE DEPARTMENT OF PATHOLOGY AND CELL BIOLOGY. (HENDON LAB)

INTRODUCING THE LEVER

This new series features forward-looking analysis from experts at Columbia Engineering. Subscribe now to stay informed about some of the biggest challenges facing society and promising breakthroughs that point to a better future.

We're kicking off The Lever with a six-part series on the race to electrify our energy system to cut reliance on fossil fuels. Subscribe now to start receiving The Lever in your inbox.

Subscribe today for exclusive insights and in-depth reports, or visit: columbiaeng.com/energy

COLUMBIA ENGINEERING

Message from the Dean

Welcome to our latest issue of Columbia Engineering magazine. This winter, we have brought back the print version of our magazine, along with the digital version available online. Our new, revamped magazine reflects the vast scope of research, outreach, and impact being done every day by our inspiring and engaged faculty and students.

Last year, we faced many challenges as a community. Despite those challenges, we began the academic year with a renewed sense of purpose and a commitment to cultivating community through new and compelling programs and initiatives. Such programming reflects some of the most exciting research happening at our School.

In this issue, we dive into the concept of Engineering ×, meaning how engineering is now integral to all disciplines, from health and medicine to social science and journalism. We also share the latest from our faculty and centers related to data, intelligence, women's health, business, climate, medicine, and journalism.

In September, we joined organizations across New York City as well as the Columbia Climate School and the Data Science Institute to celebrate Climate Week NYC. Our programming included lectures on making cities more sustainable, fusion adoption, sustainable cloud computing and AI, as well as energy storage.

The week also featured the launch of the Columbia Engineering Lecture Series in AI with Pierre Gentine, director of our NSF Science and Technology Center LEAP (Learning the Earth with Artificial Intelligence and Physics). AI continues to be a University priority, and Engineering is leading the charge. As a preeminent research institution, Columbia Engineering plays a unique role in a dynamic and complex landscape dominated by a handful of companies. I encourage you to read my discussion with our new vice dean of AI and computing, Vishal Misra, on adapting to this ever-evolving landscape. You can also learn how we are integrating AI into education with our new AI in Context course, which is being team-taught by engineering and humanities faculty.

Our new interim president, Katrina Armstrong, has made building a more inclusive and welcoming community a top priority. In that spirit, we profile several of our alumni: Disney Imagineer and Class Day 2024 speaker Lanny Smoot BS'77, MS'78; Marissa Beatty PhD'22; our new CEAA president, Reid Ellison BS'08; and Imran Shah BS'84, MS'86, PHD'94, our latest Silberstein Family Executive in Residence. You can also read about our 2024 Reunion Weekend.

I hope you enjoy this issue and take pride in the many ways we are making an impact and continuing our mission to be engineers for humanity.

SHIH-FU CHANG
DEAN, COLUMBIA ENGINEERING
MORRIS A. AND
ALMA SCHAPIRO PROFESSOR

WHAT'S INSIDE

NEWS

Breakthroughs & Insights

PHOTO OF RESEARCHER RAJARAM KAVETI HOLDING THE WATER-POWERED, ELECTRONICS-FREE DRESSING FOR ELECTRICAL STIMULATION OF WOUNDS. (NORTH CAROLINA STATE UNIVERSITY)

Some of the latest advancements and transformative research findings from Columbia Engineering faculty and collaborators.

A new way to detect AI-generated content

Generative artificial intelligence systems are already being used across the world for nefarious purposes that range from financial fraud to political propaganda. As these systems have grown more sophisticated, it's become increasingly difficult for humans to detect whether content was created by humans or by a machine.

As such, researchers are racing to develop computational methods for detecting AI-generated content.

At Columbia Engineering, computer science professor Junfeng Yang and YM Associate Professor of Computer Science Carl Vondrick are leading the charge by developing a framework, called Raidar, that exploits the tendency of AI models to prefer content created by other AI models.

Raidar detects text written by a large language model by measuring the number of edits another LLM makes when revising a given piece of text, comparing the original text with the rewritten text. Many edits mean the text was likely written by humans, while fewer modifications indicate the text was likely machine generated.

Raidar's remarkable accuracy—it surpassed previous methods of detection by up to 29%—inspired the researchers to turn their attention to video. Their video-detection system, called DIVID, extends a method called diffusion reconstruction error to compare frames of a given video against those of an AI reconstruction. As with Raidar, DIVID measures how many changes an AI system makes as it optimizes a video.

The system achieved a groundbreaking detection accuracy of up to 93.7% for videos in the researchers' benchmark data set of diffusion-generated videos from Stable Vision Diffusion, Sora, Pika, and Gen-2.

An electric bandage enables faster healing

Chronic wounds, such as sores resulting from diabetes, are extremely serious—in some cases, leading to amputation and even death. Unfortunately, the treatments currently available are expensive and often ineffective.

To help remedy that, a team of researchers developed a cheap, more effective treatment that uses electricity to promote healing.

"These lightweight bandages healed wounds faster than the control, at a similar rate as bulkier and more expensive wound treatment," says Sam Sia, a professor of biomedical engineering at Columbia Engineering and a member of the team behind the technology.

In animal tests, wounds dressed with the new bandage healed about 30% faster than those dressed with a typical bandage.

Designed to be simple enough for patients to use at home, the bandages consist of a bio-safe battery and flexible electrodes that conform to the shape of the wound. When activated with a drop of water, the battery creates an electric field that lasts for several hours.

"We found that the electrical stimulation from the device sped up the rate of wound closure, promoted new blood vessel formation, and reduced inflammation, all of which point to overall improved wound healing," says Maggie Jakus, co-first author of the study and Sia's PhD student.

A new tool for designing high-performance batteries

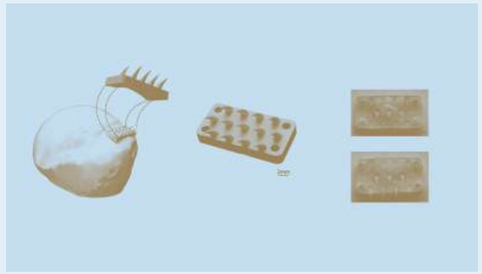
Developing new battery technology is essential in efforts to reduce society's reliance on fossil fuels and meet our carbon emission targets. Researchers have spent 40 years developing lithium metal batteries, which stand to hold significantly more energy than now-common lithium-ion batteries.

The difference between the two designs—lithium-ion batteries have an anode made of graphite while lithium metal batteries use lithium for that component—could lead to electric vehicles that can travel on a charge as far as gaspowered vehicles can travel on a tank of gas

Unfortunately, the lithium anode is so chemically reactive that designing safe, long-lasting lithium metal batteries has proved an elusive goal.

Lauren Marbella, associate professor of chemical engineering at Columbia Engineering, is pioneering new methods for peering inside batteries so researchers and developers can better understand what's happening on the anode and design components that resist damage. The technique her lab uses, called nuclear magnetic resonance spectroscopy, allows researchers to both measure how quickly lithium ions are moving and determine the exact chemical and physical structure of the problem-causing defects.

"Once we know what structural changes are occurring, then we can intentionally engineer these in and design lithium metal batteries that meet the performance metrics required for commercialization," Marbella says.



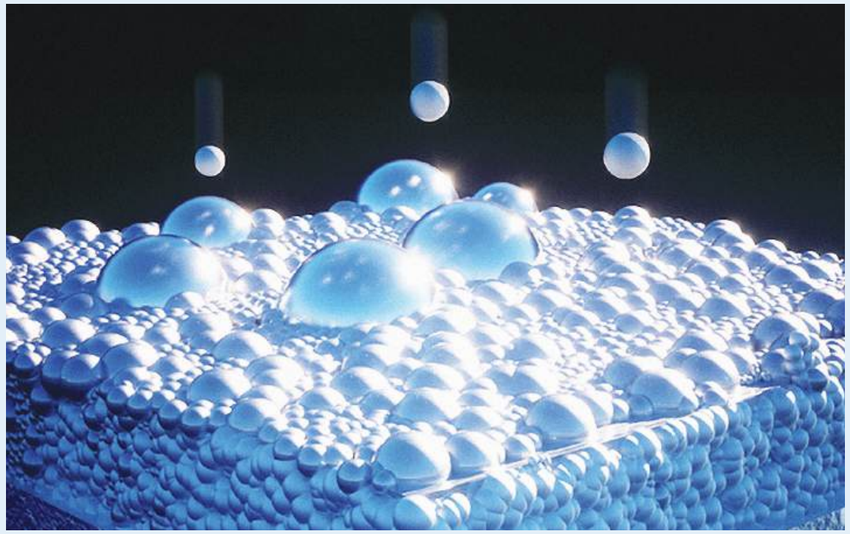
SCHEMATIC OF THE PYTHON TOOTH-INSPIRED DEVICE INTERPOSED BETWEEN TENDON A BONE SIGNIFICANTLY ENHANCES STANDARD ROTATOR CUFF REPAIR. (IDEN KURTALIAJ)

Python teeth inspire innovation that doubles the strength of rotator cuff repairs

More than 17 million Americans injure a rotator cuff every year. These injuries aren't just debilitating—they're also hard to treat with existing techniques. While a younger patient with a minor tear can expect surgery to succeed about 80% of the time, the success rate for older patients with significant injuries is just 6%.

To improve these outcomes, a multidisciplinary team led by Stavros Thomopoulos, a professor of orthopedics at Columbia University's Vagelos College of Physicians and Surgeons and a professor of biomedical engineering at Columbia Engineering, looked to the animal kingdom for inspiration.

"We designed it specifically so that surgeons won't need to abandon their current approach. They can simply add the device and increase the strength of their repair." —*Iden Kurtaliaj*



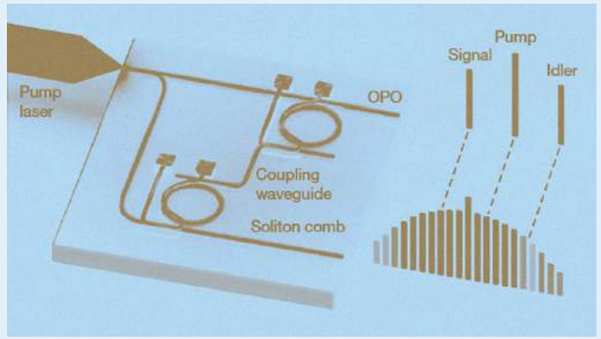
LITHIUM-IONS APPROACHING THE SOLID ELECTROLYTE INTERPHASE ON A LITHIUM METAL ANODE. (ELLA MARU STUDIO)

Pythons are known for using their bodies to constrict prey before eating it whole, but that's not the full story. The snake uses its backward-facing teeth to grasp prey so they can't wriggle away.

As it turns out, this design is perfectly suited for grasping soft tissue—such as a torn rotator cuff—without inflicting too much damage. Thomopoulos and student Iden Kurtaliaj collaborated with orthopedic surgeon William Levine and mechanical engineering professor Guy Genin to apply the technique to rotator cuff repair.

Their device attaches to a healing rotator cuff using an array of small, backward-facing teeth. By protecting the tissue from the sutures installed during surgery, the device prevents the most common route of surgical failure.

"We designed it specifically so that surgeons won't need to abandon their current approach," Kurtaliaj says. "They can simply add the device and increase the strength of their repair."



THIS SCHEMATIC ILLUSTRATES THE TEAM'S ON-CHIP LOW-NOISE MICROWAVE GENERATION VIA FREQUENCY DIVISION. (GAETA LAB)

A groundbreaking microwave chip

Electronic devices like GPS units, autonomous vehicles, and wireless communication systems need components that provide a source of stable microwave signals. These high-frequency metronomes serve as clocks and carry information. Random variation in that signal, called noise, limits the device's overall performance.

Within the past decade, researchers have developed a new way to generate microwave signals with very little noise. However, the technique—called optical frequency division—requires a hardware setup the size of a tabletop, making it impractical for use in smaller devices.

Researchers at Columbia Engineering have developed a device that performs this technique on a chip that could balance on the point of a sharp pencil.

"We have realized a device that is able to perform optical frequency division entirely on a chip in an area as small as one to two millimeters using only a single laser," says Alexander Gaeta, the David M. Rickey Professor of Applied Physics and Materials Science and a professor of electrical engineering at Columbia Engineering.

"We demonstrate for the first time the process of optical frequency division without the need for electronics, greatly simplifying the device design."

Developed in collaboration with Michal Lipson, the Eugene Higgins Professor of Electrical Engineering and a professor of applied physics at Columbia Engineering, the chip is designed and fabricated to produce a completely optical device that uses just one laser to generate a 16-GHz microwave signal with the lowest frequency noise that has ever been achieved in an integrated chip platform. The device uses two photonically coupled micro-resonators to produce the extremely pure signal.

"Eventually, this type of all-optical frequency division will lead to new designs of future telecommunication devices," Gaeta says. "It could also improve the precision of microwave radars used for autonomous vehicles."

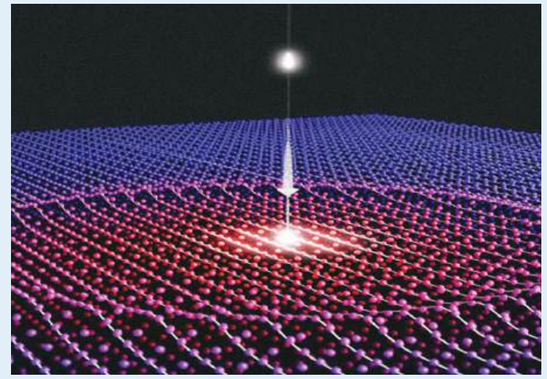
A new method for tracking atoms

The materials used to make devices like computer chips, batteries, and chemicals place a ceiling on how efficient, reliable, and robust those technologies can be.

For example, important fertilizers are created by reacting gases on the surface of a catalyst. Over time, the catalyst degrades as the atoms that comprise it shift and cause deformations, slowing the process and requiring more energy. Understanding these atomic changes is key to optimizing fertilizer production and securing the global food supply.

Until recently, researchers developing advanced materials faced a roadblock: The atoms they were working with moved faster than they could track using existing technology.

For the first time, the researchers employed a technique for analyzing materials—ultrafast atomic pair distribution function—using an X-ray free-electron laser.



THE IMAGE SHOWN ILLUSTRATES THE ABSORPTION OF A LASER PHOTON INITIATING A SMALL CHANGE THAT PROPAGATES THROUGH THE MATERIAL OVER TIME, RATHER THAN INSTANT-ANEOUSLY CHANGING THE WHOLE MATERIAL. (JACK GRIFFITHS/ BROOKHAVEN NATIONAL LABORATORY)

Just as a camera with a slow shutter speed can't capture an extremely quick event, the X-ray pulses that researchers used to study materials were too slow to capture images of atomic behavior on the scale of a picosecond. (In one second, light can travel around the earth seven and a half times. But in one picosecond, light can travel only one-third of a millimeter.)

A team of researchers at Columbia Engineering and the Department of Energy's Brookhaven National Laboratory finally cracked the problem.

For the first time, the researchers employed a technique for analyzing materials—ultrafast atomic pair distribution function—using an X-ray free-electron laser. The breakthrough required careful coordination across multiple teams of physicists and engineers.

"I was simply blown away by how well it worked," says Simon Billinge, professor of materials science and of applied physics and applied mathematics at Columbia Engineering.

Welcoming Our New Faculty for 2024

This year, Columbia Engineering brings on a new cohort of researchers poised to make a big impact. These new faculty joined Columbia Engineering in the spring and fall semesters of 2024.

Adeyemi Adeleye

ASSISTANT PROFESSOR, EARTH AND ENVIRONMENTAL ENGINEERING
SUSTAINABLE WATER TREATMENT, ENVIRONMENTAL REMEDIATION, PFAS, MICROPLASTICS

Liliana Borcea

GEORGE P. LIVANOS PROFESSOR OF APPLIED PHYSICS AND APPLIED MATHEMATICS
WAVES IN RANDOM MEDIA, INVERSE WAVE SCATTERING, REDUCED ORDER MODELING

Aravind Devarakonda

ASSISTANT PROFESSOR, APPLIED PHYSICS AND APPLIED MATHEMATICS
QUANTUM MECHANICAL BEHAVIOR OF MATTER; MATERIALS HOSTING UNUSUAL, EMERGENT ELECTRONIC BEHAVIOR

Neil Dolinski

ASSISTANT PROFESSOR, CHEMICAL ENGINEERING
DYNAMIC BONDS TO MAKE, BREAK, AND REARRANGE POLYMERS AND NETWORKS

Micah Goldblum

ASSISTANT PROFESSOR, ELECTRICAL ENGINEERING
DEEP LEARNING, SAFE AI SYSTEMS, MATHEMATICS

Anran Hu

ASSISTANT PROFESSOR, INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH
APPLIED PROBABILITY, REINFORCEMENT LEARNING, STOCHASTIC CONTROL, MEAN-FIELD GAMES

Tanvir Ahmed Khan

ASSISTANT PROFESSOR, ELECTRICAL ENGINEERING
COMPUTER ARCHITECTURE, SOFTWARE SYSTEMS, PROGRAMMING LANGUAGES

Yunzhu Li

ASSISTANT PROFESSOR, COMPUTER SCIENCE
ROBOTICS, COMPUTER VISION, MACHINE LEARNING

Tianyi Lin

ASSISTANT PROFESSOR, INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH
OPTIMIZATION, GAME THEORY, MACHINE LEARNING, NETWORK ECONOMICS

Marianna Maiaru

ASSOCIATE PROFESSOR, CIVIL ENGINEERING AND ENGINEERING MECHANICS
INTEGRATED COMPUTATIONAL MATERIALS ENGINEERING, VIRTUAL MANUFACTURING, COMPUTATIONAL MECHANICS

Grace McIlvain

ASSISTANT PROFESSOR, BIOMEDICAL ENGINEERING
QUANTITATIVE MEDICAL IMAGING TECHNIQUES AND APPLICATIONS, MRI, BRAIN BIOMECHANICS

Bento Natura

ASSISTANT PROFESSOR, INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH
COMBINATORIAL OPTIMIZATION, GAME THEORY, CONVEX OPTIMIZATION

Sakul Ratanalert

SENIOR LECTURER, CHEMICAL ENGINEERING
NANOSCALE DNA ASSEMBLIES, EDUCATION

Nuttida Rungratsameetaweemana

ASSISTANT PROFESSOR, BIOMEDICAL ENGINEERING
SYSTEMS NEUROSCIENCE, AI

Behzad Vaziri

ASSISTANT PROFESSOR, EARTH AND ENVIRONMENTAL ENGINEERING
EXTRACTIVE METALLURGY, MINERAL PROCESSING, SURFACE AND COLLOID CHEMISTRY, HYDROMETALLURGY

Zhengbo Zou

ASSISTANT PROFESSOR, CIVIL ENGINEERING AND ENGINEERING MECHANICS
CONSTRUCTION ROBOTS, RESPONSIVE ENVIRONMENTS

Climate Week in Photos

Columbia Engineering celebrated Climate Week NYC Sept. 23–27 by hosting several events that brought together researchers and experts at the forefront of developing solutions to help the planet and society.

"Climate Week 2024 gave us the opportunity to share some of our most ambitious efforts in addressing climate concerns, guided by our Engineering for Humanity vision," said Dean Shih-Fu Chang. This series of events featured 65 distinguished speakers and more than 2,800 registered attendees representing more than 1,300 institutions and companies.

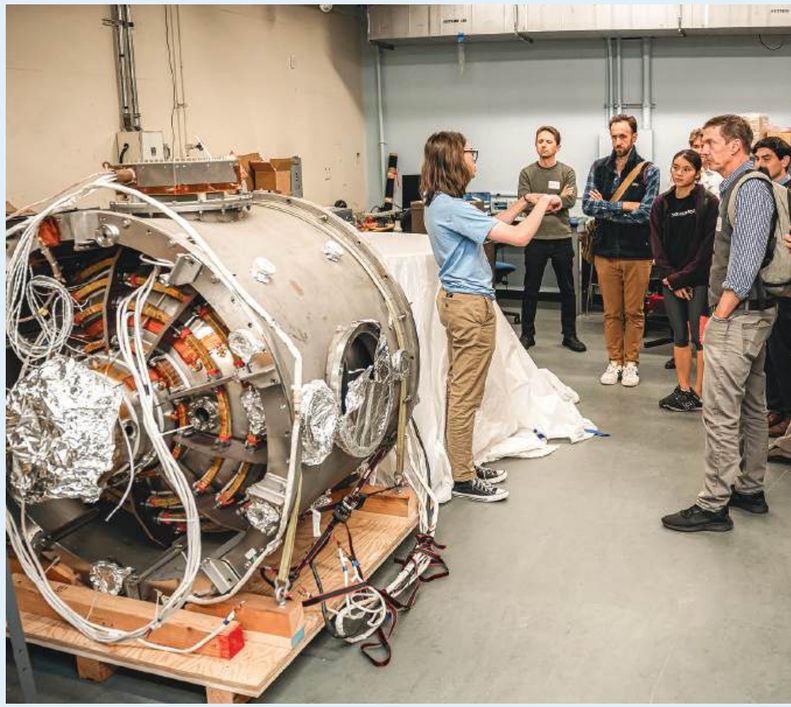
Sustainable Cloud Computing and AI

The amount of energy that data centers consume is growing exponentially. Leaders from IBM and Meta joined academic researchers to discuss how to make computing sustainable.

TAMAR EILAM, IBM RESEARCH (STEVE MYASKOVSKY)

Accelerating Commercial Fusion: the Role of Industry and Academia

After a series of milestones in fusion R&D, a panel of experts discussed progress and plans in the private sector, the ambitious timelines of leading fusion startup companies, and challenges facing the fusion energy sector.



A STUDENT RESEARCHER LEADS A LAB TOUR. (BRANDON VALLEJO)

FROM LEFT, TODD MALAN, LAURA LAMMERS, ALAN WEST. (SIRIN SAMMAN)

CEEC Fall Symposium: Climate Solutions for Sustainable Energy, Chemicals, and Materials

The Columbia Electrochemical Energy Center hosted its third annual symposium, featuring research reports and talks on green hydrogen, grid-scale energy storage, and the critical materials necessary for the energy transition.

CANDACE M. AGONAFIR, COLUMBIA WATER CENTER. (SIRIN SAMMAN)

Climate Change and Flood Risk

This workshop on climate models and flood risk was hosted by LEAP (Learning the Earth with Artificial Intelligence and Physics), an NSF-funded Science and Technology Center aimed at improving the reliability, utility, and reach of climate projections through the integration of climate and data sciences.

SATYAM VYAS, ARTHAN AND CLIMATE ASIA (LEFT) AND DORCAS AMANOR, GREEN AFRICA YOUTH ORGANIZATION. (BRANDON VALLEJO)

Catalyzing Climate Innovations in the Global South

Columbia Engineering was honored to host the launch of the EarthON Foundation, which is building an ecosystem for last-mile interventions and policy guidance to mitigate climate change, alleviate poverty, and promote health and local economies for marginalized sections of society.

TO VIEW RECORDINGS FROM MANY OF OUR CLIMATE WEEK EVENTS, VISIT: COLUMBIAENG.COM/CLIMATEWEEK2024

PIERRE GENTINE. (BRANDON VALLEJO)

Future of Computational Sciences: Learning from the AI Revolution

Pierre Gentine delivered the first talk in Columbia Engineering's new Lecture Series in AI.
In his talk, Gentine described the remarkable impact of AI and machine learning on climate change projections—and explained how researchers must build on that progress to bring about the revolution in climate science necessary to help society adapt to climate change.

Towards Sustainable Cities: Clean Air and Energy

This panel discussion and technology showcase highlighted innovative work at the interface of environmental science, engineering, public health, data science, economics, policy, and community engagement.

FROM LEFT: FAYE MCNEILL, BIANCA HOWARD, DARBY JACK, VINAY JAJU, DANIEL WESTERVELT. (DIANE BONDAREFF)

A HOODING CEREMONY FOR DOCTORAL STUDENTS TOOK PLACE DURING GRADUATE CLASS DAY—A NEW TRADITION! (LUCAS HOEFFEL)

Congratulations, Class of 2024

Words by Beatrice Mhando

The Columbia Engineering community came together at the Baker Athletics Complex for Graduate and Undergraduate Class Day, where students celebrated their academic achievements alongside friends and family.

Graduate Class Day, on Sunday, May 12, featured a hooding ceremony for doctoral students, a historic first. Additional highlights included inspiring addresses from Graduate Class Day speaker Philippe Wyder and keynote speaker Kittu Kolluri, founder and managing director of Neotribe Ventures. In his remarks, Kolluri reflected on his journey from a middle-class family to running his venture firm, advising the class of 2024 to "be honest with yourself about your capabilities and values and follow your genuine interests—the opportunities will take care of themselves."

Undergraduate Class Day, on Monday, May 13, featured remarks from Stella Lessler, senior class president, and valedictorian Andrei Coman. Seniors then heard from Disney Imagineer and alumnus Lanny Smoot BS'77, MS'78, who shared his journey from studying at Columbia Engineering to becoming a prolific inventor.

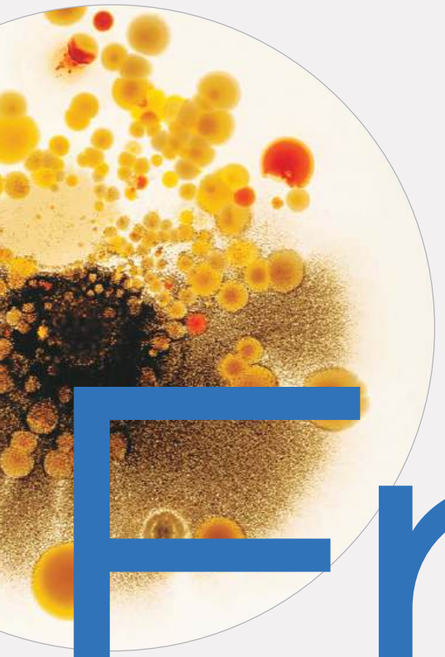
GRADUATE CLASS DAY AT THE BAKER ATHLETICS COMPLEX. (LUCAS HOEFFEL)

Smoot offered tips for navigating life after graduation, spotlighting the importance of students taking responsibility for their own futures.

"You are prepared and armored for success," said Smoot. "Do good for yourself and do good for others. And above all, enjoy what you do."

Although graduates and undergraduates celebrated Class Day separately, Dean Shih-Fu Chang addressed both audiences with a similar message: to carry the spirit of Columbia Engineering wherever their careers take them.

"The challenges of our time may be overwhelming, but the spirit of a Columbia Engineer is deeply optimistic," said Dean Chang. "As 21st century engineers, you are prepared to draw on your technical expertise and broad knowledge to develop solutions that will have a positive impact."



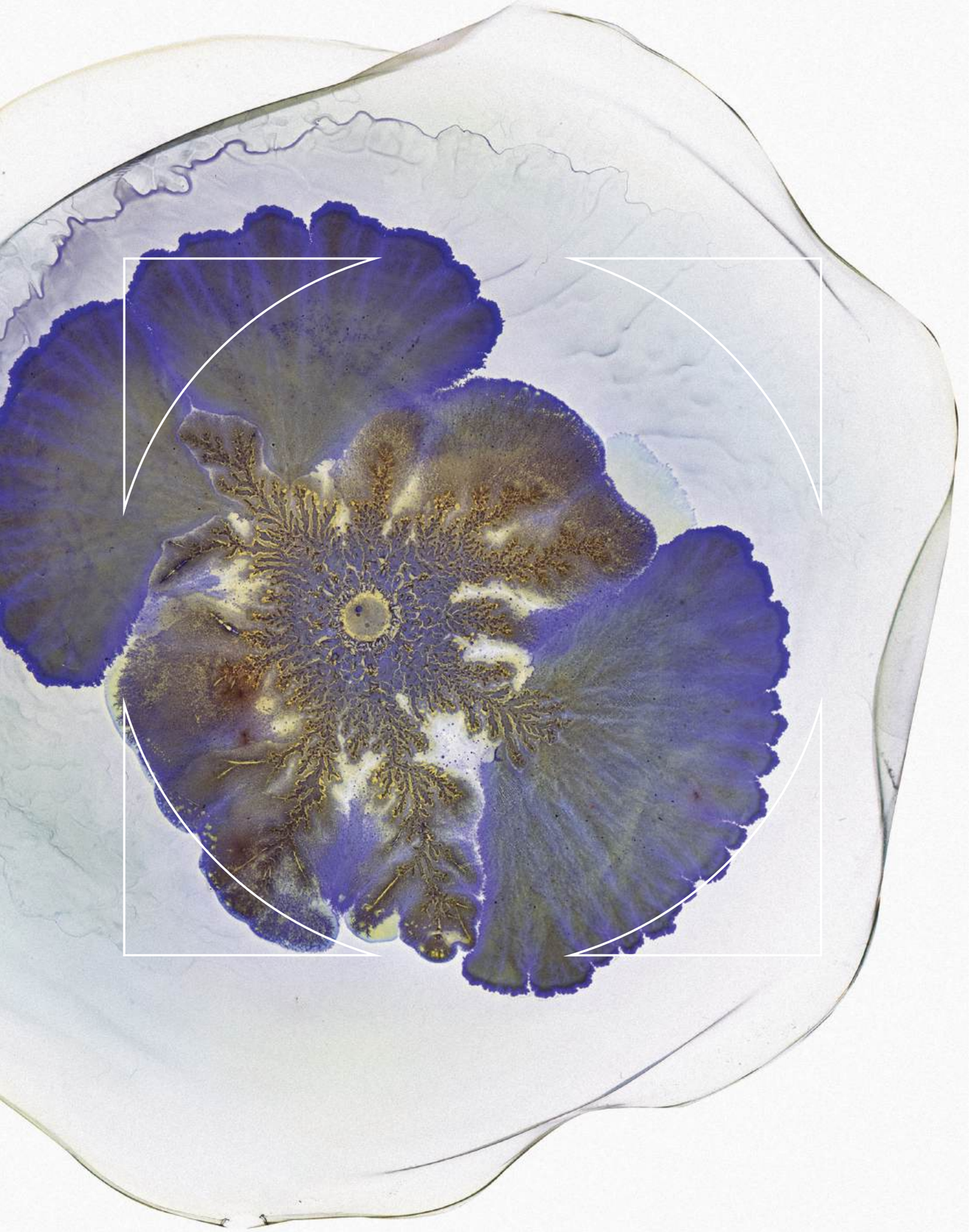
Words by
Grant Currin

THESE IMAGES OF BACTERIA WERE PRODUCED IN THE DANINO LAB AND PUBLISHED IN THE NEW ART BOOK BEAUTIFUL BACTERIA (RIZZOLI 2024).

Engineering

From the operating room to the art studio, today's greatest advances come from engineers who cross disciplines and challenge conventions.

DATA
BUSINESS
INTELLIGENCE
ART
CLIMATE
ORTHOPEDICS
NEW YORK
FREE SPEECH
WOMEN'S HEALTH



Engineering ×
The Power of Partnership

Engineer Christine Hendon and the physicians she works with see problems differently.

"A physician is trained to make the best possible decision with tools they have," Hendon says. "When an engineer encounters a problem, we're trained to ask a different question: 'Can I make a better tool?'"

An associate professor of electrical engineering at Columbia Engineering, Hendon has dedicated her career to improving health by spanning the gap between engineering and medicine. After taking a course in biomedical optics as an undergraduate engineering student, Hendon took medical school courses while completing a PhD in engineering.

"It was like learning a different language," she says. "Medicine and engineering have completely different styles of thinking."

Today, Hendon leads a research group that includes undergraduates, graduate students, and postdoctoral researchers. Working with several collaborators at Columbia University's Irving Medical School and beyond, the group is developing tools that use cutting-edge optics to help cardiac surgeons see the heart while they are delivering therapy to treat cardiac arrhythmias.

"I tell students that we're working on this because it's an unsolved problem," Hendon says. "We're all going to come up with the solution together."

Interdisciplinary collaboration is by no means new to engineers, but its role in the field is changing. As the capabilities of engineers continue to increase—and as technological innovation becomes even more fundamental to modern life—crossing disciplinary boundaries is becoming one of the most reliable routes to transformative breakthroughs.

Pushing the boundaries of engineering

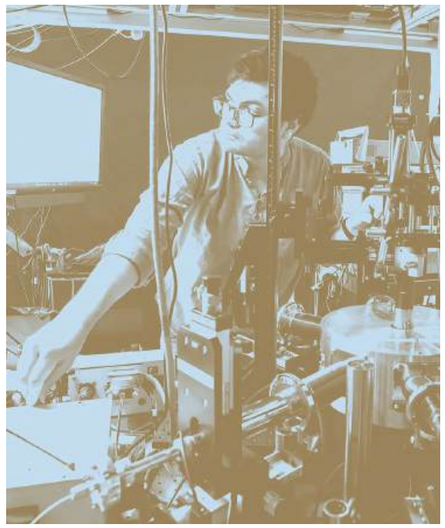
"Engineers have always been a curious lot, and we tend to be interested in the world's problems," says Garud Iyengar, a professor in the Department of Industrial Engineering and Operations Research and the Avanessians Director of the Columbia Data Science Institute. From the Industrial Revolution until the middle of the 20th century, it was the physical sciences—physics and chemistry—that most strongly influenced the field.

A SPECIES OF BACTERIA ISOLATED FROM SOIL AND GROWN IN A PETRI DISH. AFTER BEING STAINED AND DRIED, THE AGAR IN THE PETRI DISH LIFTS AND CURLS AWAY FROM THE DISH.

"When an engineer encounters a problem, we're trained to ask a different question: 'Can I make a better tool?'" —*Christine Hendon*

"There were many physicists involved in developing nuclear energy, but it took a whole bunch of engineers to actually make it happen," Iyengar says. Once physicists determined that splitting an atom would unleash enormous amounts of energy, engineers had to step in and figure out how to use technology to control the reaction, contain the energy, and transform it into useful electricity. By the 1950s, revolutions in genetics and neuroscience had laid the groundwork for engineering disciplines such as biomedical engineering and artificial intelligence. Today, researchers at Columbia Engineering are collaborating with experts in nearly every field, including the arts, humanities, and social sciences.

"Engineers have always had a need to make technology that improves human existence," Iyengar says. "Along the way, we pick up skills. As those skills develop, our breadth increases."



THE LIPSON PHOTONICS GROUP INVESTIGATES THE PHYSICS AND APPLICATIONS OF NANOSCALE PHOTONIC STRUCTURES. (JOHN ABBOTT)

Legal scholars, for example, have long had a philosophical perspective on data privacy, called contextual integrity.

"Now, we can combine this concept with differential privacy to build effective safeguards," Iyengar explains. "Twenty-five or 30 years ago, you never would have imagined that."

ENGINEERING × DATA / BUSINESS / INTELLIGENCE / ART / CLIMATE / ORTHOPEDICS / NYC / FREE SPEECH / WOMEN'S HEALTH

The building blocks of collaboration

For Hendon, the "tight community" at Columbia Engineering is one of the most important factors supporting work that crosses traditional disciplinary boundaries.

"It's amazing how those collaborations spark so much intellectual curiosity," she says. "You start your faculty position with a particular research direction. Then you get here, you meet people, and your career and research are enriched through these partnerships."

Hendon met one of her most frequent collaborators, Associate Professor of Mechanical Engineering Kristin Meyers, at an orientation for new faculty members.

"We were doing experiments together the next week," Hendon says. "It launched our 12-year collaboration."

While interdisciplinary work is increasingly encouraged and supported by the institutions that fund research, Hendon says that getting such projects off the ground can be more difficult than continuing down a well-worn path. Submitting to a large federal funding mechanism, for example, means presenting preliminary data to a multidisciplinary group of reviewers. Interdisciplinary projects often need to time to generate their own preliminary data due to the newness of the research problem they are tackling.

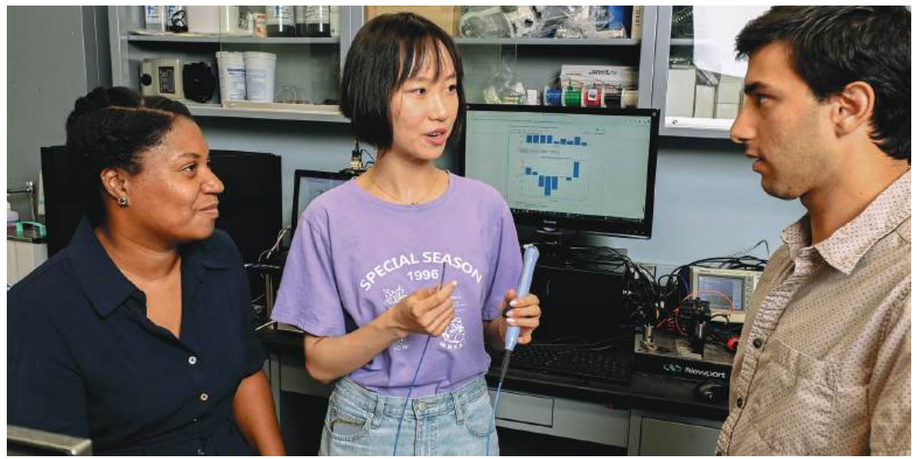
For students, working on an interdisciplinary collaboration can mean learning and exploring new terrain alongside their professor. Hendon encourages her students to incorporate what they are learning in their courses within their research.

"It takes time for the students to get comfortable, but by the end of a project, they're always proposing ideas for new designs, analysis, and experiments," she says. "It becomes a truly collaborative process among everyone who's on the team."

Read on to learn about a few recent additions to Columbia Engineering's growing portfolio of collaborations.

Visit our digital issue for featured videos and additional content.

columbiaeng.com/winter2025



CHRSTINE HENDON (FAR LEFT) WITH HER STUDENTS. (CHRIS TAGGART)

"Engineering has always been data-driven, but as we developed better measurement technologies, we entered the big data regime."

—Garud Iyengar

ENGINEERING × DATA

"In the past, engineering was driven by a symbiotic relationship with the basic sciences," says Garud Iyengar, professor of industrial engineering and operations research and director of Columbia's Data Science Institute. "Engineering has always been data-driven, but as we developed better measurement technologies, we entered the big data regime."

In the hands of computer scientists and statisticians, big data became a raw input for making predictions that didn't need to depend on understanding the underlying physics or chemistry of a system. This revolution began by tackling problems like labeling images of cats and, eventually, interpreting X-rays. Over time, researchers realized these technologies could be applied to a broad set of problems. "Suppose I want to build a new material. I know that this new material's properties are going to depend on the molecules that comprise it," Iyengar explains. "If I have data about tons and tons of molecules and how they behave, then I can start predicting what's going to happen to the properties of a particular material."

Over time, researchers have blended these approaches.

"Making predictions using data is great, but what if one could incorporate constraints based on limitations from physics and chemistry? By incorporating that knowledge, one can use the data much more efficiently and, in a sense, 'regularize' the prediction," Iyengar says.

In a virtuous cycle, breakthroughs in measurement, data analysis, and engineering have collectively enabled an explosion in progress across every domain of engineering research.

"I almost think of what is classically called data science as a step in the solution of an engineering problem," Iyengar notes. "We are very fortunate at Columbia to have engineers who are thinking about the applied problems, plus really good statisticians, operations research people, and computer scientists who can come together to develop solutions that use data in the best, most responsible way possible."

ENGINEERING × BUSINESS

Engineering and business have been deeply intertwined since the dawn of trade and commerce. While these pursuits have been two of the most powerful forces shaping today's prosperous and technologically advanced world, solving our most pressing challenges requires that relationship to become even more profound.

"Many of the most serious crises that our society is facing today—climate change, dramatic demographic change across the world, and the erosion of truth—are potentially civilization-ending," says Harry West, professor of practice at Columbia Engineering. "Those problems are going to require deep-tech solutions. They aren't going to be solved with an app."

That conviction motivated Columbia Engineering and Columbia Business School to develop the MBAxMS, a dual-degree designed to prepare students to serve as tomorrow's technically proficient business leaders.

"We need more people who can do both because the problems we're facing right now require surprising technical solutions that have to be scaled quickly," says West, who is engineering director for the program. "We aim to train leaders in a different way, one in which you are capable of making both business and technical decisions at the same time. That's the group of students we're trying to develop."

STUDENTS GATHERED BESIDE LE MARTELEUR. (JOHN ABBOTT)

ENGINEERING × INTELLIGENCE

Computer scientists have taken inspiration from the brain since the 1940s. Neuroscientists have used computational methods to interpret experimental data for nearly that long. Today, both fields are regularly making breakthrough discoveries and advancements.

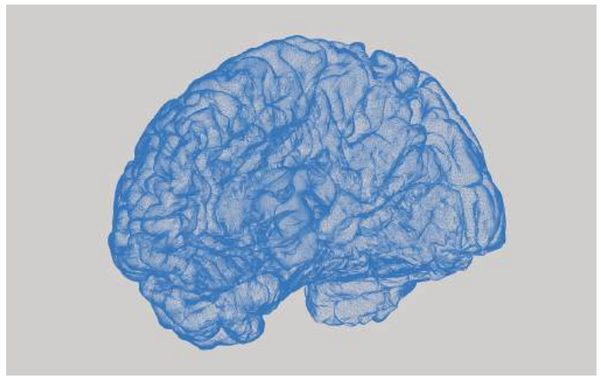
Columbia Engineering is now leading a National Science Foundation-funded research institute that enables computer scientists, neuroscientists, and cognitive scientists to search for answers to a vital question: What principles underlie both natural intelligence and artificial intelligence? Along the way, researchers at the institute, called ARNI (short for artificial and natural intelligence), hope to develop new paradigms for interdisciplinary research connecting the fields.

"Humans are constantly looking at the environment around them and trying to guess what's about to happen," says Richard Zemel, director of ARNI and the Trianthe Dakolias Professor of Engineering and Applied Science in the Department of Computer Science at Columbia Engineering.

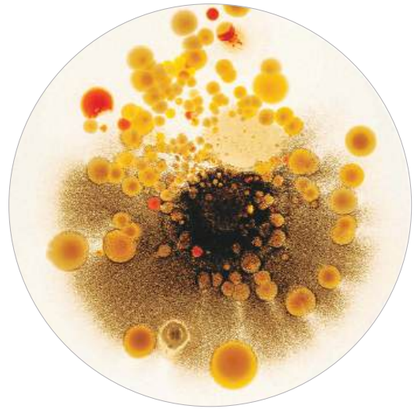
"We're faced with prediction problems all the time—either explicitly or implicitly—as we operate in the world," he says. "Presumably, that's what our brains are tuned to do."

At ARNI, every research project includes a PI whose primary specialty is natural intelligence and another who focuses on artificial intelligence. The goal is to make discoveries that accelerate progress in both disciplines, with an eye to advancing useful knowledge and technologies. For ARNI's many engineers, thinking of the brain as a prediction machine clarifies the search for common principles of intelligence as an engineering problem.

"We're trying to build a system that can predict what's going to happen next, even in novel or very challenging situations," Zemel says.



A DIGITAL RENDERING OF A HUMAN BRAIN. (UNSPLASH)



ENGINEERING × ART

Bacteria are ubiquitous almost everywhere on earth—including inside the human body.

For decades, researchers have been engineering these microbes in the hope of developing new ways to diagnose and treat disease. Tal Danino, associate professor of biomedical engineering at Columbia Engineering, is a leader in that effort. His Synthetic Biological Systems Lab has developed groundbreaking advancements in using bacteria to treat lung and colorectal cancer and even "painting" targets that lead the body's own immune system to kill cancerous cells.

Danino and his lab members are also artists, using bacteria to create wondrous images that expose the hidden world of microbes and reveal the beautiful diversity of these unseen worlds.

"As a graduate student, I made movies of *E. coli* by using a microscope to take a picture every minute and then stitching them together," Danino says. "These movies became a really effective form of science communication, both for telling colleagues about our experiments and for introducing microbes to kids and other general audiences."

Danino's movies became the launching point for making art with the bacteria themselves. In his new book, "Beautiful Bacteria" (Rizzoli 2024), he shares gorgeous images alongside a crash course in the history and future of bacteria and the many, many ways they impact human life. The Petri dish photographs also reflect toward the ephemeral nature of creating art with living things.

"Bacteria become living collaborators in the artworks. It's something that's very unique, and it's really hard to reproduce. We could never reproduce any of the images in the book—that's part of the artistic process," Danino says.

ARTWORK FROM TAL DANINO'S BOOK, "BEAUTIFUL BACTERIA."

"Engineers tend to speak different languages than scientists—or even people in different parts of engineering." —*Pierre Gentine*

ENGINEERING × CLIMATE PROJECTIONS

Developing AI models to forecast climate change "isn't so different from building ChatGPT," says Pierre Gentine, the Maurice Ewing and J. Lamar Worzel Professor of Geophysics in the Departments of Earth and Environmental Engineering and professor of Earth and Environmental Sciences at Columbia Engineering. "Instead of trying to predict text, we're trying to predict the climate."

As director of Learning the Earth with AI and Physics (LEAP), an NSF Science and Technology Center, Gentine leads a team that includes engineers, climatologists, statisticians, earth scientists, education researchers, and social workers.

"We use different terms to mean the same thing, and that's been a real challenge," he says. "Engineers tend to speak different languages than scientists—or even people in different parts of engineering."

The team overcomes this challenge through "internal knowledge transfer" sessions, where everyone makes a point of being explicit about what each term they use means to their community. "We try to keep an open mind, stay humble, and listen closely to make sure everyone understands what everyone else is doing," he says. "Ensuring that junior scientists have a voice has also proven to be very important."

That spirit of collaboration is central to LEAP's effort to jump-start the development of climate data science and transform a messy tangle of data streams into a practical resource for the world's leaders.

"It's not just science and equations—we're trying to translate data and knowledge into something useful to the world," he says. "The communications piece is crucial."

ENGINEERING × ORTHOPEDICS

NADEEN O. CHAHINE, ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING IN THE DEPARTMENT OF ORTHOPEDIC SURGERY AT VAGELOS COLLEGE OF PHYSICIANS AND SURGEONS (VP&S) (LEFT) AND CLARK HUNG, PROFESSOR AND VICE CHAIR OF THE DEPARTMENT OF BIOMEDICAL ENGINEERING AT COLUMBIA ENGINEERING AND PROFESSOR OF ORTHOPEDIC SCIENCE IN THE DEPARTMENT OF ORTHOPEDIC SURGERY AT VP&S. (STEVE MYASKOVSKY)

"Biomedical engineering was spawned from the classical engineering disciplines, but it's fundamentally multidisciplinary," says Clark Hung, professor and vice chair of the Department of Biomedical Engineering at Columbia Engineering and professor of orthopedic science in Orthopedic Surgery at Columbia's Vagelos College of Physicians and Surgeons (VP&S). "When the discipline was emerging several decades ago, orthopedics was a natural venue to showcase how mechanics could be applied to the body."

Early research centered on developing braces to correct problems by applying mechanical force to bones, teeth, and other tissues. Today, biomedical engineers work closely with clinicians and medical researchers to develop a wide range of medical devices, biomaterials, clinical methods, and insight into how living organisms function.

"Columbia has historically been a powerhouse in biomechanics—in particular for articular cartilage, which is the connective tissue that covers our bones," Hung says.

That legacy has reached a new pinnacle through a massive, accelerated project to develop the technology for a low-cost, biocompatible knee joint replacement that uses stem cells.

"There's such a deep bench of researchers at Columbia Engineering and Columbia University Irving Medical Center who work in this area, but we've never been able to have such a large multidisciplinary team come together to collaborate on one project before," says Nadeen O. Chahine, associate professor of biomedical engineering in the Department of Orthopedic Surgery at VP&S.

Typically, two or three researchers work together on a project. Now, through the ARPA-H Novel Innovations for Tissue Regeneration in Osteoarthritis program, researchers from across Columbia and beyond are working on an accelerated, high-impact project. The agency is modeled on the Defense Advanced Research Projects Agency's renowned funding approach and inspired by the tremendous success of rapidly creating vaccines during the COVID-19 pandemic.

"To bring 15 PIs and co-PIs together under a single project with one goal is an unprecedented opportunity for collaboration," Chahine says. "This is a stressful, high-paced project, and having those longstanding relationships is essential—it's really a team effort."

ENGINEERING × NEW YORK

From the Brooklyn Bridge to the system of reservoirs and aqueducts that provide a billion gallons of drinking water per day, New York City is home to some of the world's great engineering marvels.

The city's diversity, population density, and dynamic spirit make it an ideal place for developing new technologies. Columbia Engineering's faculty are leading projects across the five boroughs, ranging from using drones to map tree populations in city parks to predicting how climate change will impact individual neighborhoods.

For Sharon Di, associate professor of civil engineering and engineering mechanics, and her colleagues at the Center for Smart Streetscapes (CS3), New York City is a proving ground for emerging technologies that could transform how people travel through the city.

In one project, Di and her research team are leveraging the capabilities of the NSF-supported COSMOS testbed—a network of next-generation sensors and communications infrastructure located right beside the Morningside Heights campus—to develop an instant messaging platform that keeps vulnerable pedestrians safe.

"In New York City, we can deploy some of the sensors necessary to develop these new technologies," Di says. "That infrastructure allows us to do all kinds of research that is impossible elsewhere."

STUDENTS AT THE 125TH ST. SUBWAY PLATFORM NEAR THE MANHATTANVILLE CAMPUS. (JOHN ABBOTT)

One of the hallmarks of the research at CS3 is a commitment to working alongside the community to develop technologies that neighborhood residents want and can trust.

"Unless we work with the local community, what we are doing as researchers probably won't end up improving things in the real world," she says.

Last summer, Di joined a group of high school students from across the city as they spoke with residents at a local senior center about their views on mobility.

"They told us about issues we hadn't been considering, like how litter, puddles, and electric bikes make it difficult to navigate the sidewalks," she says. "We learned a lot about their practical challenges."

ENGINEERING × FREE SPEECH

"There's really no way to answer the hardest free-speech questions of the digital age without the involvement of engineers and computer scientists," says Jameel Jaffer, executive director of the Knight First Amendment Institute at Columbia University. "Most of the speech that's important to our democracy today is mediated by digital platforms and tools whose operation is a mystery to their users and sometimes even their creators."

Collaboration among engineers, social scientists, and lawyers is essential for contending with the profound implications of rapidly changing technologies—such as social media platforms and artificial intelligence systems—for free speech and our democracy.

"We need engineers and computer scientists to help us understand how these platforms and tools work and whether they could be designed differently," Jaffer says. "We also need them to help us understand what regulatory frameworks might be sensible and effective."

To advance these interdisciplinary partnerships, the Knight First Amendment Institute and Columbia Engineering have jointly funded projects at the intersection of law, policy, and technology, with the aim of expanding the partnership to encompass larger research collaborations, public programs, and curricular offerings.

"The leadership of engineers and computer scientists is essential to understanding the societal implications of new technology—including its free-speech implications," Jaffer says.

ON THE COVER

A New Era for Women's Health Research

In their groundbreaking collaboration, mechanical engineer Kristin Myers and electrical engineer Christine Hendon are answering vital questions in maternal and gynecological health—and developing lifesaving technologies.

Words by
Meeri Kim

Columbia Engineering professors Christine Hendon and Kristin Myers first met at a new faculty orientation in 2012, sparking a unique collaboration in women's health that has spanned more than a decade.

Hendon had just joined the Department of Electrical Engineering as an assistant professor, specializing in the optical imaging of cardiac tissue for surgical guidance. Myers, then a junior faculty member in the Department of Mechanical Engineering, approached Hendon about using her optical technique on the female reproductive system, an area she has studied since graduate school.

"I think I snagged her with the curiosity," says Myers, now an associate professor of mechanical engineering. "And then, being female engineers, we kind of got to nerd out on the uterus."

Since that first conversation, the pair have worked together on several projects focused on the quantitative imaging and biomechanics of women's physiology, particularly the uterus and cervix. Women's health has historically been understudied in engineering fields, despite the fact that many maternal and gynecological conditions have underpinnings in tissue structure and function. Myers and Hendon hope to do for women's health what engineering has done for disciplines like orthopedics and cardiology.

"There are many areas of medicine where we've seen that technology has made a large impact, either in terms of analytics for predictive algorithms and risk assessment or devices for sensing and measuring physiological conditions," says Hendon, now an associate professor of electrical engineering. "The women's health technology market is not as explored as it could be, so there are just so many opportunities for engineers to help."

ASSOCIATE PROFESSOR OF ELECTRICAL ENGINEERING CHRISTINE HENDON (LEFT) AND ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING KRISTIN MEYERS. (CHRIS TAGGART)

EXAMPLE OPTICAL COHERENCE TOMOGRAPHY IMAGE OF A SEEDLING FIBROID. (ARIELLE JOASIL)

"The women's health technology market is not as explored as it could be, so there are just so many opportunities for engineers to help."

—Christine Hendon

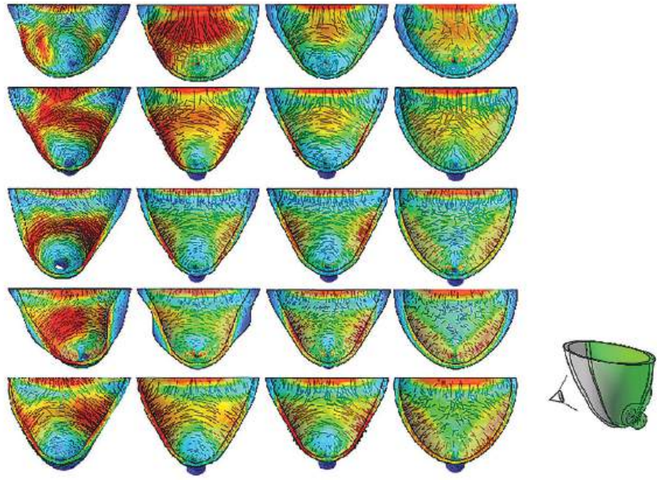
Their collaborative research started with exploring the tissue properties of the cervix and how it contributes to preterm birth. Preterm birth complications are the leading cause of death among children under 5 and affect more than one in 10 babies worldwide. The cervix, a soft fibrous organ that connects the uterus and vagina, controls when the baby exits the uterus during childbirth. Spontaneous preterm birth can occur when the cervical structure is compromised and unable to cope with downward pressure generated by the uterus.

Learning from twins

The Myers lab builds digital twins of the uterus and cervix to quantify the amount of mechanical loading on the soft tissue structures supporting the fetus and uncover the structural reasons for preterm birth. To create a more accurate digital twin, Hendon and her colleagues use optical coherence tomography (OCT) to characterize collagen fiber orientation and dispersion in cervical samples, which provides information about the mechanical properties. OCT—an optical imaging modality regularly employed in ophthalmology—takes high-resolution, cross-sectional images of tissue with light.

The researchers observed cervical tissue at micron-scale levels of detail and mapped how the variable properties of collagen fiber can make one susceptible to preterm birth. In fact, early results show measuring patient-specific cervical stiffness and load pattern predicts preterm birth better than the clinical standard of care, which is simply measuring the length of the cervix. Using a mechanics-based approach, they aim to build a preterm birth risk assessment tool that is tailored to the individual patient to replace outdated, one-size-fits-all options.

"Eventually, we want to get to a point where we can diagnose medical conditions like preterm birth and fibroids earlier," Hendon says. "Almost universally in medicine, if you identify things earlier, the easier it is to treat that condition and with better outcomes."



DIGITAL TWINS OF THE BIOMECHANICAL FUNCTION OF THE UTERUS AND CERVIX, MAPPING THE TISSUE STRETCH FOR FIVE PREGNANT PATIENTS AT DIFFERENT ANATOMICAL RESOLUTIONS. (ERIN LOUWAGIE)

Previously, they performed fundamental optical and biomechanical characterizations of the human uterus with samples taken from patients, both pregnant and not pregnant, who underwent hysterectomy. Most recently, Myers and Hendon have been tackling uterine fibroids, benign growths that form in the uterus. About 70% of women have uterine fibroids by the onset of menopause, and up to half suffer from symptoms like heavy menstrual bleeding, reproductive issues, pain, and frequent urination.

They work closely with Arnold Advincula, vice chair of women's health and chief of gynecology at the Sloane Hospital for Women at New York-Presbyterian/Columbia University Irving Medical Center, specializing in minimally invasive surgical techniques such as removal of fibroids.

"He has special techniques that can pluck out fibroids in hopes of saving the uterus," Myers says. "We want to build tools that can help him with surgical planning and diagnose if a patient's fibroids are going to be harmful."

Last year, the pair helped establish Columbia Engineering's Women's Health Initiative, which brings together a multidisciplinary community of engineers, physicians, and professionals for what remains a largely understudied and underfunded field. The initiative not only sheds light on gynecology and pregnancy but also aging, cancer, and sex-based differences.

"There's been growing interest in women's health across the board, and there are many faculty and students who want to become involved," says Hendon. "We believe this initiative can provide a mechanism for like-minded people to come together, build teams, and drive innovation."

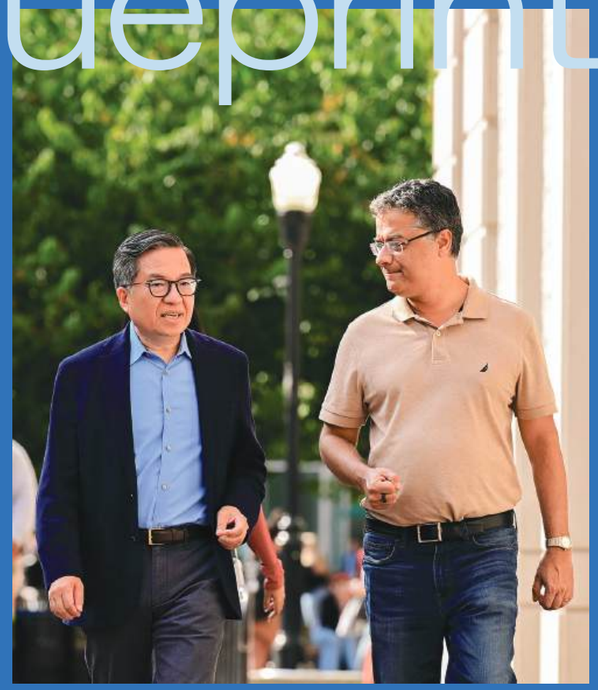
"This field of women's health—pardon the pun, but it's our baby. Christine and I started this work before being moms, and then we both became moms around the same time," says Myers. "So we've been patients ourselves, gone through the standard of care, and seen the gaps. As engineers, we feel like we can tackle them."

FEATURE

Drafting the Blueprint for AI at Columbia Engineering

Interview by
Grant Currin

Photography by
Chris Taggart



DEAN CHANG AND VICE DEAN MISRA WALKING THROUGH CAMPUS.

In this conversation, Dean Shih-Fu Chang and Vice Dean Vishal Misra discuss how the School is driving and responding to this exciting moment in the development of artificial intelligence.

Artificial intelligence isn't new at Columbia Engineering. Our researchers have been probing the foundations of AI and implementing machine learning algorithms for decades. Today, faculty in our computer science and related departments are world leaders in understanding AI systems, and researchers across the School are applying models to domain areas that range from simulating the behavior of atoms to predicting Earth's climate.

In this interview, Dean Shih-Fu Chang and Vishal Misra, vice dean for computing and AI, reflect on the recent explosion in interest and investment in AI systems as well as concerns about how they will impact society.

It's been two years since ChatGPT became widely available. As leading AI researchers, have you been surprised by its impact?

Vishal Misra: Not really. From the moment it came out, people were asking it to write poetry, code, or work with data. It could do anything that people wanted, and the fact that it was free meant everybody was trying it. It's become the fastest growing software application in history, whether enterprise or consumer. Since I had been working with these models for some time, I believed in their power. The form factor that OpenAI created—a chatbot based on a large language model—appealed to people and felt very natural.

Shih-Fu Chang: I'm not surprised by the impact either. What did surprise me was the speed of progress. In the past, software generation took years. Now, there's a new generation with exponentially greater capabilities every few months. It's amazing to see how quickly things have changed in such a short time. The idea that AI could not only answer questions one by one but remember context, engage in longer conversations, and mix different modalities—text, image, audio—is incredible. And it's doing all of this faster, cheaper, and with smaller models, which is the dream of AI researchers.

Training a foundation model is so expensive that only a handful of companies can afford to do it. How do universities fit into this resource-intensive landscape?

SC: We can't compete with companies on the sheer scale of training resources, but that's not where our strength lies. What universities can do is lead in other aspects. We go deeper into understanding the foundation of AI, explaining why it works (or why it doesn't) and why it behaves in certain ways. This concept of explainable AI has been around for a while, but it is particularly crucial now because of how fast AI is advancing. Universities should also focus on questions that industry isn't currently prioritizing. For example, How do you develop machine learning that learns with fewer examples? How do you ensure that AI behaves ethically and responsibly?

VISHAL MISRA IS VICE DEAN OF COMPUTING AND ARTIFICIAL INTELLIGENCE AND PROFESSOR OF COMPUTER SCIENCE.

VM: What we can do is really understand what makes these models tick and come up with better architectures. Many current models are trained using brute force: more data, bigger models. But do you need a model that understands both quantum gravity and Python code? Probably not. In academia, we're in a position to create more efficient architectures that are tailored to specific tasks. The challenge is finding the right set of training data and the right model size to solve specific problems effectively. The idea is to ensure that AI is targeted and not just an all-encompassing giant.

How is Columbia Engineering investing in AI infrastructure to support this kind of work?

SC: We're investing heavily in high-performance computing infrastructure for a group of faculty to use in their work on foundational AI research, experimenting with new architectures, algorithms, and data ingestion techniques. This GPU cluster will be located on the Morningside Heights campus and represents an investment of about $10 million. In addition, our faculty are playing an active role in developing the state-wide Empire AI GPU supercluster, a $400 million multi-institution public-private initiative launched in April 2024 by New York Gov. Kathy Hochul, in support of large-scale AI academic research.

How does Columbia Engineering contribute to interdisciplinary AI applications, such as in finance, health, or climate science?

SC: Universities lead in foundational technology and theory. But to have a real impact, you need to work with experts in different disciplines. Columbia Engineering focuses on combining our computational strengths with practical applications. In finance, for example, we collaborate with Columbia Business School on risk assessment, analytics, and logistics optimization. That is, how do we use AI to analyze financial information, summarize reports, and make predictions? In health care, we work closely with the medical school and New York's health care industry to develop AI-based diagnosis and treatment technologies. Climate prediction is another area where Columbia is particularly strong. We have one of the best institutions in the country for combining climate science and artificial intelligence.

VM: Sports is another example. A few years ago, we realized that many faculty members were independently working on sports-related AI projects, whether in mechanical engineering, computer science, or biomedical fields. With funding from our industry partner, Dream Sports, we recently launched the Columbia-Dream Sports AI Innovation Center. In September, we held a symposium featuring leading academics as well as AI experts from the NBA and New York Yankees. Bringing people from all over the country together in one place made a huge difference and is sure to spark many new collaborations.

Much of the discussion around AI in education centers on cheating. What role should this technology play in teaching and learning?

VM: One of the first things I do in my undergrad class is ask ChatGPT to solve an old homework problem. I ask students to find and correct the subtle mistakes in the answers generated by ChatGPT. This not only helps them understand the material—it teaches them not to blindly trust these models. Since these models are here to stay, the question becomes, how do we use them to improve learning rather than hinder it? One example is a course assistant chatbot that we're developing. It's designed to guide students toward the answer rather than giving it outright, simulating how a human teaching assistant would respond. It will offer hints, point out mistakes, and direct students to course material. We're working with the Center for Teaching and Learning to test it, but early indications show that it's helping students learn more.

SHIH-FU CHANG IS DEAN OF COLUMBIA ENGINEERING, MORRIS A. AND THE ALMA SCHAPIRO PROFESSOR OF ENGINEERING, AND PROFESSOR OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE.

SC: Another critical challenge is for educators to adapt. If we continue with the status quo—assigning the same homework or asking students to simply repeat facts—then, yes, students will turn to AI for answers. But if we ask students to think deeper, to engage in discussions, and to critique each other's work, then AI becomes a tool. It's necessary to create assignments and classroom activities that require a level of interaction and dynamic thinking that AI can't replicate.

What new skills are you trying to impart to students now that AI tools are more prevalent?

SC: When Nvidia CEO Jensen Huang was here, someone asked if he was worried that the AI models would take away human jobs in the next few years. He said you don't have to worry about AI taking away your job. You should worry about whether the person sitting next to you is going to learn how to use AI and take away your job. Students need to learn to embrace AI, learn how it works, and understand when it makes mistakes. They should learn to integrate AI into their learning process and workflows. The human's role is to guide thinking. What if boundary conditions change? What if the initial prompt is changed? We teach students critical thinking—to consider different hypotheses, to challenge assumptions, to investigate outcomes.

VM: Critical thinking is the key skill we hope to reinforce. AI will make certain tasks easier, but it will push us to explore new directions and avenues we haven't thought of before. When the camera was invented, it freed up a lot of artists who were doing portraits or landscapes. Their minds started going into Cubism and Impressionism—they started to explore abstract art. You're not going to lose your programming job because of AI, but you'll be able to use AI to do your programming job better or do new kinds of things. AI will lead us in new directions, but it's very hard to predict where we'll go. We just have to make sure we go in that direction thoughtfully and ethically.

DEAN CHANG AND VICE DEAN MISRA.

"We go deeper into understanding the foundation of AI, explaining why it works (or why it doesn't) and why it behaves in certain ways." —*Dean Shih-Fu Chang*

How do you keep up with the rapid advancements in AI, and how do you advise others to stay informed?

VM: You have to read a lot. There are thought leaders who publish blogs and insights online. Platforms like X (I still call it Twitter) are good for keeping up with conversations. Like Dean Chang said, new models are coming out rapidly, so you need to keep up with what all of the major AI companies are doing. If you're really technical, you can follow conferences like ICML or NeurIPS.

SC: We are privileged being in New York City and in a university setting. Not only do we have one of the best AI research groups in the world—we're also exposed to AI's intersection with experts in every academic discipline and every industry, including finance, health care, media, and fashion. Attending events and listening to podcasts with thought leaders are very helpful. We've just launched the Lecture Series in AI. Keeping up with those talks will be a wonderful way for our students, alumni, and community to stay up to date. Above all, it's important to learn how to use these systems to augment human ability. AI and machine learning are very well suited to fast thinking. When students ask me questions like, "How do I compete as a programmer," I tell them to compete in slower thinking, not faster thinking. That ability is a hallmark of the unique engineering education we provide at Columbia Engineering and the broad-based liberal arts education that our students receive in their curriculum across the University.

COLUMBIA ENGINEERING FACULTY MEMBERS WHO ARE TEACHING AI IN CONTEXT INCLUDE (FROM LEFT, CLOCKWISE) LYDIA CHILTON, ADAM CANNON, VISHAL MISRA, AND CHRIS WIGGINS.

The Art of AI

Words by
Meeri Kim

Photography by
Chris Taggart

In the new course AI in Context, faculty from across the University teach AI through the lens of philosophy, music, literature, and other domains.

The use of generative AI by students in higher education is fraught with controversy. With a bit of prompting, programs like ChatGPT can write code, conduct research, and even produce entire essays. An anonymous survey of more than 6,300 college students found that almost two-thirds of them use or have used AI as part of their studies.*

Critics have cited the threat of cheating, as well as weakened critical thinking, as reasons why ChatGPT and similar tools should be banned from schools. But others, like Columbia Engineering's Adam Cannon, believe students need to be educated about the technology so they can make better decisions about its use.

"The genie is out of the bottle, so we need to learn how to accommodate generative AI into our classes and into education more broadly," says Cannon, senior lecturer in the Department of Computer Science. "If we can educate them about not just the technology but also the societal impacts of the technology, then they will not only be better and more innovative users but also more responsible users."

This fall, Cannon and faculty from Engineering and Arts and Sciences launched AI in Context, a course that covers the history, development, applications, and societal impacts of AI.

The course consists of five modules, each taught by a faculty member from a different part of the University. It offers students an opportunity to explore the potential of the technology in different contexts.

"No matter what our students major in, they'll need the analytical tools to ask what AI is and how we should relate to it," says Katja Vogt, professor of philosophy at Columbia and co-founder of the ValuesLab. "These questions require collaboration between fields, including philosophy."

Eight years ago, Cannon started an interdisciplinary course, Computing in Context, that has proved immensely popular with students. The course explores elementary computing concepts, along with use of computing in disciplines like the social sciences, economics and finance, and digital humanities.

VISHAL MISRA, PROFESSOR OF COMPUTER SCIENCE.

*Von Garrel, J., Mayer, J. Artificial Intelligence in studies—use of ChatGPT and AI-based tools among students in Germany. Humanit Soc Sci Commun 10, 799 (2023). https://doi.org/10.1057/s41599-023-02304-7

> “In class, we discuss [AI] with regard to a range of values—some ethical or moral, some concerned with language and thought: fairness, truth, accuracy, understanding, interpretability, and more.”
>
> —*Katja Vogt*

Similarly, AI in Context starts with the history of intelligence beginning in the 1900s and the advent of AI in the 1950s, taught by Chris Wiggins, associate professor of applied mathematics at Columbia. Vishal Misra, professor of computer science, then describes the evolution of neural networks and large language models. Vogt covers philosophy of AI, with topics such as fairness, alignment, and biases.

“As a philosopher, I’m interested in values, language, and the mind. Applied to AI, this means I’m interested in what it would mean for AI to be aligned with values and whether this is possible,” she explains. “In class, we discuss this with regard to a range of values—some ethical or moral, some concerned with language and thought: fairness, truth, accuracy, understanding, interpretability, and more.”

Students also work on a semester-long generative AI project led by Lydia Chilton, assistant professor of computer science. Seth Cluett, a lecturer in music, will close out the course with faculty members Kirkwood Adams and Maria Baker from Columbia’s Writing Center. These modules will delve into the use of AI in creative fields.

The course is designed to be accessible to all majors, in the hope that students outside of Engineering will attend. Cannon foresees AI in Context becoming a mainstay course at Columbia that will evolve as the technology continues to rapidly advance.

“We’re going to learn a lot from [the first cohort] while they learn from us. It’s going to be as much an education for the faculty involved as the students,” he says. “We think that this is a technology that’s going to grow in its importance and impact on our culture and society, and so it needs to be incorporated into a 21st century education.”

The Pi Day Challenge is an opportunity for the whole Columbia Engineering community to come together in support of students, innovation, research, and the next generation of leaders through giving to the School.

Save the date for Pi Day!
March 14, 2025

STUDENTS IN THE MICHAL LIPSON LAB. (JOHN ABBOTT)

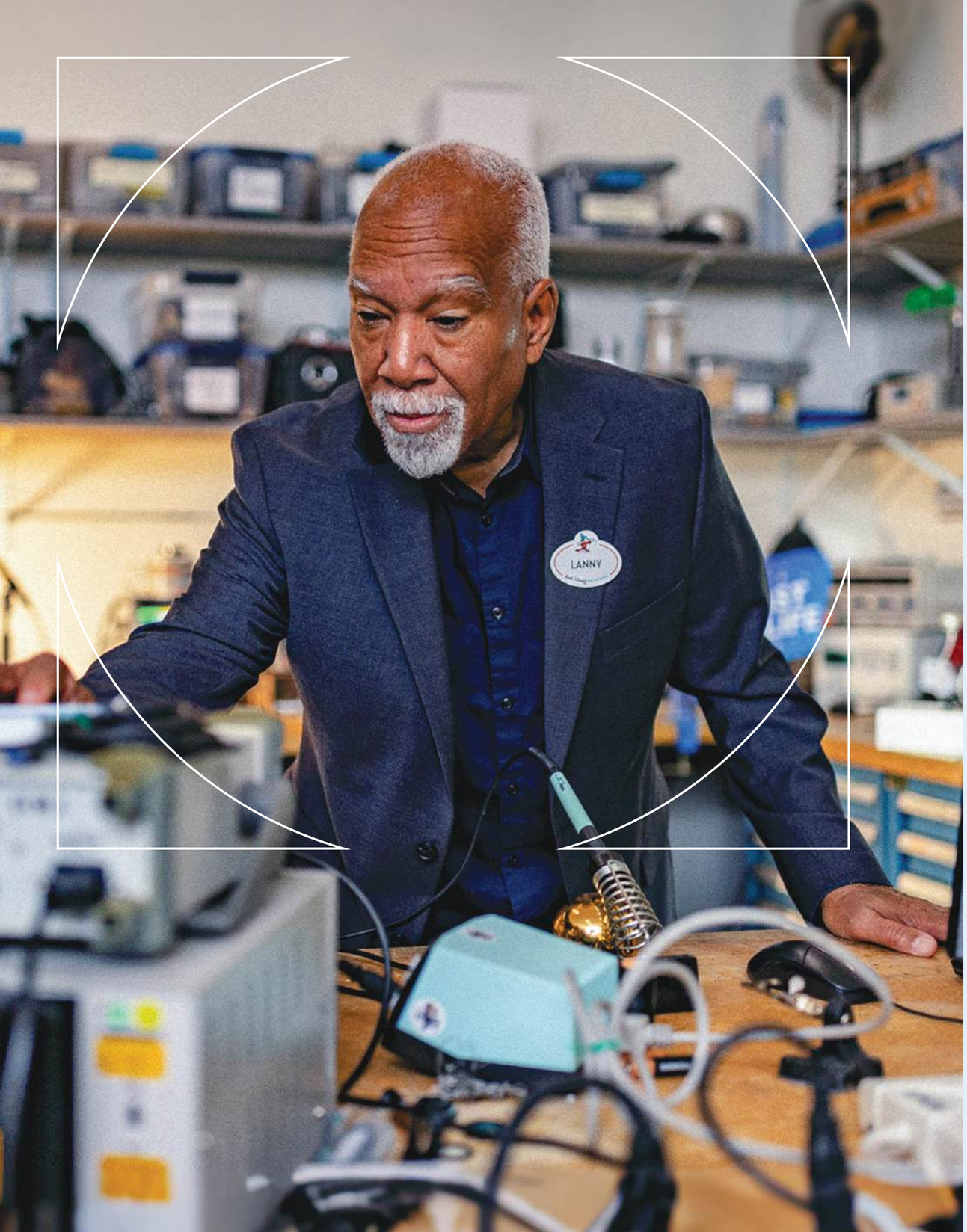
A Snapshot of Pi Day 2024

626
DONORS

$413,688
RAISED

$148,698
RAISED FOR SCHOLARSHIPS AND FELLOWSHIPS

$49,406
RAISED FOR DEPARTMENTS, FACULTY, AND ENTREPRENEURSHIP INITIATIVES



A Disney Imagineer

WITH ENGINEERING ROOTS AT COLUMBIA

Lanny Smoot

Words by
Grant Currin

SMOOT IN HIS LAB AT WALT DISNEY IMAGINEERING RESEARCH & DEVELOPMENT. (©DISNEY)

With more than 100 patents and counting, there's no stopping the creative mind of alumnus Lanny Smoot.

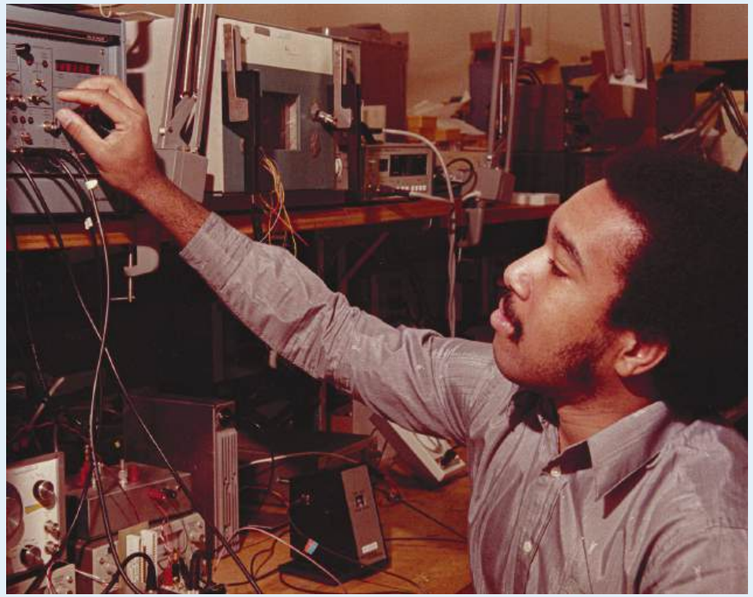
One afternoon in 1972 at Brooklyn Tech, the principal's voice came over the intercom: "Lanny Smoot, please report to the principal's office!"

When Smoot got there, he saw an unusual sight. "There was a guy—an African American guy—wagging his finger at the principal, really bawling him out," recalls Smoot, a high school junior at the time.

When the man noticed Smoot, he shifted his attention: "Lanny! Where have you been?" The man, Jim Stewart, was a recruiter for Bell Laboratories' scholarship program, and he wanted to know why Smoot hadn't shown up at any of the program's information sessions.

"I wound up having a scholarship to Columbia and a summer job at Bell Labs," Smoot says. "They also sent me back to Columbia to get my master's degree in electrical engineering." It was the beginning of a storied career.

After graduating from Columbia Engineering in 1977 with a BS and in 1978 with an MS—both in electrical engineering—Smoot would go on to serve as an executive director at Bell Labs and later join the Walt Disney Company as an Imagineer.



IN THIS ARCHIVAL PUBLICITY PHOTO FROM BELL LABS, SMOOT IS WORKING ON A FIBER-OPTIC RECIEVER.

He's been awarded 106 patents, with more in the works. In January 2024, Smoot was elected to the National Inventors Hall of Fame, only the second Disney employee to win the award—with Walt being the first.

"I learned my engineering at Columbia University, and that stood with me all my life," Smoot says.

"I learned my engineering at Columbia University, and that stood with me all my life."

—Lanny Smoot

An engineer from the start

When Smoot was 5 years old, his dad came home one day with a battery, a bell, lightbulbs, and some wire.

"He was an itinerant inventor, not a professional," Smoot says. Despite not having any training, he could fix TVs and build gadgets to use around the house. Before long, Smoot's dad had the bell ringing and the lights shining. Smoot says the experience, which is his earliest memory, "lit my entire career."

He would always take things apart, but unlike many other nascent engineers, Smoot wasn't trying to figure out how they worked. Instead, he wanted to build new things. One of his proudest boyhood creations was a unicycle built from an old tricycle and the seat from a bike. And unicycling is something he continues to do to this day.

"If I'm proud of something here at Disney, it's that I don't need a lot of money to create pretty cool prototypes of new inventions," he says.

COURTESY LANNY SMOOT

COURTESY ©DISNEY

Lanny Smoot addressed the class of 2024 at Columbia Engineering's Class Day on May 13.

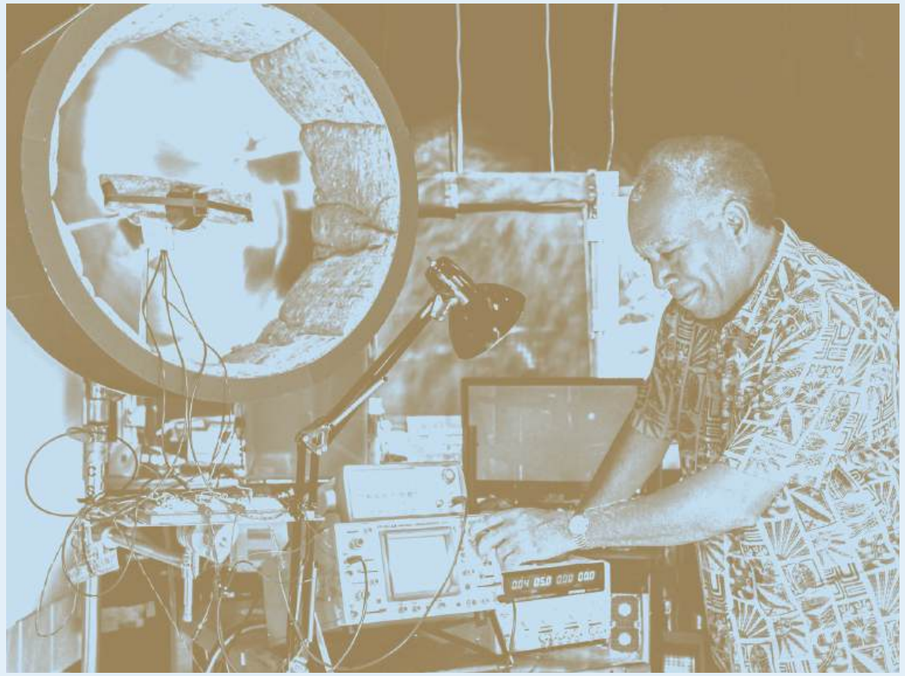
From telecommunications to the Magic Kingdom

During the summers in his undergraduate years, Smoot worked at Bell Labs, eventually building his way up to designing complex circuits and systems. "It wasn't just a summer job; it was actual work contributing to telecommunications," he says.

After graduating from Columbia Engineering, Smoot became a full-time employee at Bell Labs, where he designed some of the first fiber-optic transmission systems used widely in the Bell System. He would later design some of the first broadband systems and early video-conferencing systems.

His career at Bell Labs spanned 22 years. In 1997, while attending a trade show in Las Vegas, Smoot was approached by an inquisitive man. Smoot showed him one of his latest inventions: a system that would let viewers control which camera angles they saw on their home TV.

The man said he was interested in using the system to view animals in their enclosures. When Smoot asked what company could possibly need to do that, the man replied that he was from the Walt Disney Company.



LANNY SMOOT AT DISNEY RESEARCH. (©DISNEY)

"Turns out, he was actually talking in the code we use at Disney to make sure we don't give away what we're really doing," Smoot notes. In fact, the company was interested in using the technology to monitor free-roaming animals at Disney's Animal Kingdom theme park in Florida.

"Disney liked the invention, but they liked the inventor more," Smoot says. He joined Disney in 1998 and ran its research facility in East Hampton, Long Island. When his research and development group relocated to Glendale, California, a couple years later, Smoot moved to the West Coast.

A legendary engineer with Columbia roots

Smoot has fond memories of the community he built during his time at Columbia. A resident of John Jay Hall, he enjoyed the company of a tight-knit group of friends, including fellow Class of '77 alumni Doug Rowe, Gary Foster, Craig Thompson, and Sam Scipio. They spent time in the restaurants on Broadway and studied at McIntosh, a student center that used to stand on the Barnard campus. "The folks I happened to mention were Black and were great scholars. We wound up doing our physics and our electronics and our computer science courses together," Smoot says. "Having those supporting folks no matter what was amazing there."

Today, he is a Disney Research Fellow and the company's patent leader. Some of his most recognizable inventions include the technology that makes Madame Leota's head fly around the Haunted Mansion attraction in her crystal ball and the water harps found in the Journey of Water attraction at EPCOT. He also holds a patent for the extendable lightsabers that have been used recently in Disney attractions.

After 25 years with the company, Smoot isn't slowing down. In fact, he's more excited than ever about his latest project: the HoloTile Floor. "It's the world's first omnidirectional treadmill floor," he explains. "Every part of the floor can move anything or anybody that's on it. It can counter your walking movement, so you could walk on it forever."

When someone uses a virtual reality headset—whether at home or at a Disney attraction—Smoot's invention will ultimately allow them to move through virtual space without having to worry about the physical space around them. "We finally have the thing that was always missing from virtual reality," he says. "I think it's going to change the world."

A Greener Path Forward for the Chemical Industry

Marissa Beatty PhD'22 is pushing the chemical production industry toward net-zero carbon emissions.

Words by
Kate Cammell

Gas prices were astronomical when Marissa Beatty was in high school—and she drove a gas-guzzling pickup truck. She and her father, who was an engineer at Ford Motor Co., experimented with making biodiesel fuel to cut costs. She found the process of building a product thrilling.

Despite her remarkable accomplishment, it took some convincing for Beatty to choose engineering. She wanted to chart a path that was different from her family's and felt the profession was out of reach.

Now, Beatty, a chemical engineer, is the founder and CEO of Turnover Labs, a venture-backed climate technology startup leading efforts to decarbonize the chemical production industry.

A human approach to science

When Beatty arrived at Michigan State University (MSU) as an undergraduate, she was randomly placed in the engineering residences. The coincidence sparked a conviction that Beatty was meant for the profession.

"I see engineers as a liaison between the public and the bleeding edge of science," she says. "Engineers use research to build better technologies for people. I loved that it was a human approach to scientific work."

After graduating from MSU, Beatty was drawn to Columbia by the School's Engineering for Humanity mission. A member of the Solar Fuels Engineering Lab, she researched electrolyzers, which are reactors that transform chemicals using renewable electricity and without involving fossil fuels. While studying at Columbia, she took on the challenge of making this sustainable technology widely adopted by the chemical industry.

"These systems are currently built like Lamborghinis. They're very expensive to run and maintain," she says. "We're essentially trying to build a heavy-duty tractor."

The making of an entrepreneur

Beatty understood the need to move quickly with this technology to address climate change. "Preventing one ton of carbon from entering the atmosphere today is worth more than preventing 10 tons from entering the atmosphere in 10 years," she notes.

Her research revealed that systems the size of shipping containers could be built and installed at existing plants. It's a much faster solution than building sustainable plants from the ground up.

Beatty's adviser, Dan Esposito, encouraged her to apply for the Activate Fellowship, an entrepreneurial program for climate scientists who want to commercialize technology. In 2022, Beatty became part of the Activate Fellowship's inaugural New York City cohort.

The same year, Beatty founded Turnover Labs. The company is pioneering an electrolysis process that harnesses CO_2 waste to create petrochemicals without using fossil fuels. Once scaled and adopted, the technology she is piloting will be capable of transforming 10,000 tons of CO_2 emitted by the chemical industry annually. It's a significant step toward pushing chemical production toward net-zero carbon emissions.

From Columbia Lion to industry leader

In 2023, Beatty was named to the Forbes 30 Under 30 list for her work in climate change—a recognition she says felt very meaningful.

She notes that while being a startup founder is rewarding, the public only sees the success, not the struggle and failure. Working on climate change solutions can be taxing, since the problem is massive and urgent.

Still, Beatty remains optimistic: "There are very few times in history where the best scientific and engineering minds are aligned on a singular problem—across nations, across industries. People are unified in ways that I've never seen before. There is hope."

MARISSA BEATTY IS FOUNDER OF TURNOVER LABS. THE COMPANY IS PIONEERING AN ELECTROLYSIS PROCESS THAT HARNESSES CO_2 WASTE TO CREATE PETRO-CHEMICALS WITHOUT USING FOSSIL FUELS. ONCE SCALED AND ADOPTED, THE TECHNOLOGY WILL BE CAPABLE OF TRANSFORMING 10,000 TONS OF CO_2 EMITTED BY THE CHEMICAL INDUSTRY ANNUALLY. (DAVID DINI)

Columbia Mourns Lynn Conway BS'62, MS'63

Once overlooked, Conway's work laid the foundation for modern computing technologies.

Words by
Allison Elliott

Lynn Conway, a pioneer in the realms of computer science and engineering, and an advocate for transgender rights, passed away from a heart condition on June 9, 2024, at the age of 86. Throughout her career, Conway made groundbreaking contributions to computer architecture and microelectronics that opened the field to more researchers.

Conway was born on Jan. 2, 1938, in Mount Vernon, New York. Her interest in physics brought her to study first at MIT and then to earn a bachelor's and master's in electrical engineering from Columbia Engineering in 1962 and 1963, respectively. While at Columbia, she conducted research under Herb Schorr, who recruited her to join IBM Research in Yorktown Heights, New York, following her studies.

At IBM, Conway would make a pivotal invention—dynamic instruction scheduling (DIS)—a hardware method that enhances computer performance by reordering instructions based on readiness instead of in order. Despite the far-reaching influence of her early inventions, these achievements would become obscured due to another development in Conway's life that led to a change in her identity. In 1968, she was fired from IBM because of her decision to undergo gender affirmation surgery. (IBM apologized in 2020 and issued Conway a Lifetime Achievement Award.) Ken Shepard, the Lau Family Professor of Electrical Engineering and professor of biomedical engineering at Columbia, would later write in IEEE Solid States Circuits Magazine how Conway's need to hide her identity allowed many to overlook her research contributions.

LYNN CONWAY, PICTURED WITH AN ATTENDEE AFTER DELIVERING THE 2016 MAGILL LECTURE AT COLUMBIA ENGINEERING (TIMOTHY LEE)

Navigating a changing world

After her transition, Conway had to build a whole new life, starting out again as a contract programmer at Computer Associates and then moving to Memorex to become a digital systems designer and computer architect. She then joined the famed research organization Xerox Palo Alto Research Center (PARC) in 1973. It was during this chapter of her career that Conway did pioneering work in very-large-scale integration (VLSI) chip design methods, an effort that started her collaboration with Carver Mead, a professor at Caltech who is credited with inventing the term *Moore's Law*.

As advances in computing ramped up during the 1970s, smaller companies needed to learn to design chips in order to compete with the big semiconductor firms. Conway's background experience at IBM had helped prepare her for such work, and soon she developed a more efficient way to make microchips. She and Mead documented the process in a textbook, "Introduction to VLSI Systems." Initially a self-published text for use at Xerox, it soon became a seminal work influencing scores of future programmers and researchers.

The book and its methods—which became known as the Mead-Conway method—also became a course on microchip design at MIT taught by Conway herself. The course was so successful, it inspired similar courses across the country. Such courses prepared a new generation of tech workers and entrepreneurs who would build what would become Silicon Valley.

Shaping the future of chip design

Her contributions with Mead also included the Metal Oxide Semiconductor Implementation Service (MOSIS) system, an internet-based infrastructure that enables rapid prototyping of chips. It was another development that allowed academia and small companies to access advanced technology.

Conway would leave Xerox to join the Defense Advanced Research Projects Agency (DARPA) in the early 1980s for the Defense Department's Strategic Computing Initiative. Then in 1985, Conway joined the faculty of the University of Michigan and its burgeoning program in VLSI design. She retired in 1998 as professor emerita. On Aug. 13, 2002, Conway married her longtime partner Charles "Charlie" Rogers, a professional engineer.

Outside of her contributions to science and technology, Conway became an outspoken advocate for transgender issues after going public with her own story post-retirement.

LYNN CONWAY BS'62, MS'63, PROFESSOR EMERITA OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE AT THE UNIVERSITY OF MICHIGAN, ANN ARBOR, POSES FOR A PORTRAIT AT THE UNIVERSITY OF MICHIGAN'S NORTH CAMPUS. (MARCIN SZCZEPANSKI/ MICHIGAN ENGINEERING)

Lynn Conway revolutionized microchip design, empowering a new generation of tech innovators and transforming the future of computing.

Through her website, she documented her life journey and promoted awareness and acceptance, and provided medical resources and information on transgender issues. She also advocated for employment protections for transgender workers in tech and transgender inclusion in the the Institute of Electrical and Electronics Engineers' (IEEE) code of ethics.

Throughout her career, Conway garnered numerous awards and honors, including election to the National Academy of Engineering and the American Association for the Advancement of Science, and was named a fellow of the IEEE. She also received IEEE's 2009 Computer Pioneer Award and the 2015 IEEE/RSE Maxwell Medal. She was awarded honorary degrees from Trinity College, the Illinois Institute of Technology, the University of Victoria, the University of Michigan, Princeton University, and Syracuse University. For her advocacy, she was named one of the 21 Transgender People Who Influenced American Culture by Time magazine and one of the Stonewall 20 Trans Heroes by the International Court System and the National Gay and Lesbian Task Force.

In 2016, Conway was the guest speaker at Columbia Engineering's annual Magill Lecture, where she shared how advances in technology throughout history had helped shepherd in great social changes. Her own legacy had helped make technology more accessible and diffused ideas, which in turn, had advanced the state of the art. Speaking of our own time and current and emerging technologies, Conway hailed it as the "techno-social age," a time when cooperation and sharing of ideas would be more important than ever.

While Conway cautioned that energy use and overuse of the planet needed to be reined in, she ultimately looked forward to humanity "opening up unprecedented explorations of the greatest frontier... the frontier of what it's possible to do."

A Career Innovator Guides the Next Generation

Words by
Jennifer Ernst Beaudry

For Imran Shah BS'84, MS'86, PhD'94, Columbia roots run deep. The media and telecom executive earned his bachelor's, master's, and PhD, all in electrical engineering, at Columbia Engineering. Shah's wife is an alumna of Teacher's College, and their son followed in their footsteps, attending Columbia as well. He's a longtime member of the Board of Visitors and has served on the Engineering School's Entrepreneurial Advisory Board.

Shah deepened his commitment again this fall, serving as the Silberstein Family Executive in Residence to provide mentorship and tactical advice to engineering students. The Silberstein Family Executive in Residence program was endowed by Alan M. Silberstein BS'69 and his wife, Carol '69BC, in 2019 to recruit luminaries in industry, government, business, and the nonprofit sector to short-term roles as executive advisors and mentors to students in the School of Engineering. It's a role his many careers have uniquely equipped him to play.

PORTRAIT OF IMRAN SHAH (BRANDON VALLEJO)

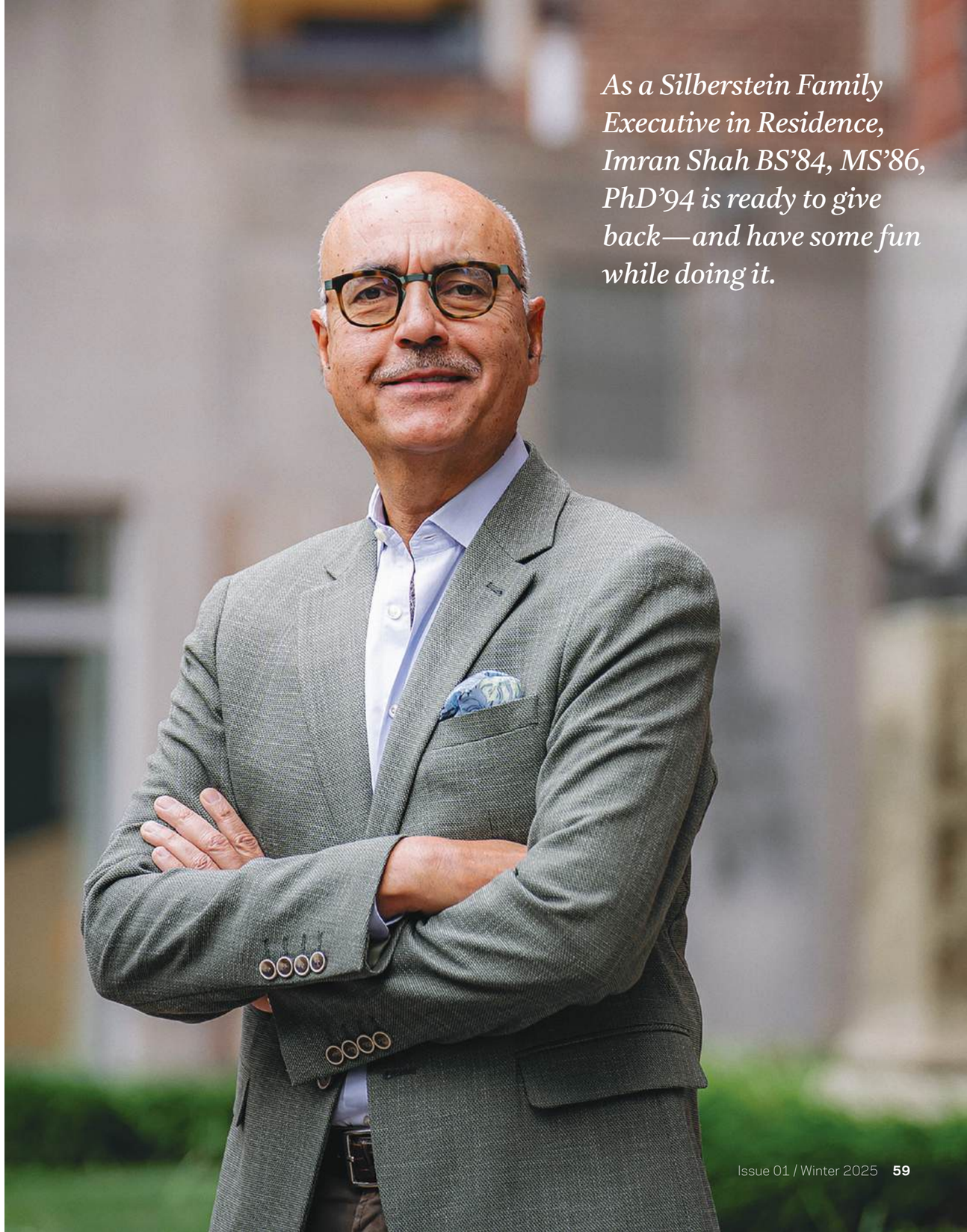
The Columbia effect

Shah was the global industry group lead at the professional services firm Accenture, serving in its Comms & Media, Software & Platforms, and High-Tech Strategy practice. He was appointed to the position after the acquisition of his cable, media, and wireless consulting firm, IBB Consulting Group, in 2017.

Shah is also co-founder of video products company DigiForge, which was acquired by TiVo in 2011. He began his career as a researcher in multidimensional signal processing and was on the ground floor in the early development and wide dissemination of digital high-definition television. He holds 14 patents.

The course of his career hasn't necessarily unfolded the way he expected when he left his home in Pakistan for the first time to attend Columbia Engineering in 1980—and that's a testament to Columbia's program, he says.

"I had come very focused on doing engineering, but it turned out we were going to take art and music and study literature and philosophy. It was the most fantastic experience; the breadth of courses you take and the seamless educational integration with Columbia College and Barnard ended up becoming quite influential for me," he says. The variety of the educational experiences Columbia Engineering offered informed the "180-degree pivot" in his career, where he moved from deep research to founding product and management consulting firms.



As a Silberstein Family Executive in Residence, Imran Shah BS'84, MS'86, PhD'94 is ready to give back—and have some fun while doing it.

"The strength many Columbians have is that they can go really deep but also have a broad vision of the place of their work in society," he says. "It's credit to the training we get at Columbia: You're ambidextrous."

Resident Exec

In taking up the position of Silberstein Family Executive in Residence, Shah is following in the footsteps of fellow Board of Visitors member Armen Avanessians MS'83, University trustee emeritus and the inaugural executive in residence in May of 2023.

Shah hosted lunch-and-learn sessions centered around topics like entrepreneurship, professional services, and how to navigate a career as a technologist. He connected with students, both undergraduate and graduate, who have "an entrepreneurial bent" and those interested in careers in consulting and professional services.

In fact, in a full-circle moment, Shah's connection with Columbia students didn't end with the close of his residency. He has endowed a scholarship for an engineering student who attended high school, or lived, worked, or otherwise studied, in Pakistan, allowing a future student to follow in his footsteps and pursue a Columbia Engineering education.

Shah says while he was glad to share his experience and learnings with current Columbia students, he thinks he got just as much out of the exchange as they did.

"It's extremely energizing whenever I go back to campus, especially when I'm interacting with students and young faculty," he says. "[It's] the common thread in all my involvement with Columbia Engineering."

WISDOM FROM THE TOP: SEASONED EXECS GUIDE THE NEXT GENERATION

An Executive in Residence program gives students a chance to learn from leading executives and gain insights from their career trajectories.

Established in 2019 by Alan M. Silberstein BS'69 and his wife, Carol '69BC, the Silberstein Family Executive in Residence program recruits distinguished short-term visitors in fields across industry, business, government, and the nonprofit sector. The program aims to help students expand their understanding of leadership in business and industry and offer ways they can build their skills as leaders early on to make an impact in the world.

Columbia Engineering students gained valuable insights from recent Executives in Residence, including alumni Armen Avanessians, Anne Gates, and Georgia Papathomas—all members of the Board of Visitors at Columbia Engineering.

ARMEN AVANESSIANS MS'83, UNIVERSITY TRUSTEE EMERITUS AND RETIRED GLOBAL HEAD AND CHIEF INVESTMENT OFFICER OF QUANTITATIVE INVESTMENT STRATEGIES AT GOLDMAN SACHS, OFFERED STUDENTS ADVICE GLEANED FROM HIS PROFESSIONAL LIFE AND SHARED PERSONAL ANECDOTES THAT INFORMED HIS CAREER DECISION-MAKING OVER THE YEARS. (TIMOTHY LEE)

ANNE GATES MS'82 SHARED MOMENTS FROM HER CAREER IN FINANCE AND AS A TOP EXECUTIVE AT PEPSICO, DISNEY, AND MGA ENTERTAINMENT. HER VISIT TO COLUMBIA INCLUDED "OFFICE HOURS" WITH STUDENTS FROM THE NEW MBA/EXECUTIVE MS IN ENGINEERING JOINT PROGRAM WITH COLUMBIA BUSINESS SCHOOL AND A SELECT GROUP OF DIVERSE STUDENTS IN STEM AND UNDERREPRESENTED GROUPS. (EILEEN BARROSO)

GEORGIA PAPATHOMAS BS'73, MS'74, PHD'78 HELD SESSIONS ON HOW TO DELIVER PRESENTATIONS AND SHARPEN INTERVIEW SKILLS. SHE SHARED HER LIFE AND CAREER LESSONS WITH STUDENTS IN SMALL GROUP SETTINGS. PAPATHOMAS, WHO HAS LED IT AT BIOPHARMA GIANTS LIKE PFIZER AND JOHNSON & JOHNSON, ALSO MET WITH FACULTY MEMBERS TO DISCUSS HOW TO BUILD AND STRENGTHEN INDUSTRY PARTNERSHIPS. (DIANE BONDAREFF)

Paying It Forward

As president of the Columbia Engineering Alumni Association, Reid Ellison BS'08 is creating opportunities for students and alumni to flourish.

REID ELLISON POSES WITH MEMBERS OF HIS GRADUATING CLASS DURING REUNION.

Words by
Kate Cammell

The COVID-19 pandemic marked a major turning point for Reid Ellison. After serving as a vice president at Goldman Sachs and then a portfolio manager at SG Capital Partners, Ellison embraced the uncertain moment in financial markets and founded Long Run Partners, a mortgage investment firm backed by major capital investors.

Ellison, who serves as president of the growing firm, credits part of his success to his training as an engineer.

"Whether in the machine shop or the investment world, it's a great framework for thinking," he says. "In fixed income, there's not a right or wrong answer—it's probability. It's making the best determination that you can with uncertainty."

Framework for finance

Ellison arrived at Columbia from a small town in California. Being on a global campus in the heart of New York was eye-opening. A lifelong car fanatic, he was drawn to mechanical engineering.

As a first-year student, Ellison joined the Formula SAE (Society of Automotive Engineers) where students built Formula One race cars for international competitions. The club offered a holistic look at the engineering process and a chance to work across disciplines from vehicle design to business.

The experience cemented his love of building machines and systems. Ellison treasures the days and nights he spent with classmates in the machine shop, which introduced him to the practical side of engineering, applying classroom concepts to create real products. During his senior design class, he worked with a team to build an automatic drum tuner. With the help of advisors, Ellison and his team patented their design.

As an alumnus, Ellison has remained engaged with the Columbia Engineering alumni community. When he decided to establish his financial firm, Ellison "looked to my friends from Columbia who had started their own business and got great advice. It's invaluable to have that support network that can point you in the right direction." He adds, "I really believe Columbia changed my life." Now, he wants others to have the opportunities he has seized.

Investing in the future of engineering

As a young alumnus, Ellison asked himself, "How do I pay forward the support I got from my mentors and the skills I learned?" While working for Goldman Sachs, he recruited interns from Columbia and supported their experience.

In 2012, Ellison joined the Columbia Engineering Young Alumni (CEYA) board. Two years later, he rose to the executive committee as career chair, where he organized career-related events for Engineering students.

REID ELLISON (TIMOTHY LEE)

In 2013, Ellison joined the Engineering Development Council and has since partnered with the Alumni Office on securing many gifts for the School.

After serving four years on CEYA, Ellison joined the Columbia Engineering Alumni Association (CEAA) Board of Managers in 2016. Ellison served as vice president of student relations, and in 2024, was elected President. Having served on both CEYA and CEAA, Ellison has been a champion for growing connections among the two boards. He has also served on the five-, 10-, and 15-year reunion committees, which he savors for the chance to connect beyond his core friend group.

Over his years of service, Ellison has worked tirelessly to build community among CEAA's 50,000 members across the world. After years of giving back to the community, in 2023 Ellison received the Le Marteleur Award for Service to Columbia Engineering Young Alumni.

"There's a huge benefit of the advice that students get from young alumni," Ellison says. "The alumni know how companies hire and what day-to-day is like the first few years you're out of school. I think it's incredibly valuable to be involved early on."

Alan & Carol Kaganov

ALAN KAGANOV ENGSCD'74 PICTURED AT COLUMBIA COMMENCEMENT

Forging a Legacy, Giving Back

After the death of her husband, Alan Kaganov EngScD'74, Carol Kaganov continues his commitment to supporting innovation in biomedical research.

Words by
Allison Elliott

When Carol Kaganov first met her husband, Alan, in 1966, it was far from the bustle of Manhattan and the major cities where they would spend their life together.

It was on a beach in Nantucket. "He was with a group of friends, and I was with a group of friends, and I knew one of the men he was with," Carol remembers. "They were playing beach volleyball and making a lot of noise, and he was sitting on a blanket doing the New York Times crossword puzzle—that's the guy for me," she thought.

Their meeting sparked not just a lifelong love of doing the crossword puzzle together but also a commitment to advancing health, medicine, and educational philanthropy.

When the Kaganovs started dating, Carol was working in Manhattan as a copy editor and writer at publications including Seventeen magazine and Harper's Bazaar, while Alan was working for Johnson & Johnson in New Jersey as a packaging engineer. Already armed with a degree in mechanical engineering from Duke and an MBA from New York University, he became more curious about the medical side of engineering. "He decided he wanted to know more about the product, not the packaging," says Carol.

Road to Columbia

With the guidance of a mentor, he applied to doctoral programs and chose Columbia, where he received support with a prestigious Career Fellowship from the National Institutes of Health (NIH). Though Columbia had no formal biomedical engineering program at the time, Alan was able to devise a curriculum with courses from different areas, effectively creating his own program and establishing himself as a trailblazer in the emerging field. The novel plan resulted in him needing to take three separate doctoral exams to obtain his degree: in chemical engineering, mechanical engineering, and anatomy and physiology.

Carol fondly remembers the six years they spent living on Riverside Drive while Alan pursued his degree.

"Our view was looking down to the Hudson and the cathedral there," she says. "We would sit and look at the view of the sunset like we were watching TV. It was fantastic."

With a Columbia Engineering degree in hand, Alan was able to pursue his interest in the burgeoning field of health-related technologies and rise to senior management positions at several major companies. His career took the couple all over the country—from Danbury, Connecticut, to Chicago to San Francisco to Boston and back to the

PORTRAIT OF ALAN AND CAROL KAGANOV (CAROL KAGANOV)

> "Alan's career was about creating new medical products and doing medical research and mentoring entrepreneurs who were starting medical device companies. And I always shared his enthusiasm for the products and the projects." —*Carol Kaganov*

West Coast again. It was in San Francisco where he became embedded in the venture capital community.

After serving as vice president of corporate development and strategic planning at Boston Scientific, he became a partner at U.S. Venture Partners in Menlo Park, California. Over the course of a long and successful career, he obtained 15 patents and developed many effective medical devices for treating a host of conditions, including heart arrhythmia and spinal and circulatory diseases, as well as drug delivery systems.

A shared passion for innovation and giving

As residents of the Bay Area, the Kaganovs had been involved with and supported the local arts and culture. Today, Carol sits on the board of a San Francisco Symphony League and supports local theater and ballet companies, as well as several volunteer groups at nearby Stanford University. After her husband's death in 2019, Carol wanted to continue their shared project of giving to people and programs they believed in.

"I'm not a scientist, and I really didn't share in his work, but I did share his excitement of the work and his love of discovering new things," she says. "His career was about creating new medical products and doing medical research and mentoring entrepreneurs who were starting medical device companies. And I always shared his enthusiasm for the products and the projects."

KE CHENG, THE ALAN L. KAGANOV PROFESSOR OF BIOMEDICAL ENGINEERING

In 2023, Columbia welcomed Ke Cheng, a noted expert in pulmonary bioengineering, to the faculty, and in 2024, he was named the Alan L. Kaganov Professor of Biomedical Engineering. The professorship was created by Carol to honor her late husband and supports outstanding scholars in biomedical engineering. With its special focus on pulmonary and/or cardiovascular systems, the professorship aligns with Cheng's lifelong research interests.

COURTESY CAROL KAGANOV

At Columbia, Cheng runs the BioTherapeutics Lab and serves as chair of the NIH Biomaterials and Biointerfaces study section. His research focuses on regenerative medicine and the clinical application of stem cells and exosomes.

He has also founded biotech companies for stem-cell drugs and extracellular vesicles to advance lung and heart regeneration, cancer therapy, and drug delivery.

"We are so grateful to Carol and Alan for their support of learning, research, and scholarship at Columbia Engineering," says Dean Shih-Fu Chang.

"Alan Kaganov had an inspiring Columbia journey, from studying biomedical engineering before it was a formal program to then supporting world-class research in an area where attention is sorely needed—in cardiovascular and the lesser studied area of pulmonary bioengineering. He was a true pioneer, but more importantly, a husband, mentor, and friend known for his kindness and generosity."

Alan's legacy was recognized in November at the Archimedes Dinner, an event that celebrates faculty who have recently been honored as named chairs and the donors who support professorships.

She also endowed the Alan L. and Carol M. Kaganov Doctoral Fellowship which will be held by Weihang "Savannah" Zhang who is a doctoral student in the Ke Cheng lab.

"[Alan] was kind of at the beginning of bioengineering, and we were excited to be part of that, and he had an amazing network of people," Carol says. "To this day, I hear from people who knew him and thanked him for helping them in their careers. Because we didn't have children, we wanted to help finance other people's children if they needed the support."

Columbia Engineers Celebrate 2024 Reunion

THE CLASS OF 1974 CELEBRATES THEIR JUBILEE AT THE 2024 REUNION. (MICHAEL DIVITO)

Words by
Beatrice Mhando

Alumni return to campus for special events and lectures and the annual Dean's Alumni Welcome Dinner & CEAA Awards Presentation.

Columbia Engineering Reunion Weekend kicked off May 30, bringing more than 270 alumni to Morningside Campus to reconnect with former classmates and fellow alums, as well as faculty and staff.

On the first night of Reunion, Dean Shih-Fu Chang, former University President Minouche Shafik, and University Provost Angela Olinto honored alumni who have made a remarkable impact in their professions and for society at the annual Dean's Alumni Welcome Dinner & CEAA Awards Presentation at Casa Italiana. Alumni and guests, including Mary C. Boyce, former dean of Columbia Engineering and former provost of Columbia University, mingled at the pre-dinner reception where William Lembeck BS'53, '52CC was awarded the Crossed Hammer Award for years of distinguished service to the CEAA.

Dean Chang welcomed attendees and underscored the growing importance of science and engineering. "Engineering is more interdisciplinary than ever, more collaborative, more global, and more aware than ever before of the ethical implications of technology and our collective responsibilities to society and to the planet," he said.

Award Recipients

The Michael Pupin Medal for Service to the Nation in Engineering

Shu Chien PhD'57, recognized for his pioneering work in cardiovascular research and for spearheading the development of bioengineering and mechanobiology. In addition to receiving his PhD in physiology, Chien was a professor at Columbia from 1969 to 1988.

Nobel Laureate Robert Lefkowitz '62CC, '66VPS, recognized for his contributions to health care through his work in cellular signal transduction and receptor biology. Lefkowitz received the Nobel Prize in Chemistry in 2012 for discovering a new family of G-protein-coupled receptors, nearly half of which all prescription drugs engage with.

The Thomas Egleston Medal for Distinguished Engineering Achievement

James Scapa BS'78, for his significant contributions to the fields of computational science and artificial intelligence through his software company, Altair. Scapa was also commended for establishing his Altair #OnlyForward scholarship, which supports 10 undergraduate students pursuing STEM-related degrees.

The Samuel Johnson Medal for Distinguished Achievement

Armen Avanessians MS'83, for his achievement in a field other than engineering or applied science. Avanessians was recognized for his contributions to the fields of computational science and artificial intelligence through simulation development, the internet of things, high-performance computing, and data analytics.

CEAA BOARD OF MANAGERS MEMBERS VIJAY B. SAMANT MS'77 (RIGHT) AND ALEXANDER A. NED BS'87, MS'90 (BARBARA ALPER)

Earlier in the day, Avanessians was recognized as the namesake of the Avanessians Conference Room for Data Science on the 14th floor on the campus' Northwest Corner Building. The conference room honor recognized his gifts in support of doctoral students, the Avanessians Doctoral Fellowship for Engineering Thought Leaders and Innovators, and the space itself.

Back to Where it All Began

In addition to celebrating alumni, attendees were invited to faculty talks to learn more about current innovative research at Columbia Engineering. On Friday, May 31, Computer Science Professor Elias Bareinboim conducted a master class on AI and causality, where attendees learned of the barriers to general applications of AI.

Mike Massimino BS'84, a mechanical engineering professor, alumnus, and former NASA astronaut, gave a talk on Saturday morning called "From Columbia to Space," in which he shared insights from his tenure at NASA.

PICTURED, LEFT TO RIGHT: BONNIE SILVERA BS'97, JOHNSON MEDAL COMMITTEE CHAIR; ARMEN AVANESSIANS MS'83; UNIVERSITY PROVOST ANGELA OLINTO; ALEX POTULICKI MS'10; DEAN SHIH-FU CHANG. (BARBARA ALPER)

Also on Saturday, Sunil K. Agrawal, professor of mechanical engineering and rehabilitation and regenerative medicine, gave a talk called "Rehabilitation Robotics," sharing how robotics can be used in new ways to characterize human neuromuscular responses and retrain human functions.

Columbia Engineering also hosted special receptions for master's and PhD alumni, alumni of color, and Golden Lions celebrating their 50th anniversary. In addition, the Society of Columbia Graduates hosted a ceremony for the 2024 Great Teacher Awards, with David Vallancourt, senior lecturer in circuits and systems in the Department of Electrical Engineering, recognized as this year's winner for Columbia Engineering.

Reunion Weekend also included tours, activities on campus and around the city, and a party on the waterfront at Chelsea Piers for alumni from Columbia Engineering, Columbia College, Columbia General Studies, and Barnard College.

Columbia's Chapter of the National Society of Black Engineers, Past and Present

Generations of alumni gathered to commemorate the history of Columbia's NSBE chapter—and to chart a bright future for Black alumni.

Words by
Grant Currin

FROM LEFT: KAREEM STANLEY BS'17, DUBEM ANWUNAH BS'24, CARLOS BARKSDALE BS'14, ANGELA EDWARDS BS'92, MS'97, AMANDA JENKINS BS'25, DEAN SHIH-FU CHANG, CHELSEY ROEBUCK BS'10, DANEEN COOPER BS'80, GREG TARVER BS'78, MS'82, CHRISTINE HENDON, ASSOCIATE PROFESSOR OF ELECTRICAL ENGINEERING AND VICE DEAN OF DIVERSITY AND STRATEGIC PARTNERSHIPS, GEORGE ELLIS BS'79, STEPHEN MGBEMEJE BS'24, (TIM LEE)

More than 100 engineers gathered in Morningside Heights Campus Feb. 23, 2024 for the first-ever reunion of Columbia Engineering's Black alumni. In celebration of the 46th anniversary of the School's chapter of the National Society of Black Engineers (NSBE), the group toured laboratories, participated in panel discussions, and fellowshipped at a reception and dinner at the University's Faculty House.

In remarks during dinner, the chapter's inaugural president, Greg Tarver BS'78, MS'82, explained the motivation that led the co-founders to establish the organization, which still thrives today.

"This organization was critical for those of us who, 46 years ago, were responding to an environment that frankly was not always so welcoming," he said. "We didn't always get

invited to the study groups that some students had. We dealt with microaggressions and, at times, overt aggressions. This chapter was a place of connection, encouragement, and support that helped us to make it through."

Alumni Milestones & Memories

With a global network of more than 50,000 alumni making transformative impacts across industries and technical fields, Columbia Engineers continue to innovate, inspire, and lead in their communities and beyond.

1950s

Bernard Friedland (EE) '52CC, BS'53, PhD'57 recalls an experience in 1952 when he and his lab partner designed an experiment that briefly plunged the Morningside campus into darkness.

He writes: We wired up the system and turned it on. Almost immediately the lights went out—not only in our lab but all over Columbia. Not knowing much about control theory, we apparently caused an unstable oscillation that drew excessive current but somehow failed to trip the laboratory circuit breaker. Instead, it tripped the main breaker at the powerhouse and all things supplied by it went down.

Friedland would go on to earn a PhD in control theory, write two books on the subject, and teach for more than 50 years.

Gordon Silverman (EE) '55CC, BS'56, MS'57 writes: NSF reviewer for several years. (Taught my first AI course in 2000!!) Co-author of "Cognitive Science: An Introduction to Study of Mind," four editions. A company (JoGo Health) has honored me by including the "Go" in my first name as part of their name. Recently, they reported having treated 20,000 (!) patients using Reinforcement Learning, which I introduced in the late 1970s.

Robert Paaswell (CEEM) '56CC, BS'57 writes: Retired as distinguished professor of civil engineering at City College New York but still very active on projects and civic issues. The big item in our lives is a great-grandson!

Read a selection of edited class and program notes here, and visit Columbia Engineering Magazine for a full listing of entries. Scan the QR code or visit columbiaeng.com/winter2025 for more.

1960s

Richard Lacoss (EE) '59CC, BS'60 writes: I went from Columbia to UC Berkeley where I earned my PhD in electrical engineering in 1965. Next stop was the MIT Lincoln Laboratory where I first worked on seismic methods for underground nuclear test monitoring. I think I was the first person to use seismic array data to characterize the nature of ambient seismic noise and to clearly demonstrate a link to distant ocean storms. In 1984, I married my current wife, Cynthia Oldham, in Charlotte Amalie in the Virgin Islands. While flying back to Boston, the plane was hijacked and flown to Cuba. Quite an adventure.

Matthew Sobel (IEOR) '59CC, BS'60, '64GSAS writes: 2024 has been a good year personally so far. Two grandchildren graduated college, and my wife (Susan Slotnick, Columbia PhD in linguistics) and I remain reasonably healthy. My research activities continue, and two papers have been accepted this year. In the bicycling competition at the 2024 Ohio Senior Olympics, I competed in the 10K time trial. I won gold because I was the only competitor in my age bracket (85-89). Of course, that means that I also came in last in my age bracket!

Seymour Goodman (CEEM) BS'65, MS'66 writes: Seymour (Sy) Goodman retired as a Regents' Professor at Georgia Tech, ending 64 years as a student or faculty member at R1 universities. Sy and Dee (Diane Samuel Goodman, '66E) celebrated with a return trip to Antarctica (last time 1989), South Georgia, the Falklands, and the Chilean fjords.

CEYA MEMBERS POSE WITH ROAR-EE WHILE ATTENDING COLUMBIA ALUMNI LEADERS EXPERIENCE 2024. (THE COLUMBIA ALUMNI ASSOCIATION)

DEPARTMENT ABBREVIATIONS

APPLIED PHYSICS AND MATHEMATICS
APAM

BIOMEDICAL ENGINEERING
BME

CHEMICAL ENGINEERING
CHEME

CIVIL ENGINEERING AND ENGINEERING MECHANICS
CEEM

COMPUTER SCIENCE
CS

EARTH AND ENVIRONMENTAL ENGINEERING
EEE

ELECTRICAL ENGINEERING
EE

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH
IEOR

MECHANICAL ENGINEERING
MECHE

UNDERGRADUATE CLASS NOTES

Bill Quirk (Applied Physics) BS'67, '70GSAS writes: Finally retired from the California legislature. I am now president of the resident council at my retirement community, Acacia Creek in Union City. Can't resist volunteering.

Steve Nahmias (IEOR) BS'69 writes: It's been well over 56 years since I graduated from Columbia's engineering school. From there, I went on to earn a PhD in operations research at Northwestern. My entire career was spent in academia, starting with Pitt's Industrial Engineering Department, a year at Stanford's engineering school, and 43 years in the business school at Santa Clara University. During that time, I published approximately 50 technical publications and eight editions of a textbook, "Production and Operations Analysis." I am now fully retired and living in the Bay Area. I am an active musician, playing trumpet in seven bands, and also enjoy playing golf.

COURTESY
BILL QUIRK

1970s

Alan Greenglass (MechE) BS'71 writes: After Columbia, Alan graduated from Brown Medical School. He practiced medicine as a primary care internist and was a health system executive in Connecticut and Delaware. Recently, he's been focusing on public policy on climate and health issues. He's also the author of "Curing Physician Management: Why Physician Managers Fail," a book about some of the unique challenges of managing, and being managed, in health care.

1980s

Paxton Louis (EE) BS'81 writes: Just completed my doctorate in computer science from Pace University's Seidenberg School of Computer Science and Information Systems. This was part of my bucket list. Suffered through a lot of good-natured industry mocking for going for the degree. It was worth it. Looking forward to the next steps in my life. Definitely thinking of returning to private equity and even completing the research I began at Pace. Looking forward to enjoying semi-retirement with my wife and kids.

Christopher Dorn (CS) BS'86, MS'88, '91LAW writes: I completed my Embassy Baghdad tour in 2023 and spent the past year back in Washington, D.C., working on Middle East counterterrorism policy. This fall, after 21 years, I decided to retire from the U.S. Foreign Service and make a career pivot based on my Columbia BS and MS computer science degrees. I was accepted into a post-graduate program in artificial intelligence and machine learning. As I write this, I am going through a Python bootcamp. Trust me, it's like riding a bike. It's all coming back.

Alo Mukerji (IEOR) BS'97 writes: Very proud to say my daughter, Ariana, just started her first year at Barnard in the class of 2028!!! Love that I'll be able to attend another Columbia graduation!!

COURTESY
ALO MUKERJI

2000s

Daisy Chow (EE) BS'00 writes: I've been baking professionally since 2004 (sorry, Engineering), opened Breadboard Bakery in Arlington, Massachusetts, in November 2019 (thanks, COVID), and recently won first for Best Baguette at Le Gran Prix Elmendorf du Pain in Cambridge, Massachusetts.

Ayesha Sattar (BME) BS'03 writes: After graduating and finishing medical school and residency in New York, my husband and I moved to California in 2011 for my fellowship at Stanford, and I stayed on as faculty until my husband was offered an opportunity to move to Cairo and then Basel, where we now reside with our three children. In Basel, I translate medical protocols at the University Hospital of Basel from German to English and remotely teach emergency medicine to physicians in developing countries. In 2023, I established MaBasel Trust, a foundation that seeks to advance women and children in limited-resource settings.

COURTESY
AUSTIN BRAUSER

2010s

Austin Brauser (MechE) BS'10 writes: This spring, I ran my first half marathon at Lake Garda in 1 hour 52 minutes. After the race, I proposed to my fiancée, Victoria, and we plan to get married in April 2025!

Raymond Barker (EE, CS) BS'12, MS'18 writes: I've been a software engineer and engineering manager at Google for the past ~12 years. I spent many years building and validating the serving stack for Search. More recently, I've focused on understanding and improving engineer productivity.

I'm recently engaged to Celia Eddy ('12CC, '21GSAS), and we're excitedly planning a wedding and an apartment renovation. We live in NYC, still close to Columbia, with our cat, who is very fluffy.

Jane Zellar (CEEM) BS'12 writes: Jane Zellar and David Coplon (both BS'12, civil engineering) were married at the Arapahoe Basin ski area in Colorado in May 2024. Among the wedding guests were more than 20 Columbia and Barnard alumni, a mix of SEAS classmates, and Columbia ski team friends.

Shannon Sullivan (BME) BS'14 writes: I'm in my last year of diagnostic radiology residency, serving as chief resident, and I just matched into a neuroradiology fellowship at NYU. I'm looking forward to returning to New York City and attending more local Columbia alumni events—and of course, reuniting with my best friends from Columbia who still live in the city!

COURTESY
RAYMOND BARKER

Computer Science

Donald Hagen (MS'77) writes: Enjoying retirement. I wrote up memories of my USMC service in the Vietnam War before my memory fails me, and it is on Amazon Kindle: "16 Months in Vietnam (4/68 - 8/69)."

Lei Liu (MPhil'00) writes: After nine years in NYC working for Two Sigma Investments, I moved to Shanghai to start a hedge fund in 2013. I am living in Shanghai now with my family (kids 14 and 12).

Xiao Zhu (MS'15) writes: I currently reside in San Jose with my wife and our incredibly sweet Goldendoodle, AlphaGou. I work as an engineering manager at Databricks, where my team is dedicated to developing infrastructure that bridges data with AI applications. Outside of work, I enjoy trading and carpentry. I've crafted some furniture pieces for our home.

Alan Xie (MS'21) writes: After graduating from Columbia, I received my MBA from Harvard Business School. Along with a classmate from my section, I'm currently working on an AI-native business process outsourcing startup. Our company, Callback, is part of the Y Combinator summer 2024 batch.

COURTESY ALAN XIE

Harald Gerhardsen (MS'23) writes: Though the job market in 2023 and 2024 has been extremely tough, and despite applying to well over 500 positions (and getting rejected by all of them), I landed myself a position as the lead machine learning engineer at a small startup in Indiana, where I lead the research and development efforts of a novel sensor technology for the construction industry. I am very lucky to say that, in many ways, I have my dream job, and I get to take a large role in building a company and a product from the ground up, together with my brilliant colleagues.

Mahesh Jindal (MS'23) writes: I am currently working as an applied scientist at Amazon, where I am engaged in cutting-edge research in information retrieval and recommender systems.

Chenyu Zhang (MS'24) writes: I graduated in February 2024 with a master's degree in data science from Columbia University's Data Science Institute. After completing the rigorous 30-credit program, I took the opportunity to travel the world before beginning my PhD studies at MIT's Laboratory for Information and Decision Systems and Institute for Data, Systems, and Society.

Electrical Engineering

Michael Otten (MS'65) writes: My experience at Columbia and after has always been cross-disciplinary. As my work was mainly computer science before Columbia had such a department, I was technically an EE, but my MS project was to design a laboratory computer, which was used for some time after my graduation as a device to demonstrate the errors that could result from critical races, an electronics problem for early computers. In the past five years, I've led an initiative that has catalyzed important changes in election law.

Alex Chan (MS'02) writes: In August 2024, the Supreme Court of California appointed Mr. Alex Chan as chair of the Committee of Bar Examiners of the State Bar of California, a 17-member committee comprising appellate and administrative law judges, district attorneys, public defenders, and mayors responsible for overseeing all aspects of licensing and admissions to practice law in California.

Industrial Engineering & Operations Research

Lida Low Kon (MS'70) writes: Retired after 35 years at IBM and living in Menlo Park, California. Very grateful for all the great memories!!

Bruce Jacobs (MS'73) writes: I co-edited the "Journal of Portfolio Management" special issue dedicated to Nobel Laureate Harry Markowitz, which was published on July 1, 2024. My firm, Jacobs Levy Equity Management, celebrated its 38th anniversary this fall.

Alexander Berenbeim ('11CC, MS'12) writes: In the time since I graduated from SEAS and left Columbia, I have worked as a mathematical consultant for health care companies, worked to develop an AI startup, and am presently a senior AI and machine learning researcher at the Army Cyber Institute, located at West Point. Although my subsequent master's and PhD in pure mathematics enriched the technical background informing my current research, the skill set developed through the IEOR department has proved invaluable for my past and present endeavors.

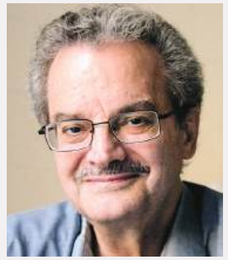
COURTESY MICHAEL OTTEN

Mechanical Engineering

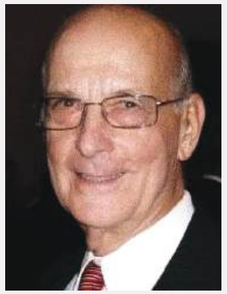
Wilbur Shapiro (MS'59) writes: Since retiring from an engineering career in 2005, I have become an author and have written eight novels. My book "Amos the Gifted" will soon be absorbed by a major publisher, Penguin Random House.

In Memoriam

Columbia Engineering mourns the loss of **Richard Longman**, professor of mechanical engineering and professor of civil engineering and engineering mechanics. Longman, who taught at Columbia for more than 40 years, was best known for his innovation in the control of dynamic systems, resulting in important contributions to three burgeoning fields: time optimal control of robots for increased productivity, satellite mounted robot kinematics and dynamics, and iterative learning control to make robots doing repetitive tasks improve their performance to ultimately achieve zero tracking error. In his many collaborations, Longman brought an incredible mathematical talent, an instinctive understanding of dynamics, and an intellectual curiosity and attention to details that were unmatched and helped raise the bar of all the collaborators.



RICHARD LONGMAN



TULLIO "TED" BORRI

Tullio "Ted" Borri BS'51, '82BUS, '84BUS died peacefully on April 5, 2024, two days after his 95th birthday. His connection with Columbia Engineering was very important to him. He was an active member of the Columbia Engineering Alumni Association, serving as president and a board member, and was the secretary of the Class of '51. He was also a member of every milestone reunion committee, serving his class with pride. Ted and his wife, Cecil Ane Borri, endowed a scholarship, and meeting and mentoring the scholarship's students was an ongoing source of pleasure and pride.

Mark Carlos MS'77 passed away on July 16, 2024, at age 72.

Lynn Conway BS'62, MS'63 passed away on June 9, 2024, at age 86.
Read our tribute on page 54.

Columbia Engineering mourns the loss of **Dr. Edward A. DeCarbo Jr.**, former Engineering dean of students (1985–1990), who passed away on Feb. 18, 2024, in New York City.

William "Bill" Doll MS'55 passed away on July 10, 2024, surrounded by his loving family. He obtained his MS in electrical engineering at Columbia University in 1955. He was most proud of creating CHIRP, a radar technology that uses frequency modulation and pulse compression. Following a 20-year career at Bell Labs, he took a position at Lockheed Electronics and continued to work in the defense industry designing radars for warships and planes for the U.S. and other countries. Bill was always curious and a lifelong learner who will be greatly missed by his friends and family.

KRISTOPHER "KRIS" HOLDER

Kristopher "Kris" Holder MS'24, age 30, passed away on July 5, 2024, in a tragic motorcycle accident. Kris was a man of faith and an adventurer, who deeply loved his friends and family, and work as a traffic engineer.

Dr. Michael N. Infantino BS'76, MS'77, 70, of Holmdel, New Jersey, passed away peacefully at his home, on July 30, 2024. Michael was born on April 6, 1954, in Brooklyn, New York, where he grew up in the Dyker Heights section and met his beloved wife, Veronica "Ronni" (Albergo) Infantino. He earned both his bachelor's degree in bioengineering and his master's degree in chemical engineering from Columbia.

IRA M. MILLSTEIN

Ira M. Millstein SEAS'47, LAW'49 died on March 13, 2024 at age 97. Ira was the oldest and longest serving partner at Weil, Gotshal & Manges, a prominent civic leader in New York City, and an ardent supporter of Columbia University. Although his passion was in law, Ira remained an avid member of the Engineering community. In 2007, he became the first recipient of the Samuel Johnson Medal. He was later a longstanding committee member on the Samuel Johnson Medal committee, serving from 2009 to 2019.

Raymond Moran BS'96, MS'04 passed away in January 2024 following a serious illness. Raymond earned a BS in mechanical engineering and an MS in civil engineering and engineering mechanics. He was also a student in the Doctor of Engineering Science program, working under the supervision of Dr. Ibrahim Odeh.

Engineering Materials for Humanity

RESEARCH LEAD

Nanfang Yu, associate professor of applied physics, Department of Applied Physics and Applied Mathematics

For hundreds of millions of years, the ancestors of modern butterflies and moths have evolved wings that can control light waves and regulate temperature. Researchers at Columbia are investigating the nanostructures and optical properties of these remarkable biological materials to figure out how they work. By studying tens of thousands of specimens from the Museum of Comparative Zoology at Harvard University — and leveraging developments in computational electromagnetism, deep learning, and nanofabrication — they aim to develop a new class of photonic materials and structures. When put to use in service of humanity, these technologies could address energy and environmental challenges by enabling microclimate regulation and energy harvesting.

COLUMBIA ENGINEERING

Engineering for Humanity

COLUMBIA ENGINEERING MAGAZINE

WINTER 2025
VOL. 66 NO. 1

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AND APPLIED SCIENCE OF COLUMBIA UNIVERSITY
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WILL CELEBRATE
THEIR JUBILEE YEAR.