Undergraduate research initiative opens doors



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When Cornell University's ORIE Undergraduate Society (OUS) held a research night this fall, the student-run event met with an enthusiastic response. "We had a huge turnout," said member Jody Zhu '22. "After talking to some underclassmen, I realized they were feeling the same way I did two years ago when I first went looking for research opportunities—hungry for knowledge and wanting hands-on experience."

It is a need the School of Operations Research and Information Engineering is working hard to meet, says Associate Professor David Goldberg, the OUS faculty advisor. Over the past summer, he put out a call to students to revive the group, which had become less active during the pandemic, with a strong focus on research. “I thought that people may be feeling a little isolated, and this would be a great way to bring them together,” he explained.



Jody Zhu ’22



Willem van Osselaer ’22

Willem van Osselaer ’22, who had changed his major just as classes moved online and had yet to meet his fellow ORIE students, was among dozens of students happy to take him up on the offer. Van Osselaer, Zhu and a handful of other students are currently working with faculty advisor David Shmoys, the Laibe/Acheson Professor of Business Management and Leadership Studies, to help the Cornell Registrar better schedule exams to minimize the number of students with conflicts. “Research has been a great way to get to know not only ORIE professors but also other ORIE students,” van Osselaer said. “It has been a joy to work together on something that impacts the Cornell student community so directly.”

The project is one of six on offer through the society, adding research opportunities with such partners as CVS, General Motors and the Enfield Food Pantry to those traditionally available directly through faculty members for academic credit or pay. Between one and two dozen students enroll in the ORIE Project course (ORIE 4999) each semester as they conduct independent research with an advisor, while typically up to four ORIE students per year receive

grant support for wages or project expenses from the college-wide Engineering Learning Initiatives Student Grant Program (ELI). (The Meyer Gross '58 Scholar in Undergraduate Research Fund is earmarked specifically for one or two ORIE undergraduates annually.)



Bonnie Akhavan '22

Bonnie Akhavan '22, for one, is working on the Cornell COVID-19 modeling team for academic credit. There she joins Eleanor and Howard Morgan Professor of Engineering Peter Frazier, Charles W. Lake, Jr. Chair in Productivity Shane Henderson, Shmoys, five Ph.D. students and her friend Henry Robbins '22 in using data science to study the spread of COVID-19 on Cornell's Ithaca campus and the impact of various interventions on public health. "Doing research on my team is a very empowering experience," said Akhavan, who has been running a simulation developed by two of the doctoral students to determine how different levels of masking could impact the number of infections seen in a semester. "The faculty in our group have been incredibly supportive and given me so many opportunities to take charge of my work and contribute meaningfully to the avenues that we're trying to research."

Thanks to this first research experience, Akhavan is now considering extending her plans for a master's degree into a Ph.D.—like Zhu, who has decided to pursue a doctoral degree after greatly enjoying the challenges of several semesters of research. In addition to the OUS project with the Cornell Registrar, she has also worked with a team around Shmoys on optimizing seating assignments with social distancing constraints and is part of a small group of undergrads helping Henderson code up a library of test problems on which to run and improve a variety of solvers.

For Henderson, the benefits of the undergraduate research relationship go well beyond the fact that students are taking on a time-intensive task that may result in solvers with a "huge" scope of application. "It's fun getting to know some of the students who are just terrific personalities, people with incredible potential, whom we can help on to the next stage of their careers," he said. Getting to know them as individuals outside of the classroom also makes it a lot easier to write personalized and genuine letters of recommendation. "You can view them as a full-dimensional person."

Students, on the other hand, find that engaging in research builds bridges—to their professors and peers, to careers in academia or industry, and between the classroom and real-world applications. Hoping to understand how theory can be leveraged to make a practical impact, Christopher Archer '22 first participated in Associate Professor Jamol Pender's research with the Ithaca Police Department as a freshman. Two years later, he worked with his advisor, Associate Professor Siddhartha Banerjee and graduate student Sean Sinclair, Ph.D. '23, on developing a reinforcement learning environment for fair online resource allocation, motivated by the challenges that face the Food Bank of the Southern Tier. (Both experiences were supported by the Hunter Rawlings Presidential Research Scholarship.)



Christopher Archer '22

"My classwork gave me more theoretical grounding for the topics that surfaced in my research, and my research gave me topics that motivated my study, including which classes to take and what to focus a project on," Archer said. "I got a huge confidence boost. I know now that, with enough time, I can solve real-world problems and convey the correctness of my solution using math and data science."

Pender, whose own undergraduate research experiences helped steer him onto the academic path, points out that, by pursuing research, students also hone important independent critical thinking and computational skills, as well as their abilities in oral and written communication. Add to that the chance for students to practice leadership by directly managing relationships with industrial partners through OUS projects, and undergraduate research in ORIE "really provides a holistic experience to close the loop on what they learned in the classroom," said Goldberg.

For Vishruth Rajinikanth '22, understanding how to speak with industry partners was a big takeaway from working on two project teams—one optimizing the CVS supply chain, the other examining questions in pricing and advertising at GM. "It is just as crucial to communicate the work we have done as it is to do the work itself," he concluded. "Making interpretable conclusions that decision makers can ultimately use is a skill in itself. For me this research experience has been invaluable."

Goldberg believes alumni can play a key role in creating such opportunities. “I think of it as an OR ecosystem, where alumni who were undergraduates connect to current students and help mentor them on their path,” he said. “Then those students will themselves become alumni. You get this virtuous cycle.” He hopes to host alumni for virtual or in-person chats with groups of undergraduates and plans to launch a more formal mentoring network through OUS in the coming months.

Other forms of support are just as welcome. “For the undergraduate society and these research initiatives to reach their fullest potential, we do need funds to not only staff and run all these projects, but also hold events for students to showcase their work, send students to conferences, and bring in speakers from industry and academia,” Goldberg said. Pender adds that anyone wanting to back undergraduate research may also consider contributing to ELI, specific professors who provide opportunities to students or the ORIE department. (A generous gift from an alumnus, for example, flowed into the ORIE Fund for Innovation in Undergraduate Research last year.)

As students’ response to the OUS research night proved, they are eager—and grateful—for the increasing avenues to expand their learning and skill sets through undergraduate research. “I applaud the efforts to give more students the opportunity to participate,” Zhu said. “Before, cold-emailing professors seemed like the only way to get involved, so it’s exciting to see ORIE breaking down barriers and opening doors.”

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