On Campus

Columbia’s New Provost Looks Forward

Mary C. Boyce, the former engineering school dean, will put the University’s scholarship to work on some of the world’s most pressing problems.

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Mary C. Boyce (Diane Bondareff)

This summer, Mary C. Boyce, a prominent mechanical engineer who served for eight years as dean of the Fu Foundation School of Engineering and Applied Science, became the University’s provost, or chief academic officer. The first woman and the first engineer ever to hold the position, she now oversees faculty appointments and tenure decisions, directs the development and implementation of Columbia’s

academic plans and policies, and supervises the work of its faculties, departments, institutes, and research centers.

Boyce, who came to Columbia from the Massachusetts Institute of Technology in 2013, has chalked up an impressive list of achievements in her academic career. As an expert in nanotechnology and materials science, she has pioneered new ways of modeling and developing synthetic materials that are found in vehicles, protective equipment, sporting goods, and many other products. As a professor, mentor, and department head, she has been a passionate advocate for women in education and research in the STEM fields (science, technology, engineering, and math). And as dean of Columbia Engineering, Boyce elevated the stature of many of the school's degree and research programs and increased the diversity of its faculty and students. She also led a capital campaign, called Engineering for Humanity, that raised more than $300 million and forged new collaborations between engineers and scholars across the University to amplify the field of engineering's impact on challenges facing humanity.

So what are Boyce's goals as provost? And how might her background as an engineer inform her perspective in that role? *Columbia Magazine* spoke with Boyce about these topics and more.

You've assumed the position of provost at a critical moment, as Columbia is returning to campus life after the pandemic. What challenges do you see ahead?

I like to focus more on the opportunities ahead. Of course, COVID-19 presented challenges, but the members of our University community also became more deeply engaged with one another and formed incredible bonds as we confronted those challenges. The intensity of our community spirit was evident early on in the pandemic, as we quickly adapted and innovated to deliver world-class education to our students, no matter where they were. Our labs rapidly rebounded to maintain progress on fundamental research, while at the same time faculty and students from across our schools and institutes expanded their efforts to conduct research on the disease and to design and produce personal protective equipment for health-care workers. I think these experiences have built a stronger, more resilient Columbia community. Moving ahead, I want us to build on this unity and connectedness and to consider the future that lies before us and how we as Columbians can think boldly

about what we can accomplish together. The Office of the Provost is uniquely positioned to understand and support the talent, programs, and future directions of each school and to identify collective opportunities that can lead to even greater impact in our research, our teaching, and our service to the world.

You have always been a strong advocate for interdisciplinary research. Why is it so important to the future of Columbia?

Here at Columbia, one of our strengths is in what I call pan-disciplinary research, which involves collaborations between disciplines that haven't traditionally intersected. We have engineers working with journalists and with clinicians, neuroscientists teaming up with social scientists and artists, climatologists collaborating with economists and policy experts, and so much more. Columbia is particularly well positioned to show leadership in pan-disciplinary research because the University has a depth of expertise in so many different fields — from the natural sciences to the humanities to our many programs focused on the public interest, from social work to public health to urban planning. Columbia is unsurpassed in its capacity to understand the world's most urgent challenges and to develop transformational solutions to address them.

Columbia's impact is further amplified by our presence in a global city that is the locus of so many institutions, a city where many different industries and ideas converge. In New York City, our faculty and students — who come from across the nation and around the world — witness pressing challenges as they are first emerging, and they are at the forefront of efforts to address them. Indeed, Columbia attracts students and faculty who have this mindset of being engaged with the world.

This all builds a collective sense of excitement at Columbia right now because of how boldly we're thinking about the role of collaboration in our University's future, both in terms of our scholarly leadership and our impact on society. We see this in the formation of the new Columbia Climate School, the Zuckerman Mind Brain Behavior Institute, the Columbia Nano Initiative, the Data Science Institute, and Columbia World Projects, all of which bring together leaders and scholars from multiple disciplines to tackle important scientific and social challenges. It is at the interfaces of academic disciplines that the most exciting new discoveries and innovations can emerge.

You helped to make a lot of connections like this during your tenure at the engineering school. How did you do it?

Some of it happens organically. Curiosity drives faculty and researchers to find people in other fields who can enrich their own work and with whom they can together have a greater impact. But you can also encourage collaboration by bringing people from different parts of the University into the same room and then providing seed funding for new joint research and education. For example, during my time as dean, we'd periodically hold forums or dinners to discuss pressing topics, such as engineering's impact on health and medicine or on sustainability and climate, inviting faculty from across engineering and from other schools. Inevitably, once people start talking, opportunities for collaboration arise, and the next thing you know, interdisciplinary teams of researchers begin to work together.

The curriculum and cocurricular activities at Columbia Engineering also seek to promote interdisciplinary thinking among students. The school has in recent years launched joint-degree programs with the journalism and business schools, as well as a data-science degree offered in partnership with the Graduate School of Arts and Sciences' statistics department and the Data Science Institute. Columbia Engineering has also offered courses that are team-taught with faculty in liberal arts, public policy, business, and law to promote the use of more sophisticated analytics in those areas, as well as entrepreneurial workshops and courses in collaboration with the medical school. The school's introduction of design challenges for students — which are project-based sprints to address timely topics — has attracted participation from across Columbia to work together on actionable solutions to societal challenges, including diseases like Ebola and COVID-19, environmental and urban challenges, mobilizing the US Census's count in New York City, and more.

President Lee C. Bollinger and other members of Columbia's senior leadership have begun to articulate a new core mission for the University, which they call its Fourth Purpose. What is this new mission?

The Fourth Purpose complements the University's traditional missions of teaching, research, and public service; it's all about translating knowledge into solutions to major societal challenges like climate change, access to energy and clean water, economic inequality, and cybersecurity threats. The Office of the Provost will take a lead role in advancing the Fourth Purpose, and my staff and I will be looking for ways to support faculty and students who are interested in bringing their knowledge out

into the world to make a positive impact. We'll be asking: Where are the opportunities for putting academic knowledge into action more rapidly? What might the barriers be, and how can we minimize those? How can we provide the right kinds of support and structure to propel such efforts? And how do we better facilitate partnerships with government, industry, and the nonprofit sector in order to translate knowledge into solutions? Columbia World Projects is emblematic of the Fourth Purpose and will continue to spearhead convenings and collaborative projects; I envision a great partnership between Columbia World Projects and the Office of the Provost as we advance this transformative initiative, taking advantage of the breadth, depth, and beauty of the entire University to better tackle real-world problems.

What are your other goals?

Of course, my basic goal is to advance excellence across the entire University in talent, education, research, service, and the type of translational work we've been discussing. I still have a lot to learn, and a lot of thinking to do, about how to advance all of these elements of our mission. A key priority is attracting the best faculty, students, and researchers. And an important dimension of that is ensuring that we create an environment and culture that helps us attract and support talent from diverse backgrounds. Diversity can mean many things, including welcoming people whose personal perspectives, countries of origin, or gender, racial, ethnic, or socioeconomic backgrounds are traditionally underrepresented. Attracting diverse talent is vital because diversity of thought and perspective influences the intellectual questions and challenges that we choose to pursue. It also fuels innovation, because if the people working on a creative project all think alike, they make fewer breakthroughs. Diversity is key to our intellectual leadership and impact.

Promoting educational innovation is another one of my goals. Every Columbia school has been actively innovating in how we teach students, particularly during the pandemic. The University has an amazing Center for Teaching and Learning that fosters collaborative learning across disciplines and supports the effective use of new technologies. I'd like to see Columbia further experiment with new ways of expanding our educational reach and impact, particularly as we recognize the convergence of different fields and interdisciplinary thinking, as well as the increasing need for lifelong learning in our rapidly evolving knowledge-based economy and globalized world.

Columbia’s engineering school made remarkable progress in diversifying its student body and faculty in your time as dean.

The so-called STEM fields have historically had challenges attracting diverse talent. I’ve been pleased to see how this has been changing over the last decade or so. At Columbia Engineering, we were able to double the number of women faculty and to attract an undergraduate student population that is one-half women in our entering class, while also making strides in our graduate-student population. We have recently had parallel success in attracting students from historically underrepresented racial and ethnic backgrounds to our undergraduate programs, and we aspire to make further inroads in our graduate programs and our faculty. Of course, we need to remain vigilant and continue this momentum. Across Columbia, our department chairs in the STEM fields and beyond are deeply committed to expanding racial and ethnic diversity among our students and faculty. In particular, I am excited to be a part of new initiatives that focus on building pathways to attract talent to graduate programs.

What was your experience like starting out in the field?

When I was an undergraduate at Virginia Tech in the late 1970s, there simply weren’t many women studying engineering. So that was a bit of a challenge. It was a time when there was inherent pressure to demonstrate that you belonged in engineering — that you were not only capable but excellent. While the number of women in the field of engineering has generally improved, there has been uneven success across academia and in some industries. With respect to historically underrepresented minorities, these challenges are even greater. So we all have to recognize that there is much work still to be done.

I was fortunate that many of my professors, who were all men, were very supportive. This was the case at Virginia Tech and at MIT, where I earned my PhD. It is imperative that all students know that they have that recognition and support for their capabilities and talents. That made a big difference for me, and it had a lasting impact, because it gave me the encouragement to go on to graduate school and academia. It also inspired me to be an effective mentor to my own students.

Had you received much encouragement when you were younger?

My parents recognized that I found great joy in math and physics and that I was very good at those subjects. They were supportive but not pushy. I was born right here in

Inwood and grew up in New Jersey as the second oldest of seven children, and my parents always stressed the importance of education, hard work, and perseverance. At the same time, they let each of us find our own way, since we are quite different from one another. This shaped me and gave me confidence in my studies and in my life. I was also influenced by my grandparents and their history — they each came to New York City from Ireland as a young adult with little money or education. They were wonderful people who showed great courage and ambition leaving their home and finding their way in the city; they worked extremely hard at difficult jobs to build a life for their own children and for me, my brothers, and my sisters.

As a graduate student and professor at MIT, you did groundbreaking work in mechanical engineering. Can you explain the nature of your research?

I'm a mechanical engineer who works in an interdisciplinary area that merges fundamental mechanics — which itself is based in mathematics, physics, and, in recent years, chemistry — with the study of the microstructure and behaviors of physical materials. More specifically, I study the structure of materials from the nanoscale (the level of atoms and molecules) all the way up to the macroscale (where particles combine to make complete materials). Most of my research has focused on the complex mechanical behaviors of soft polymers and composites. These materials are remarkable in their ability to stretch and deform, while storing the energy of their deformations and then recovering afterward or dissipating the energy to absorb or cushion a physical impact. My work has been theoretical, computational, and experimental, with an emphasis on developing predictive models for design. Some of the models that my colleagues and I have developed are incorporated into major software programs that engineers use when designing materials and components found in automobiles, airplanes, and biomedical devices, as well as in sporting goods and protective equipment.

What inspired you to enter administration?

I'm someone who feels great satisfaction and joy in research, in pursuing the puzzles of a material's structure and function, and in formulating models and experiments to understand, to predict, and to design. Part of this also involves collaborating with students and colleagues in different fields. My entry into leadership was connected to my research: I designed and led multidisciplinary teams of faculty and students on large-scale challenges. Over the course of my career, I've come to see that I can have a bigger impact on my field, and on higher education in general, by taking on

leadership positions. In my last few years at MIT, as chair of the institute's mechanical-engineering department, I saw that engineering disciplines were converging with other fields to develop innovative solutions to societal needs. Engineering knowledge and thinking were becoming more broadly fundamental. At Columbia, I recognized that engineering and applied science were poised for such a renaissance.

At the same time, we need to be sensitive to how technological advancements can both do tremendous good and have unintended consequences. For example, artificial intelligence, while improving many aspects of our lives, is also raising serious concerns about the amount of trust we place in algorithms, like the potential for bias in their results or the promotion of misinformation. Simultaneously, areas in health and medicine are poised for dramatic advancements, where new linkages with engineering fields will help to usher in this future. Part of the reason I came to Columbia to lead the engineering school was that I wanted to be in a place where engineers have the opportunity to collaborate with experts and scholars in diverse fields — for example, addressing the ethical, legal, and social consequences of our work or tackling crucial challenges in public health or medicine or climate. As engineering dean, I enjoyed keeping in close contact with our sister schools. And now, as provost, I'll be looking for opportunities to forge new connections among all the University's academic programs, acting as a sort of intellectual integrator, if you will. The level of expertise that can be found across so many fields at Columbia is without parallel. To identify solutions to complex problems such as climate change, water and food insecurity, lack of access to health care, and racial and social injustice, academics will need to work across disciplinary barriers — and Columbia is positioned to lead this bold future.

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Guide to school abbreviations

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