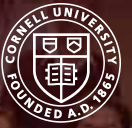


CornellEngineering

Operations Research and Information Engineering



MAGAZINE 2023

**ORIE WELCOMED
THE WORLD BACK TO
ITHACA IN 2022**

AN INVITATION

As I look forward to welcoming many of you back during Reunion on June 10th, I think about what might bring me back to visit ORIE. Here are some things that come to mind. First, the vibrant, collegial environment you left remains, even if some of the faces have changed. During the pandemic, I worried that coming out of the fog might lead to a significantly different feel when we returned. Nothing could be further from the truth. I credit this in part to the students, faculty, and staff who gave selflessly over the last two and a half years and have continued to put the pieces together toward our return to normalcy.

Next, reconnecting with your classmates is certainly a huge part of Reunion and I hope you have that opportunity. In addition to seeing some of your professors, I think you will find the energy of the newer hires exciting. Our focus has leaned heavily on hiring in data-driven decision-making with faculty touching all areas of this space while crossing the traditional boundaries of optimization, applied probability, and statistics.

Third, the students will not be here when you arrive, but it will not be hard to envision them (or yourself) in the faculty offices, outside in the hallways or attentively listening in the classrooms. We have made some changes to make the school more inviting without changing its character.

Lastly, and most importantly, there is so much to be proud of within the School of ORIE. In these pages, you will read about some of our recent activities and accomplishments. We are particularly proud of our students who are both innovative and inspiring. Our faculty and students (often together) earn recognition on an (inter-)national level, while also making a difference on our own campuses. We are excited about what is going on in



Ithaca, at Cornell Financial Engineering Manhattan, and at Cornell Tech. Even if you cannot make it back to reunion, please stay in touch. Enjoy the magazine!

P.S. I would be remiss not to mention the passing of long-time ORIE Professor Uma Prabhu; a teacher, researcher, and mentor many of you may have had the pleasure and honor of knowing in your years at Cornell. There is a remembrance of Uma on page 21 of this magazine. He will be missed.

Warm regards,

Mark E. Lewis
 Director, ORIE
 ORIE_Director@cornell.edu
 607.255.9126

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Director: Mark E. Lewis
 Director of Admin.: Leslie Meyerhoff

Writers: Chris Dawson, Pat Gillespie

Editors: Chris Dawson, Reeve Hamilton, Syl Kacapyr, Mark E. Lewis, Leslie Meyerhoff
 Designer: Rob Kurcoba

Photography: Jason Koski, University Photography, Robyn Wishna, Chris Dawson, Jake Cornelius

ON THE COVER

ORIE Professor David Shmoys teaching a summer class and attendees of the long-delayed Stochastic Networks Conference posing in Duffield Hall.
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THE ORIE MISSION

The School of Operations Research and Information Engineering, on the forefront of Operations Research science, continues to influence and impact organizational and managerial process improvement, productivity, and performance through sophisticated mathematical and analytical techniques—quantitative methodologies applied to solving complex problems and reducing business risk.

Cornell University
 School of Operations Research & Information Engineering
 206 Rhodes Hall
 136 Hoy Road
 Ithaca, NY 14853
 607.255.4856
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ORIE welcomed the world back to Ithaca in 2022

The school hosted two major gatherings this year in a welcome change from the isolation of 2020 and 2021.



A movie focused on the nuts and bolts of what OR researchers and practitioners actually do during many of their working hours would probably feature artful shots of computers and keyboards, fingers typing, numbers scrolling across screens, and steaming coffee cups fueling early-morning and late-night data crunching.



Such a montage, though not inaccurate, would be leaving out an essential and invigorating part of the research process: getting together with other researchers and practitioners to share data, debate methods, discuss applications, sharpen models, float ideas, and tell stories.

Because of the COVID-19 pandemic, OR researchers—and everyone else—found the opportunities to meet in person and to make the personal and professional connections so valuable to life severely limited for more than two years. Not all conferences were cancelled or held virtually in those two years, but many of them were. And those held in person seemed to draw fewer people.

While COVID is not over, circumstances did change enough in 2022 for OR researchers to once again meet in person. Cornell ORIE took full advantage of the possibility and hosted two major conferences on campus, with visitors coming from far and wide.

Stochastic Networks Conference

After a two-year postponement the bi-annual Stochastic Networks Conference was held the week of June 20-24 at Cornell. The conference, initiated in 1987, is a major forum for researchers to learn the latest developments and new research directions in stochastic networks.

Stochastic networks is a multifaceted area of research concerned with the modeling, stability, control, performance,

approximation, and design of stochastic networks. It gives rise to challenging and subtle mathematical problems, whose solution often requires a combination of ideas and techniques from several branches of mathematics, including probability theory, stochastic processes, analysis, optimization, algorithms, combinatorics, and graph theory. Research in this area is strongly motivated by applications in diverse domains, ranging from the traditional areas of telecommunications and manufacturing to service operations, biological and social networks, revenue management, and health care.

This year's conference, sponsored by ORIE, Cornell's Systems Engineering program, the National Science Foundation, DiDi, INFORMS' Applied Probability Society, the SC Johnson College of Business, and IMS, drew roughly 100 participants and featured a poster session, talks, lightning rounds, meals, a reception, excursions around campus, and more. It was organized by Professors Jim Dai, David Goldberg, Itai Gurvich, and Jamol Pender, and doctoral student Sean Sinclair.

Young Researchers Workshop

The Young Researchers Workshop organized by ORIE Professor Shane Henderson took place October 6-8, 2022, at Cornell. The workshop has been a yearly event since Cornell ORIE first hosted it back in 2014 and it draws young scholars from universities and research institutions around the world.

Participants travelled to Ithaca and Ithaca rewarded them with some stellar fall weather. There was an opening night reception at Liquid State Brewing Company, giving attendees a chance to socialize and ease into two days of talks and poster sessions.

There were five sessions dedicated to workshop speakers, with each speaker given 20 minutes to present their work and take questions. These sessions were each chaired by a Cornell faculty member, including ORIE's own Jamol Pender, Omar El Housni, Manxi Wu, and Christina Lee Yu, and the S.C. Johnson College of Business's Ruihao Zhu. The talks were organized along much the same lines as talks given at INFORMS conferences, and feedback about all of the sessions was overwhelmingly positive.

In addition to the speakers, there were close to 60 posters presented in the Physical Sciences Building during sessions Friday afternoon.

Conferences such as the Stochastic Networks Conference and the Young Researchers Workshop are the lifeblood of the field—they give people at all stages of their OR careers a chance to come together, put faces to names, talk about ideas, and then go back to their work reinvigorated. In that way, 2022 was a very good year here at Cornell's School of Operations Research and Information Engineering.



S U C C E S S F U L O R I E S H O W C A S E H I G H L I G H T S U N D E R G R A D R E S E A R C H , P R O M O T E S T H E F I E L D

The Cornell Undergraduate ORIE Society and Associate Professor David Goldberg hosted an event billed as an ORIE Showcase on Tuesday, May 3 in Rhodes Hall. The event featured a poster session, networking, food, and a short talk by Professor Peter Frazier and ORIE undergrads Henry Robbins and Bonnie Akhavan.

The showcase was conceived with several purposes in mind. One was to give ORIE undergraduates a chance to share their research projects with peers, professors, grad students, and students from outside of ORIE. Another was to help build a feeling of community in the school after two long years of

limited chances to socialize. And a third goal shared by Goldberg and the student leaders of the Undergraduate ORIE Society was to introduce the field of Operations Research to students who have not yet chosen a major.

There were ten posters and a software demo in the poster session, representing the work of close to 25 ORIE undergraduates in collaboration with faculty members Mark Lewis, David Shmoys, Shane Henderson, Jamol Pender, Gennady Samorodnitsky, Katya Scheinberg, and David Goldberg. The crowd of more than 80 people circulated and had a chance to ask questions of the students about their research design, methods,

results, and conclusions.

Attendees also had pizza and soft drinks provided by the School.

In the second half of the event, Peter Frazier, (the Eleanor and Howard Morgan Professor of Operations Research and Information Engineering), was joined by seniors Robbins and Akhavan as they presented a description of the invaluable work done by a large team of ORIE faculty and students in response to the emergence of the COVID-19 epidemic in late 2019.

The work done by the University's COVID-19 modeling team is what enabled the University to be open for in-person classes

while simultaneously monitoring disease spread and relative risk.

The talk was well-received and students in the audience had many questions about both the methods used and the challenges of real-time, consequential research.

Professor Goldberg collected contact information from more than 40 students interested in learning more about Operations Research at Cornell. This year's event—organized by Goldberg along with Cornell Undergraduate ORIE Society leaders Jody Zhu, Kathy Byun, Vaish Gajaraj, Henry Robbins--was a big success and is now scheduled to happen every April in the coming years.

O R I E W E L C O M E S N E W M E M B E R S T O T H E I N F O R M S O M E G A R H O H O N O R S O C I E T Y

In the past two academic years Cornell's School of Operations Research and Information Engineering has welcomed 36 new members to the INFORMS Omega Rho Honor Society. In May the School hosted a reception to recognize and congratulate these students.

Due to COVID considerations, ORIE was unable to gather to recognize 2021's 23 honorees. In 2022, the School hosted an ice cream reception for the 13 members of the 2021-22 cohort as well as for those from last year's group who were still at Cornell.

The Institute for Operations Research and the Management Sciences (INFORMS) is an international society for practitioners in the fields of operations research, management science, and analytics. One of the many valuable roles INFORMS plays in the development and promotion of the field of OR and analytics is the administration of the Omega Rho Honor Society. Omega

Rho was founded in 1976, independent of INFORMS, and came under the INFORMS umbrella in 1998.

According to the Omega Rho oath, the society exists "to encourage the study of Operations Research and Management Science related disciplines and to recognize academic excellence and leadership potential in these areas." There are currently 38 chapters of Omega Rho, with Cornell being home to a large and active chapter.

To be considered for admission to Omega Rho, a student must be a junior or senior in the top 25% of their class and have a G.P.A. of 3.5 or higher. In addition, the ORIE faculty must also approve a student for admission to the society.

Several ORIE staff and faculty joined the honorees for ice cream from Cornell Dairy and some welcome comments from ORIE Director Mark Lewis.

The two most recent cohorts are listed below:

Omega Rho 2022

Hanyu Zhang
Bonnie Akhavan
Vladia Trinh
Bennett Miller

Vishruth Rajinikanth
Rebecca Westerlind
Jeren Konak
Yingxi Li

Christopher Lawson
Kevin Jiang
Trey Hensel

Emily Hanh
Caroline He

Omega Rho 2021

Zachary Katz
Yiheng Dong
Arjun Suri
Devin Smedira
Allison Grimsted
Sophia Arzumanov

Lea Nassar
Selena Kang
Jacob Arnold
Rhythm Raghuvanshi
Stephen Tse
Rachel Lu

Joseph Merhi
Eva Zhang
Jack Rehmman
Julia Allen
Henry Robbins
Christopher Archer

Zili Zhou
Kaitlyn MacGillis
Ja Young Byun
Jody Zhu
Yichen Feng

THE INTERNATIONAL HONOR SOCIETY
OF INFORMS



OMEGA RHO
Whose objective is the encouragement of
OPERATIONS RESEARCH and MANAGEMENT SCIENCE

CFEM TEAM WINS IAQF CONTEST

In July 2022 the International Association for Quantitative Finance (IAQF) announced the winners of the Eleventh Annual Academic Affiliate Membership Student Competition. Twenty-five teams representing fourteen academic programs submitted papers in response to the 2022 competition problem which focused on predictors of the state of the market.

The IAQF is the not-for-profit, professional society dedicated to fostering the profession of quantitative finance by providing platforms to discuss cutting-edge and pivotal issues in the field. Founded in 1992, the IAQF is composed of individual academics and practitioners from banks, broker dealers, hedge funds, pension funds, asset managers, technology firms, regulators, accounting, consulting and law firms, and universities across the globe.

Cornell's Team One Price was one of the six winners chosen and their paper was called "The Boy Who Cried Bear: Multi-Model Approach for Predicting Market State." The team was led



by student team captain Evan Kurzman. Team members included Payton Martin, William Line, Kelvin Sun, Peter Emanuel, and Vishad Bhalodia. The team worked under the direction of Senior Research Associate Sasha Stoikov. The authors are (or have been) Master of Engineering in Financial Engineering students at Cornell.

FALL 2022 KICKOFF EVENT



In late September 2022 ORIE hosted a Kickoff event that got the semester off to a great start. Students, faculty, and staff were present—as well as one baby! A panel of prominent

alumni from a wide array of fields joined via video and answered student questions about Operations Research and the many paths it can lead to. And if that weren't enough, there was pizza!

ORIE GRADUATION 2022

More than 170 undergraduate, M.Eng., and doctoral students received their degrees from Cornell University and the School of Operations Research and Information Engineering on the weekend of May 28-29, 2022.

The weekend was marked by fully in-person ceremonies at Schoelkopf Field, Uris Hall, and Sage Chapel with families,

friends, and faculty joining the graduates to celebrate their achievements. While the weather was variable, (with some rain on Saturday and sunny blue skies on Sunday), the mood was joyous.

Kathryn Caggiano, professor of Practice and Director of M.Eng. studies, presented individual awards to the undergraduate and M.Eng. students chosen for fellowships or other special recognition.



Honorees are listed below:

Byron W. Saunders and the Allen H. Mogensen Awards for Outstanding Students

- Bonnie Akhavan
- Christopher Archer
- Henry Robbins
- Zachary Katz
- Hanyu Zhang

Merrill Presidential Scholars

- Bonnie Akhavan
- Kaitlyn MacGillis

National Science Foundation Graduate Research Fellowship

- Christopher Archer

Geraldine and Samuel Dell Master of Engineering Fellowship

- Zachary Katz

Jack and Linda Muckstadt Graduate Award for ORIE Master of Engineering Excellence

- Zachary Schaffer

Omega Rho Honor Society Members

- Bonnie Akhavan
- Ceren Konak
- Bennett Miller
- Vishruth Rajinikanth
- Vladia Trinh
- Rebecca Westerlind
- Hanyu Zhang
- Selena Kang
- Eva Zhang
- Jack Rehmman
- Henry Robbins
- Christopher Archer
- Zili Zhou
- Kaitlyn MacGillis
- Ja Young Byun
- Jody Zhu
- Yichen Feng

Silent Hoist and Crane Material Handling Prize

- Honorable Mention: ORIE M.Eng. team working with The Home Depot on the project: "Developing Health Reports for Web Pages". Lihe Cao, Fei Gao, Tara Khanna, Vishruth Rajinikanth, and Gloria Zhang. The project was advised by Professor Sid Banerjee.
- Third Place: ORIE M.Eng. team working with MITRE Corporation on the project: "Analyzing Pharmaceutical Freight Transportation Network for Resilience". Chang Feng, Lirou Luo, Trevor Xavier, Yue Xiao, and Zongyuan Yuan. The project was advised by Professor Jim Dai.
- Second Place: ORIE M.Eng. team working with Wegmans on the project: "Improving the Efficiency of Wegmans' Inbound Supply". Ruifan Chen, Lang Lei, Mert Onengut, Louis St. Pierre, and Jing Zhang. The project was advised by Professor Damek Davis.
- First Place: ORIE M.Eng. team working with Premier Paint Roller on the project: "Putting Premier Paint's Mexico Operations in Prime Position: An Application of OR Techniques". Ignacio Arevalo, Pratyush Kothiyal, Jianxiao Li, Zhengyi Sui, and Bjorn Teo. The project was advised by Professor Eric Gentsch.

Andrew Schultz Jr. Awards for Outstanding M.Eng. students

- Gretchen Siewert
- Louis St. Pierre
- Chengyuan Yang

MAKING BAYESIAN OPTIMIZATION ALGORITHMS MORE EFFICIENT



Raul Astudillo wants to help machines and people make better decisions. Toward that end, he studies Bayesian methods for efficient sequential decision-making for problems where there is a nested structure. These sorts of problems are common and are found in realms as disparate as formulating optimal COVID-19 testing policies and training robots through reinforcement learning.

Astudillo, who is a doctoral student in Cornell's School of Operations Research and Information Engineering (ORIE), has been drawn to mathematics ever since he was a child growing up in the southern Mexican state of Guerrero. In high school, he took part in math competitions and grew more fascinated by the challenges as the problems evolved from a focus on computation to an emphasis on problem solving.

When it came time to decide on a college, he accepted an invitation to study in the undergraduate program in Mathematics offered jointly by the University of Guanajuato and the Center for Research in Mathematics (CIMAT) in Mexico. In comparison to the larger National Autonomous University of Mexico in Mexico City, CIMAT offered smaller classes and the more personalized approach Astudillo was looking for. At CIMAT, he gravitated toward probability and statistics.

He found one particular summer experience had a profound effect on the path he chose after earning his undergraduate degree in mathematics. "I was able to do a research internship with Professor Victor Pérez-Abreu at CIMAT and I spent the whole summer working with him," Astudillo said. "That was a very important experience for me—it helped me decide between doing a masters, doing a Ph.D., or just finding a job after I completed my undergrad."

Pérez-Abreu impacted Astudillo in another way, as well: he is the one who recommended Astudillo apply to Cornell.

During his first year in Ithaca, Astudillo met with many ORIE faculty members to talk about their research. When he sat with Peter Frazier, the Eleanor and Howard Morgan Professor of

Operations Research, he knew right away that Frazier's group would be a good fit for his own academic interests. "One of the things I really liked about Peter's work was he had papers that were applied and addressed very specific real-world problems, but he also had some papers that were much more theoretical. And this is a combination I wanted for my own work," Astudillo said. "I knew I could learn a lot from working with Peter."

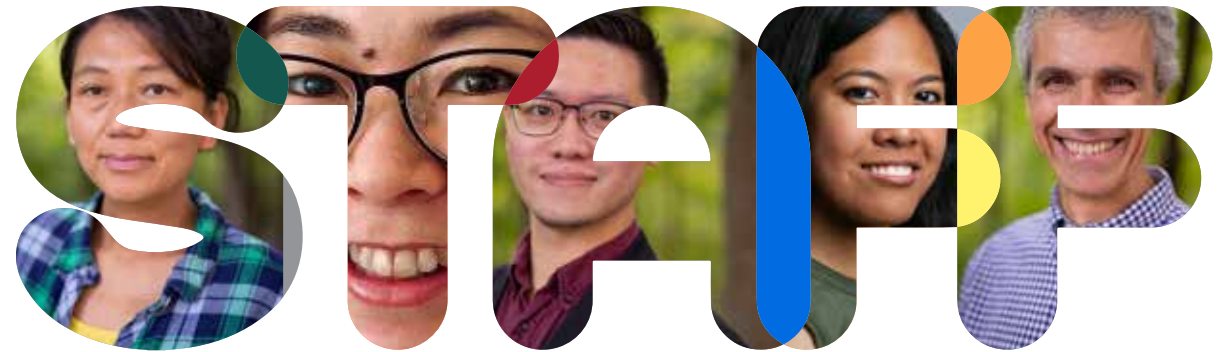
Now in his last year at Cornell and preparing to graduate in August, Astudillo is happy about how things have turned out. He has developed a deeper and more nuanced understanding of Bayesian optimization algorithms for nested functions. "We were trying to understand under which conditions this kind of nested structure can be most efficient and valuable," Astudillo said. "The work was a good combination of the applied and the theoretical."

This summer, Astudillo will be moving to California to begin a position as a postdoctoral researcher at the California Institute of Technology (CalTech) in Pasadena. The focus of his work at CalTech will be adaptive experimental design, with applications to two fields: robotic locomotion, and optimal imaging for large-scale telescopes. As he describes this work it is clear that Astudillo has managed to find a position that will allow him to continue to have one foot in the world of theory and the other in the realm of applications.

His long-term goal is to have a tenure-track position and his own research group. "I am hoping to use this postdoc to consolidate what I know as an independent researcher," Astudillo said. "Working with Peter here I have developed several essential research skills. But I also know there are a few more steps I need to take to become fully independent."

In addition to his research skills, Astudillo devoted quite a bit of time and effort to learning how to play tennis. He arrived in Ithaca not knowing the game and has since become, in his own words, someone who has gone from being "pretty bad" at tennis to someone who "is still a beginner but can now go play and enjoy it." Maybe there is a Bayesian optimization algorithm that can help him improve even further?

ORIE STAFF



Roselle Bajet

Program Coordinator at CFEM
The Bloomberg Center at Cornell Tech



Henry Lam

Director's Assistant
Frank H.T. Rhodes Hall, Room 272



Leslie Meyerhoff

Director of Administration
Frank H.T. Rhodes Hall, Room 212



Odrick Palmer

Events Coordinator, Office Manager
Frank H.T. Rhodes Hall, Room 204



Heidi Russell

Undergraduate Student Services Coordinator
Frank H.T. Rhodes Hall, Room 278



Ayumi Sakamoto

Associate Director of Career Development at CFEM
The Bloomberg Center at Cornell Tech



Luiz Vieira

Finance Lead
Frank H.T. Rhodes Hall, Room 274



Mingming Wang

Graduate Field Assistant
Frank H.T. Rhodes Hall, Room 279



Onnolee Wierson

Graduate Field Assistant
Frank H.T. Rhodes Hall, Room 279

W E L C O M E O R I E ' S N E W E S T F A C U L T Y M E M B E R S



IMPACTING THE DESIGN AND IMPLEMENTATION OF **URBAN TRANSPORTATION INFRASTRUCTURE AND SYSTEMS**

Manxi Wu cares about sustainability, efficiency, and fairness and wants to have an impact on the design and implementation of urban transportation infrastructure and systems. To Wu, who joined the ORIE faculty as an assistant professor in the fall of 2022, there is no guarantee that simply having better technology will mean better systems.

"People may think that improved technology naturally makes the urban environment better, but that is not necessarily the case," Wu said. The example Wu gives is the introduction of the automobile in the 20th century. Consumers adopted the technology quickly but there were very few efforts by municipalities or regional authorities to proactively plan for the car's popularity. The infrastructure required by the ubiquity of cars has lagged behind ever since, with traffic, pollution, inequalities, and inefficiencies getting worse rather than better.

Wu sees the current moment as a chance to make right some past transportation systems mistakes. Electric vehicles are no longer a distant possibility. Autonomous vehicles are not far behind. Preparing for electric and autonomous vehicle adoption needs to happen now or we risk getting it drastically wrong again.

Wu, who has a B.S. from Peking University in applied math, an M.S. from MIT in transportation, and a Ph.D. from MIT in social and engineering systems, is well-positioned to make an impact with her research. Her fields of interest are societal networks, game theory, network optimization, and theory of economic incentives—all of which are connected to the design of transportation systems and policies.

"There are already for-profit companies building electric and autonomous cars; there are already ride-sharing and car-sharing apps," Wu said. "Technologies are being integrated into urban systems more and more and governments are creating policies focused on these technologies. It is essential that these policies take into account the needs and priorities of all of the stakeholders."

Wu has a special interest in situations exactly like this, where game theory meets urban system modelling. Game theory is a useful tool because it allows you to model behavior, and the efficiency of any system is determined by the behavior of the people using it. If the incentives built into a system are not aligned with the actual goals of the people using the system, things will not function efficiently no matter how good the technology is.

In addition to being driven by the compelling question of how to design and implement a fair, sustainable and efficient urban transportation infrastructure, Wu says she is also driven by the techniques she uses to solve these problems. "In my own work I apply game theory and machine learning algorithms to tackle this challenge at the intersection of economics, computer science, and engineering systems," Wu said. "This is the beauty of operations research as a field: you have interesting problems and in the process of solving them you delve into new tools—you have both theory and applications."

Wu is excited to be at Cornell where there are experts in any field or technique she is interested in learning more about as well as endless opportunities for collaboration.

UNIQUELY POSITIONED TO HELP STUDENTS **BECOME FINANCE PROFESSIONALS**

Back in 2016 Cornell Engineering officially adopted a new faculty title: Professor of Practice. Lance Collins, who was Dean of the college at the time, was thrilled by the flexibility the title would give when hiring new faculty. "We are excited to have this title available," Collins said at the time. "It provides a way to bring a very different set of complementary skills to campus to add to our already stellar faculty. Now, people with deep experience in industry will have a chance to be part of the teaching corps of the university."

Johannes Wissel is exactly the type of person Collins was talking about.

Wissel, who has nine years of experience as a consultant and a senior quantitative researcher in the financial industry, joined the ORIE faculty as a professor of practice in the summer of 2022. More than any department or school at Cornell Engineering, ORIE has sought to take full advantage of the power of this title to attract experienced professionals to the faculty, with a total of five professors of practice now on the school's faculty.

For Wissel, entering Rhodes Hall in the summer of 2022 was a bit of a homecoming. After earning his undergraduate and graduate degrees in mathematics from Ludwig Maximilian University of Munich and ETH Zurich (respectively), Wissel was a visiting assistant professor in the School of ORIE. He held the position for four years and looks back on that time fondly. Wissel's doctoral thesis focused on how to better understand and account for the risks coincident with certain financial instruments available in the derivatives market.

As he finished grad school and started teaching at Cornell the financial crisis of 2007-2008 was in full swing and his expertise was immediately relevant and in demand. "It was a very

interesting time, to say the least," Wissel said. "Everybody in the financial industry and in the academic areas of finance, financial engineering, and mathematical finance was rethinking the old wisdoms very carefully. In its own way, it was exciting—and a great time to be working with M.Eng. students."

In 2013 Wissel left Cornell and returned to Germany, where he worked for three years as a financial consultant. His teaching experiences came in handy as he often found himself explaining rather complex financial concepts to people who were not professionals in finance. In 2015 he joined G-Research, a quantitative research firm in London, as a senior researcher focusing on gaining a better understanding of certain features of the markets in order to gain a competitive advantage in quantitative investing. Wissel was able to focus on mathematics and mechanisms and says it was as close as a person can get to the academic world while still working in the private sector.

When the opportunity arose to return to ORIE and teach, Wissel jumped at the chance. "ORIE at Cornell is such an interdisciplinary place," Wissel said. "Being here gives me the freedom to explore some research questions that were beyond the scope of my job in London. In addition, the students are so bright and I'll get to work with undergraduates, M.Eng. students, and doctoral students. In practice, there is such a small gap between academic education and professional applications in many areas of finance. Because of my professional experiences I feel uniquely positioned to help students step over that gap."

When he is not teaching or conducting research, Wissel says he likes to spend as much time as he can outdoors with his two young children and that Ithaca is a great place to do exactly this.

COLLABORATION TO INFUSE HUMAN BEHAVIOR INTO EPIDEMIOLOGICAL MODELS

Six Cornell faculty members from three different colleges will work together to improve epidemiological models of infectious disease, including by better incorporating human behavior into the models, using a \$1 million grant from the National Science Foundation.

COVID-19 made clear the need for improved models. Organizations at all levels of society, from small businesses and schools to cities and countries, have been making decisions throughout the pandemic without a clear idea of exactly what factors they should be considering.

Cornell's successful COVID-19 response was shaped largely by models created and updated by members of the School of Operations Research and Information Engineering (ORIE) under the leadership of Peter Frazier, the Eleanor and Howard Morgan Professor, with major contributions by David Shmoys, the Laibe/Acheson Professor of Business Management and Leadership Studies. Shane Henderson, the Charles W. Lake, Jr. Professor in ORIE, says that the effort to create these models was happening in real-time with huge consequences and under lots of pressure, and he is proud of what Cornell's response team was able to do.

"But it wasn't perfect," Henderson said. "And now is the time to take stock and ask how we can improve these types of models so that we are better prepared for the next time."

The grant proposal, called "Behavioral Heterogeneity and Uncertainty in Epidemiological Models," was one of eight across the nation funded with the goal of infusing human behavior into epidemiological models.

When Henderson, Frazier and Shmoys saw the call for proposals they felt they were in a good position to be awarded one of the grants. They had been deeply involved in the creation of the COVID-19 models Cornell has been using for two years and they have access to the great breadth of expertise across the Cornell campus. They recruited Casey Cazer, assistant professor of population medicine and diagnostic sciences, and Gen Meredith, professor of practice in public and ecosystem health – both from the School of Veterinary Medicine – and Benjamin Cornwell, chair of the Department of Sociology in the College of Arts and Sciences, to join the team.

One goal of the group is to combine their knowledge of mathematical modeling, sociology, public health and infectious disease epidemiology to capture some of the unpredictability of human behavior and bake it into the models they create. Another aim of the researchers is to get the models into the hands of public health professionals and decision makers so that they can plan and implement evidence-informed policies.

Cornwell brings his knowledge of social networks and human behavior to the models.



"To understand the factors that drive transmission and risk, you have to understand networks," Cornwell said. "We are going to integrate what we know about the number and types of daily contacts people are likely to have into our models so that we can get even better estimates of risk of epidemic spread than we already have."

The researchers want to create models that will be of use beyond simply Cornell or college campuses in general, where in some ways, behaviors are more heterogeneous than community populations as a whole.

"In public health we talk about the importance of interdisciplinarity to approach problem-solving," Meredith said. "It is gratifying to see the NSF recognize the value and potential of a team like this, and the research and reach this might have."

As part of the grant, Meredith will be talking with public health leaders to better understand if and how they use epidemiological models to inform policies and actions, and how models could be better designed for access and use.

In addition, the project will produce educational materials and activities to expand health officials' appreciation for what modeling can do, and be integrated into university course offerings and experiences for engineering and public health students.

"Our research team has considerable practical experience, having conducted extensive modeling to advise Cornell University leadership on essentially every major decision related to the COVID-19 pandemic since April of 2020," Henderson said. "We have the skills to advance the field, and the contacts and credibility needed to generate real impact. We are very pleased and grateful that the NSF agrees."

GIVING STUDENTS AN EARLY INTRODUCTION TO OPERATIONS RESEARCH

There are not a lot of high school students who know what Operations Research is. Mark Lewis and David Shmoys did their best in the summer of 2022 to change that.

Lewis, the Maxwell M. Upson Professor of Engineering and Director of the School of Operations Research and Information Engineering (ORIE) at Cornell, and Shmoys, the Laibe/Acheson Professor of Business Management and Leadership Studies, have a combined 50 years experience teaching the theory and practice of operations engineering.

If anyone can convey the excitement, beauty, and sheer usefulness of mathematical modeling, it is them.

Lewis was a key part of the 2022 CATALYST program this year, where he got to work with more than 50 high school students. CATALYST Academy is a one-week program for rising high school juniors and seniors from underrepresented backgrounds who want to learn more about engineering. To help the students understand the concerns and scope of OR, Lewis presented them with an actual operations problem facing a large national pharmacy chain and then walked them through a simulation and the modeling tools professionals would use to solve the problem.

"This is a part of a larger campaign to improve the understanding of, (and appreciation for), the applicability of the mathematical modeling tools we use to spark improved decision-making," Lewis said. During their week at CATALYST, the students were exposed to the tools at the core of Operations Research and along the way, they learned the difference between open (design) and closed (dynamic) loop control.

Shmoys taught ENGR 1101 (Engineering Applications of ORIE) to students in the Pre-Collegiate Summer Scholars Program. This invitation-only program includes workshops, guest lectures, social and cultural activities, and summer session courses. "Many of these students show up with only a vague understanding at best of what operations research is," Shmoys said. He views the class as a win-win situation: the students, who are all incoming first-year Cornell Engineering students, get an academic jump on their first-year course load, and ORIE benefits by having a larger percentage of the first-year class know what operations research practitioners actually do.

Shmoys taught this course for six weeks and gave the students a detailed introduction to the problems and methods of OR while giving them a taste of the mathematical modeling, algorithms, and software used to solve problems in realms as diverse as ride-hailing services, efficient deployment of ambulance services around metropolitan areas, supply chain management, university class and final exam scheduling, and proper medical staffing levels for walk-in clinics, to name just a few.

Both Lewis and Shmoys were excited about the opportunity this summer to spread the word about operations research. And being firm believers in the value of good data, you can bet both will be paying attention to these students in the coming years to see how many affiliate with ORIE.



NEW GIFT ENDOWS MORGAN CHAIR TO ORIE'S TOPALOGLU

Cornell Tech Dean Greg Morrisett announced in early 2022 that a gift from Howard Morgan Ph.D. '68 and his wife Eleanor, will be used to endow a new faculty chair—the Howard and Eleanor Morgan Professor—awarded to Professor Huseyin Topaloglu, an expert in operations research whose work focuses on dynamic programming and applications in supply chain logistics.

"Eleanor and I are thrilled that endowing this chair allows us to support the scholarship of brilliant faculty like Huseyin who have had such an important impact in the field of operations research," Morgan said. "It's very meaningful to help make this kind of work possible and invest in the future of Cornell Tech during this critically important campaign for the campus and the university."

Morgan has had strong ties with Cornell for many decades, going back to his time as a Ph.D. student and, briefly, as a professor. He was a member of Cornell's College of Engineering Advisory Council from 2012 to 2019, and has been a member of the Cornell University Board of Trustees since 2019. He also joined the Cornell Tech Council, formerly the Board of Overseers in January. He was even in the room in 2011 when New York City Mayor Mike Bloomberg announced that Cornell and Technion had won the competition to build what's now Cornell Tech.

His background makes him especially well-suited to endow a chair to Topaloglu, as his Ph.D. in the 1960s was also in operations research. Morgan later taught at the Wharton School of the University of Pennsylvania, where his research on networks and



user interfaces led to his bringing the ARPAnet to Philadelphia in 1974.

"Howard has been a long-time supporter of Cornell Tech, from mentoring postdocs in the Runway Program to serving as a member of the Cornell Tech Visiting Committee," said Cornell Tech Dean Greg Morrisett. "We're so very grateful for the support of individuals like Howard and Eleanor in being able to grow our faculty and expand our research footprint."

SCHEINBERG NAMED INFORMS FELLOW

Katya Scheinberg, Professor in Cornell's School of Operations Research and Information Engineering, has been named a 2022 Fellow of the Institute for Operations Research and the Management Sciences (INFORMS).

INFORMS, the largest association for the decision and data sciences, has officially named 12 outstanding members as Fellows, including ORIE's Katya Scheinberg. The 2022 INFORMS Fellows will be inducted during the INFORMS Annual Meeting, Oct. 16-19, which will be held in Indianapolis.

Scheinberg joined the School of Operations Research and Information Engineering faculty in July 2019, after serving as the Harvey E. Wagner Endowed Chair Professor at the Department of Industrial and Systems Engineering at Lehigh University.

INFORMS honored Scheinberg "for outstanding research contributions to continuous optimization, particularly derivative-free optimization and the interface of optimization and machine learning, as well as outstanding service and leadership."

WILLIAMSON AND GOEMANS RECEIVE 2022 STEELE PRIZE FOR SEMINAL CONTRIBUTION TO RESEARCH

ORIE Professor David Williamson and MIT's Michel Goemans received the 2022 AMS Steele Prize for Seminal Contribution to Research for their paper "Improved Approximation Algorithms for Maximum Cut and Satisfiability Problems Using Semidefinite Programming," published in 1995 in the Journal of the ACM. This paper, which focuses on the Max-Cut problem, a core problem in combinatorial optimization, has had major, sustained impact on the fields of theoretical computer science and optimization theory.

"I'm very honored to be the co-winner of the Leroy P. Steele Prize with my Ph.D. advisor, Michel Goemans," said Williamson.

In their seminal work, Goemans and Williamson presented a new approximation algorithm for the Max-Cut problem that yields an approximation ratio of 0.878. The algorithm introduced several key innovations that have become classic. This result and the systematic analysis procedure had an immediate and major impact—many related NP-hard problems were studied via relaxation to semidefinite programs and approximation ratios were established and characterized for many problems. Moreover, over time, the result has grown in centrality and importance, with connections to complexity theory, cryptography, combinatorics, and algebra.

"Michel and I worked out the idea of representing a cut by vectors and relaxing these to a semidefinite program during my years in graduate school," Williamson said. "But then we got stuck on the question of how to extract a cut from the vectors, and we shelved the work for at least a year while I finished up my dissertation on an entirely different topic. I turned in my thesis

and took a two-week vacation. On my return, we picked up the pieces again and during a two-hour meeting one Friday afternoon we hit on the idea of using a random hyperplane to partition the vectors. The analysis of the main result quickly followed. I sometimes tell my students (and myself) this story to explain why persistence is important and why one shouldn't give up too quickly on one's ideas."

Professor Williamson is the chair of the Department of Information Science at Cornell University, and a professor in the School of Operations Research and Information Engineering. He received his Ph.D. in computer science from MIT under Professor Goemans in 1993. After a postdoc at Cornell under Professor Éva Tardos, he was a research staff member for IBM Research at the T.J. Watson Research Center in Yorktown Heights, NY. From 2000-03, he was the Senior Manager of the Computer Science Principles and Methodologies group at IBM's Almaden Research Center in San Jose, CA. He moved to Cornell University in 2004.

The Steele Prize for Seminal Contribution to Research is awarded for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research. The prize is awarded according to the following six-year rotation of subject areas: Open, Analysis/Probability, Algebra/Number Theory, Applied Mathematics, Geometry/Topology, and Discrete Mathematics/Logic. The Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein, and are endowed under the terms of a bequest from Leroy P. Steele.

The 2022 prize was presented Wednesday, January 5 during the Joint Prize Session at the 2022 Joint Mathematics Meetings in Seattle.



DAVID WILLIAMSON EXTENDS HIS CHAIR APPOINTMENT

David Williamson, professor in the School of Operations Research and Information Engineering and professor in the Department of Information Science in the Cornell Ann S. Bowers College of Computing and Information Science, has agreed to extend his appointment as Chair of the Department of Information Science, a role he has held since July 1, 2021, for an additional year.

"I am grateful for his continued leadership and vision to ensure the department continues its great work and builds a strong future," said Dean Kavita Bala.

Well-known for his work in the area of discrete optimization, his research focuses on finding efficient

algorithms for hard discrete optimization problems, with attention to approximation algorithms for problems in network design, facility location, and scheduling. For his many contributions, he has been recognized as an ACM Fellow and SIAM Fellow, and has received several awards for his research including the 1994 Tucker Prize from the Mathematical Programming Society and the 2000 Fulkerson Prize from the Mathematical Programming Society and the American Mathematical Society. He has served as an associate editor on several journals and was the editor-in-chief of the SIAM Journal on Discrete Mathematics.

MULTIPLE ORIE FACULTY WIN PRIZES AT 2022 INFORMS

The Institute for Operations Research and the Management Sciences (INFORMS) held its annual meeting in Indianapolis October 16 through October 19 and Cornell ORIE faculty came away with an impressive number of prizes.

ORIE Director Mark Lewis, who has been with the School for 17 years, was pleased by the recognition of so many ORIE faculty members.

INFORMS is the leading international association for operations research and analytics professionals, so to be honored at their annual meeting means a lot. In an email to ORIE faculty Lewis said, "It was an award-winning year for ORIE at INFORMS. We once again 'punched above our weight.' Way to go to all! You represent us well!"



HERE IS A COMPLETE LIST OF ORIE-AFFILIATED FACULTY MEMBERS HONORED BY INFORMS THIS YEAR:

Katya Scheinberg was inducted as an INFORMS Fellow

Su Jia won the Dantzig Prize

Ziv Scully won the Nicholson Prize

Sid Banerjee won the Erlang Prize

David Shmoys won the Khachiyan Prize

Andrea Lodi won the Best Paper in Transportation Science Award



Katya Scheinberg



Sid Banerjee



Su Jia



David Shmoys



Ziv Scully



Andrea Lodi

CFEM CELEBRATES 15TH ANNIVERSARY BY HOSTING **FUTURE OF FINANCE CONFERENCE**



Cornell Financial Engineering Manhattan (CFEM) celebrated its 15th anniversary on September 16, 2022, by hosting the Future of Finance Conference. The event, sponsored by Rebellion Research, was held at the Cornell Tech campus on Roosevelt Island in New York City and was a great success.

"While I had no doubts this would be a successful forum, I could never imagine the level of positive response. Comments from attendees surpassed any expectation that our panelists or our sponsor envisioned," Victoria Averbukh, Director of CFEM, said.

The conference brought together senior academics, Wall Street practitioners, finance entrepreneurs, and some non-finance people to discuss the future of quant finance. There were 15 wide-ranging panel discussions and a keynote address delivered by retired US Navy Admiral Scott Sanders on "The Geopolitical Risk of Tomorrow."

The sheer number and quality of speakers and panelists highlighted the leading role CFEM has come to occupy in its 15 years in Manhattan. Rebellion Research founder Alex Fleiss has been involved in various student projects for six years at CFEM. He has seen first-hand the quality and value of the program. "Working with students at Cornell these past six years has been some of the most rewarding time of my life. As the students learned in various projects, I felt I learned as well and my time with CFEM has been just so rewarding. I felt that the program

deserved a conference to celebrate its awesomeness," Fleiss said.

Cornell Financial Engineering faculty members Andreea Minca and Sasha Stoikov took part in the panel discussions as moderator and panelist and CFEM practitioner-lecturers Andrew Chin and Gordon Ritter also participated as a moderator and a panelist.

"This was an incredible conference and a testament to CFEM's ability to connect students with practitioners from all levels of quant finance," Averbukh said. Students at CFEM earn a Master of Engineering degree with a Financial Concentration, and the program's proximity and access to the financial industry in Manhattan has been a great strength and selling point since its inception.

The program has a flexible curriculum that encourages the study of data science, optimization, analytics, and computing, in addition to a broad range of courses in finance. CFEM has a rich history of providing relevant and practical coursework in line with the demands of the financial industry.

Fleiss has seen just how valuable the program can be. "CFEM is a pillar of the quant community. An essential school for aspiring quants around the country who wish to make it to the elite ranks of Wall Street & Technology," Fleiss said.

After the success of the 2022 Future of Finance Conference, Averbukh and Fleiss are thinking about the possibility of making this conference an annual event. Stay tuned for updates.

AWARDS AND HONORS



Gordon Ritter



Marcos Lopez de Prado



Sasha Stoikov



Victoria Averbukh



Oktay Gunluk



Katya Scheinberg



David Shmoys



Eva Tardos



Damek Davis

Gordon Ritter, adjunct professor (CFEM), **Marcos Lopez de Prado**, professor of practice (CFEM), **Sasha Stoikov**, senior research associate (CFEM), and **Victoria Averbukh**, director and professor of practice (CFEM), were all named to Rebellion Research's Top Ten Quant Professors 2022 list.

Oktay Gunluk, professor of practice, has been named Chair-elect of the INFORMS Optimization Society.

Katya Scheinberg, professor, received the INFORMS Simulation Society's 2021 Outstanding Publication Award for her work on a stochastic trust-region method.

David Shmoys, the Laibe/Acheson Professor of Business Management and Leadership Studies, and **Eva Tardos**, the Jacob Gould Schurman Professor and chair (CS), received a FOCS 2021 Test of Time Award for their paper on fast approximation algorithms.

Damek Davis, associate professor (ORIE) received a Cornell Engineering Research Excellence Award.

NARAHARI UMANATH PRABHU, PROFESSOR EMERITUS, DIES AT 98

Narahari Umanath Prabhu, a professor emeritus who helped make Cornell's School of Operations Research and Information Engineering (ORIE) truly international, died at his home in Ithaca on Oct. 14. He was 98.

Known to most as Uma, Prabhu was born in Calicut (now Kozhikode), India, in 1924 and earned his B.A. in mathematics at Loyola College in Madras, India, an M.A. in statistics from the University of Bombay and an M.S. in mathematics from the University of Manchester in England – all at the top of his class.

Prabhu joined the ORIE faculty in 1965 at the age of 41. He had been living in Perth, Australia, and teaching at the University of Western Australia, when a book he wrote, "Stochastic Processes: Basic Theory and Its Applications," found its way to Frank Spitzer, the late Cornell mathematics professor. Spitzer was greatly impressed by the book and gave it a rave review. The two men started writing to each other and eventually Spitzer recommended Prabhu for a job teaching at Cornell in what was then called the Department of Industrial Engineering. The two remained close friends until Spitzer's death in 1992.

Prabhu's work focused on stochastic processes and queueing theory and he co-founded the journal *Stochastic Processes and Their Applications*, which he co-edited from 1973 to 1984. He was also editor of the *Queueing Systems Journal* from 1986 to 1994.

In addition to his research, Prabhu was well-known for his love of and dedication to teaching. Student evaluations from his days in the classroom attest to his rigorous but supportive teaching style. His family members said that he considered his students his "spiritual children."

Prabhu was a prolific letter writer and contacted mathematicians and researchers across the globe to ask questions and discuss ideas. Many of these researchers then sent their students to Ithaca to study with Prabhu at Cornell. In this way, he expanded the diversity of the school and helped strengthen its international reputation.

Professor Gennady Samorodnitsky joined the ORIE faculty in 1988, when Prabhu had already been at the school for 23 years.

"Uma came to the school of ORIE when it was very young, and he was one of the people who made this school what it is today: one of the leading departments anywhere in the world," Samorodnitsky said. "He loved the school and was a mentor to many of the junior faculty members well before a position of a mentor came into existence. The school, Cornell and the science of applied probability have lost a great colleague and a great friend."

Prabhu retired from teaching in 1994 but remained committed to the Cornell and Ithaca communities. In retirement, Prabhu continued to play an active role in the life of the school. Mark Lewis, director of ORIE, recalled meeting Prabhu during Lewis's first days on campus in 2005.

"Of course, I knew of Uma Prabhu before I arrived here in 2005, but he was one of the first people to come into my office in my first week to welcome me," Lewis said. "We talked about



teaching, the importance of the student experience and not surprisingly, queueing. He left me with a copy of his book, which I promptly asked him to sign. He was a star academic, and an even kinder person."

In 1999, Prabhu and his wife Sumi created the Rabindranath Tagore Lecture Series in South Asian Literature. The series brings international authors to Ithaca each year for readings and discussions which are free and open to the public. In 2018 Prabhu made a gift to establish the Frank Spitzer and Narahari Umanath Prabhu Assistant Professorship of Mathematics in honor of his longtime friend.

Prabhu was preceded in death by Sumi, his wife of 66 years. He is survived by his daughter Vasundhara Prabhu ("Vas") and her husband Bob; his daughter Purnima Prabhu; and his granddaughters Basyah and Aliyah Prabhu.

ORIE MAGAZINE ALUMNI PROFILE

JAMIE HINTLIAN

Even though Jamie Hintlian '82, M.Eng. '85, MBA '86, grew up in Boston and has lived there most of his life, all roads seem to lead him back to Cornell.

Hintlian heard stories of Cornell from his father, who graduated with a degree in electrical engineering in 1946. After his junior year of high school, Hintlian took summer college classes in English and Calculus at Cornell and loved everything about the experience. The following year he was accepted into Cornell Engineering and discovered the field of Operations Research.

"Originally, I was thinking I might major in mechanical engineering, but then I saw how OR involved applying math, which had a lot of appeal. And I learned about modeling and simulations and game theory from Professor David Heath and it all resonated with me deeply," Hintlian said. He declared his major and never looked back.

His first job after graduating in 1982 was with the firm then known as Arthur Anderson. Hintlian spent two years as a consultant before returning to Ithaca to earn his M.Eng. and MBA degrees. His two years with Anderson were enough to convince the ORIE M.Eng. program that instead of tackling an M.Eng. project, Hintlian and his classmates would be better served if he

acted as a TA for one of the project groups. Hintlian says he was surprised and humbled by the opportunity.

"To be asked to help teach these students who I thought of as my peers felt like a real honor and I took the responsibility very seriously," Hintlian said. The experience went well and gave Hintlian his first taste of teaching—a taste that helped bring him to back to Ithaca yet again many years later.

With his M.Eng. and MBA degrees in hand, Hintlian began a professional career that has thus far led him to senior positions at Accenture, Aspen Technology, EY, and the Leavitt Corporation. He has been a Senior Partner, a Vice President, a Partner, and a Chief Operations Officer, in each case bringing an ever-deeper knowledge of how to manage supply chains in complex business environments.

In his current position with the Leavitt Corporation, Hintlian is part of the third generation of Hintlians to manage the family business, which was started by his grandfather Michael Hintlian in 1925 and produces Teddie brand peanut butter and other nut products. The company is well known in New England for the scope of its community involvement and philanthropic activities.

While the family business is located just north of Boston in Everett, MA, Hintlian still finds himself driving back to

Cornell many times a year. He served as President of the Cornell Engineering Alumni Association for seven years and is currently the Chair of the Cornell Committee for Alumni Trustee Nominations. For the past nine years he has been taking an increasingly expanding role teaching about supply chains and operations in Cornell's Johnson Graduate School of Management. (Unsurprisingly, Hintlian found time for the interview that led to this profile while he was driving on one of his many trips to and from Ithaca.)

Hintlian co-leads the Strategic Operations Immersion program, which supplements in-class instruction with guest lectures from senior operations executives and site visits to meet with operations practitioners and their management teams. "This is a unique experiential learning approach for graduate students pursuing careers in supply chain and operations, consulting, or looking for grounding in operations management to round out their MBA," Hintlian said. "They are a treat to teach."

He has also developed a new course, "Applied Operations Strategy," which is topic-oriented and largely case-based and explores how operations strategies are developed and executed and what makes those strategies successful or not.

It is clear in listening to Hintlian discuss his role as a Visiting Lecturer that he is fully committed to sharing what he has learned from his many years in industry. "I'm not looking at this as just a thing to do on the side," Hintlian said. "I want to have an impact on these students and their careers the same way so many of my ORIE professors did when I was a student here." Hintlian went on to list David Heath, Jack Muckstadt, Bill Maxwell, Les Trotter, Bruce Turnbull, Lee Schruben, and Peter Jackson in quick succession as teachers and mentors who left their mark.

Hintlian has also stayed connected to ORIE, serving on the school's official advisory council and participating in panel discussions with current students.

When asked why he is so connected and committed to Cornell, Hintlian says it is an easy question to answer. "I love Cornell and everything it is about; I owe so much of what I have—and have accomplished in life—to Cornell. I received a great education in ORIE and at the Johnson School. I met my wife there. Our children went to Cornell. I'm glad to be able to give back to Cornell in whatever ways I can, so I will keep coming back. All my roads take me back to Cornell."

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