Jack Muckstadt, Students Team Up to Battle Contagion

In a pandemic such as the virus that spreads in the movie Contagion the focus is on understanding the virus so as to develop a vaccine. But there is a lot more to dealing with a pandemic than finding a vaccine, as hard as the movie shows that to be.

ORIE Professor Jack Muckstadt, with Nathaniel Hupert, Associate Professor of Public Health at Weill Cornell Medical College, has spearheaded an effort to assure that public health officials pay attention to the proper design of supply chains for fighting contagion. Their work is relevant to distribution and dispensing not only of vaccines but of antiviral medications that, even before a vaccine has been formulated, can be used to treat those already attacked by the virus. Muckstadt, who serves on the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC), involves undergraduates and Ph.D. students closely in this work.

While the movie Contagion establishes early that no antiviral drug is effective against the fictitious “MEV-1” virus, for actual seasonal flu and epidemics such as H1N1, antivirals can be positioned early and can improve symptoms and reduce the death toll. But their effectiveness depends on logistics.

Muckstadt recently attended a meeting of the Advisory Committee at the CDC in Atlanta, and reports that the movie, partly filmed on site there, was much discussed there, mostly in a positive way.

He points out that in the real world “almost all states reported problems with distribution and dispensing of antivirals and shortages of all types of antivirals in some geographic locations, at some points of time during the [2009 H1N1] pandemic.” So the CDC is embarking on a new effort to redesign the way antiviral medications are distributed. The CDC has awarded Muckstadt and ORIE M.Eng. student Christine Barnett ‘11 a grant to provide their expertise to this effort.

Microworlds
Here in ORIE, Barnett and others have been developing simulated environments, or “microworlds,” that enable public health officials to see the impact of alternative designs to distribute an-
tivirals and vaccines. Using one of these microworlds public health administrators test various logistics structures with their many constraints - demands, capacities, and service and refill rates - to predict how well each logistics design delivers countermeasures during a simulated pandemic, and at what cost. The administrators can specify the number and location of dispensing points, distribution centers, and warehouses, as well as the policies that govern dispensing, such timing of startup.

From Simulation to Optimization
The simulations developed by Barnett and others, including current ORIE M. Eng. Adam Schultz ’11 and past ORIE undergraduates Kenneth Chu ’11, Cindie Wu ’08, Caitlin Hawkins ’08 and James Codella ’07 M.Eng. ’08, require the user to nominate the inventory approach (known as a “policy”) to be evaluated. The computations do not seek such a stocking and distribution policy on their own. To supplement the simulation work, King is building a mathematical model that, if solved computationally, can find an optimal stocking and distribution policy based on the characteristics of a pandemic. Her research takes the uncertainty and variability in the spread of the pandemic into account. The computational problem is so difficult that only approximate solution policies can be found.

One possible strategy (which public health officials have been planning to use) is simply to deploy inventory proportional to population. This strategy is called the “fair share” method. Another possible strategy is to reduce the number of time periods the model looks ahead to see the implications of current allocations. A third uses a technique, developed by ORIE Professor Huseyin Topaloglu and Sumit Kunnumkal, ORIE Ph.D. ’07, that breaks the overall problem into a series of smaller problems whose solutions can be combined to arrive at an estimate of the optimal policy. King has found that the latter two methods provide much better solutions than the proposed “fair share” method.

The close collaboration among faculty, graduate students and undergraduates working to contain contagion has a valuable educational and personal impact. Professor Jack Muckstadt and Ph.D. student Kathleen King have become mentors to the students involved in the activity.

"Working with them has been a huge part of my decision to go on for a Ph.D.,” said ORIE M.Eng. student Christine Barnett ’11. “I’ve talked to Kathy a lot about the process of applying for a Ph.D. and about what to look out for in doing so.” King said “I’ve told her a few things that I wished I’d known at the beginning of graduate school – like the fact that it’s okay if you feel like you’re out of your depth sometimes -- everyone feels that way!"

"I was an undergraduate myself just a few years ago,” said King, "so I can easily remember my first experiences with research; I didn’t really understand what ‘research’ meant and I wasn’t used to having extremely open-ended projects. I’m happy to have the chance to help other undergraduates make the transition to research."

Barnett said that in working with Muckstadt and King "I got to see the interaction between Ph.D. student and professor." The project "opened my eyes to the possibility of a Ph.D." she said.

Inspired in part by her work with Muckstadt and King, Caitlin Hawkins ’08 is now a Ph.D. student in industrial and systems engineering at the University of Southern California.

James Codella ’07 M.Eng. ’08 is now a Ph.D. student in industrial engineering at the University of Wisconsin-Madison. He is currently working on methods to mitigate infectious disease spread in hospitals.

Barnett will work full time on the CDC project after completing her M.Eng. in December, and has begun applying to Ph.D. programs.

Researchers like Barnett, Codella, Hawkins, King, Muckstadt, and others are in the forefront of preparedness for the counterattack on future pandemics.
David Heath, Co-Founder of Financial Engineering at Cornell, Dies at 68

David Heath, together with ORIE field member Robert Jarrow of the Johnson Graduate School of Management, established Financial Engineering as a discipline in ORIE. Heath was on the ORIE faculty for more than twenty years, and retired as Orion Hoch Professor of Mathematical Sciences from Carnegie Mellon University (CMU) in 2006.

David Heath died in Rochester, New York on August 11, 2011. He leaves his wife, Judith, their three children and four grandchildren, as well as the many Ph.D. graduates of Cornell and CMU whose thesis work he supervised.

Heath worked on many problems over the years. One of the more noteworthy ones was when he collaborated with Robert Jarrow and their Ph.D. student Andrew Morton to establish the Heath-Jarrow-Morton (HJM) framework for determining the term structure of interest rates, i.e. the yield from a fixed income investment as a function of the time until its maturity. This work, widely recognized in the finance community, established a new approach to developing models for the evolution of the entire term structure, or forward rate curve, over time.

Jarrow commented that “it was always fun to do research with David. His ideas were fresh, imaginative, and rigorous. I always learned something from our conversations.”

Among Heath’s Cornell Ph.D. students was Dr. Victoria Averbukh, now director of Cornell Financial Engineering Manhattan. Heath, an accomplished violinist, advised numerous Cornell undergraduate and Ph.D. students and made countless valuable contributions to ORIE as a whole.

ORIE Professor Sidney Resnick summarized the reaction of Heath’s ORIE colleagues: “Bad news! A gentle giant and ideal colleague went down.”

Where Are ORIE Grads Going?

Recent ORIE undergrads are leaning more toward financial services (42.1%) and consulting/professional practice (28.9%) jobs, while ORIE graduate degree recipients have been accepting positions in financial services (30.3%), consulting/professional practice (21.2%) and technology (18.2%). Below is a breakdown of all 2010 graduates who responded to the survey.
Sheldon Jacobson, Ph.D. ‘88 Has A Wide Range of Research Interests

From aviation security to stockpiling pediatric vaccines to the NCAA basketball tournament to individuals gaining weight as a result of driving their cars, Sheldon Jacobson, Ph.D. ‘88 has a wide range of research interests.

Jacobson recently visited Cornell’s campus to present at the ORIE Colloquium on October 18.

As a result of his work on aviation security, Jacobson proposes that TSA identify the relatively large group of people who pose no threat, perhaps 60 to 70 percent of travelers, and subject them to a standard level of security, freeing up resources to screen the remaining travelers with the more advanced technologies and procedures. “We want to ‘right size’ security,” says Jacobson, who received an industry award for his work on aviation security.

In his research on the stockpiling of pediatric vaccines, Jacobson concluded that “maintaining a six-month rotating vaccine stockpile isn’t the optimal solution for achieving ‘herd immunity,’” which occurs when a sufficient percentage of a population has been immunized against a disease to protect unvaccinated individuals as well.

In filling in published diagrams representing the series of games in the NCAA “March Madness” basketball tournament, a practice known as “bracketology,” fans are guided by the ranking of teams, or “seeding,” established by the tournament selection committee. Using data from 25 years of March Madness, Jacobson concluded that for the “elite eight” remaining in the tournament after three rounds, “flipping a coin is as much a determinant as seeding.”

ORIE Professor Shane Henderson said “Sheldon is one of those rare individuals who cross many disciplinary boundaries and have impact in a host of areas. He has a sense for important problems, and draws on statistics, probability, optimization and other techniques to solve those problems. He is a true information engineer!”

Since earning his Ph.D. in ORIE in 1988, Professor Jacobson, who is on faculty at the University of Illinois in the department of computer science, has held Operations Research (OR) positions in a school of management, a department of industrial engineering, and a department of mechanical and industrial engineering, before his current appointment in computer science. He also holds affiliate appointments in mathematics, civil and environmental engineering and the College of Medicine at his university.
Andreea Minca joined the School of Operations Research and Information Engineering in August 2011. She received her Ph.D. in Applied Mathematics from Pierre et Marie Curie University in Paris, France in 2011. In 2008, she earned an M.S. in Probability and Finance and the Diplôme de l'Ecole Polytechnique. During her Ph.D. studies she was a member of the Mathematical Finance team at INRIA Rocquencourt, funded by a grant from the Natixis Foundation for Quantitative Research.

Her research is focused on the mathematical modeling of default of financial institutions in the context of a banking system. In her thesis, she introduced a mathematical framework for understanding systemic risk via network analysis and tools drawn from random graph theory.

Her research interests include financial networks, control of epidemics in random graphs, credit risk and liquidity risk.

To read more about Andreea’s current research, please go to www.orie.cornell.edu/news/.

Gwen Spencer Receives First Steuwer Fellowship

As Gwen Spencer wraps up her Ph.D. in Operations Research, she has much to look back on and much to be thankful for. Receiving the inaugural Steuwer Fellowship in the spring of 2011 has allowed Gwen to focus on her research and job search, and less on how she’s going to finance her education.

“It’s given me more flexibility to attend more events that I may not be funded for,” Spencer says. “It’s provided me more time to spend exploring what the next step is.”

The Steuwer Fellowship was given by Sherri K. Steuwer ’73, MS ’75, who retired at the end of December as Vice President - Environmental Policy and Planning for ExxonMobil Corporation.

Spencer works with Professor David Shmoys on topics in optimization and approximation algorithms. She taught ENGR 1101: Introduction to Optimization in spring 2011. “I loved teaching,” Gwen says. “It’s really cool to have this window as a result of this award.”

With an eye toward graduating in May, Spencer says, “I’m optimistic. Seems like a lot of my classmates have found jobs they like. It’s an interesting change of pace and takes a lot of initiative to figure out what you want to do next.”

Did You Know?
62% of ORIE’s 2010 Bachelor of Arts recipients are employed.
33% went on to Grad School
54% of all ORIE grads found employment through Cornell Career Services

For more information on how you can help an ORIE Ph.D. student, please contact Adrian Lewis, ORIE Director, asl55@cornell.edu or Jennifer Micale, Alumni Affairs and Development, jjm368@cornell.edu.
Where Are They Now?
Catching up with ORIE Faculty

Lee Schruben
- After working for 25 years on the Cornell ORIE faculty (and was an undergrad there, too!), retiring with the Andrew Schultz Engineering Endowed Professorship, I am now a Chancellor’s Professor at UC Berkeley (which is not nearly as big a deal as the Schultz Chair at Cornell).
- This year I was the “Day One” speaker at a Cambridge University (UK) workshop on Design of Experiments.
- I have sent the very best Berkeley UC-IEOR undergraduates to graduate school at CU-ORIE, and not just because of dyslexia. I believe ORIE has the best M.Eng. and Ph.D. OR programs in the world – and always has had outstanding undergrads.

William (Bill) Maxwell
- Both Judy and I are physically active and enjoy exercising. I swim at least half a mile every day.
- We (Judy and I) have been traveling with Lindbald expeditions. We went to Antarctica with them in 2010 and also the Road Scholar, whom we’ll be traveling with to Iceland in June and Australia next January.
- During the fall and throughout the spring, I enjoy volunteering as a lifeguard at the Ithaca YMCA. And the summer months you can find me at the local neighborhood pool, Alex Haley Pool where I’m the head honcho, life guard and swim instructor.

Bill and Judy Maxwell in Antarctica. (Photo provided)

Jack Muckstadt
- I have six season tickets to University of Michigan football and enjoy taking different friends and family members to the games, but my grandson attends every game with me.
- When I went to the University of Michigan for grad school I got hooked on the Detroit Tigers. Now my son and my three grandchildren are avid Tiger fans, which works out nicely since they live in Ann Arbor, Mich.
- I’m something of a wine connoisseur. I’m currently enjoying Finger Lakes Wine, especially Red Newt Riesling. But my all-time favorites are German Rieslings.

Mark Eisner
- I write stories for the ORIE website. There are nearly 200 of them online now. I think they give a good picture of what ORIE students, faculty, and alumni are up to these days.
- I’m a bicycle commuter most of the year – it’s the fastest, cheapest and healthiest way to get around here. I’ve worked out a way to bike to the Commencement procession wearing academic garb (but wearing a helmet instead of a mortarboard until I get there).
- It’s great to live here. We enjoy kayaking on Cayuga Lake and hiking in the gorges.

Mark and Paula Eisner enjoying time together kayaking. (Photo by Justin Steele)
I am delighted to introduce a fresh look to alumni news from the School of Operations Research and Information Engineering. ORIE continues to thrive as a world-class research and teaching institution, both interdisciplinary and entrepreneurial. We maintain a leading international reputation, recently reaffirmed by the National Research Council, resting on core expertise in optimization, probability and statistics, enriched by applications in industry, government, and the service sector, and supported by strengths in financial engineering, healthcare operations, and supply chain and revenue management.

This is a busy and exciting time for ORIE. A major focus for us this year is faculty renewal. More than 40% of our faculty – including many of the stars who have built our reputation - are now over the age of 60, and contemplating retirement. To address the growing urgency of ORIE faculty openings, Dean Lance Collins has approved three faculty searches this year. Our core is strong, but with an infusion of fresh talent and energy to plug holes from recent departures, some pre-filling for our retiring stars, and perhaps some opportunistic hiring, we can strengthen and broaden our superb international research profile still further, while maintaining and evolving our outstanding teaching programs. Generous help recently arrived in the form of a faculty renewal pledge of $500,000 from Don Follett ’52 and Mibs Follett ’51, a pledge that will be matched by an additional $500,000 from the University. The new fund will be named in the memory of ORIE’s founder, Andrew Schultz Jr. ’36, PhD ’41.

The strength of this year’s graduating class of seniors was particularly encouraging. The class, judged by various final cumulative GPA percentiles, proved to be, by a significant margin, our strongest ever. In particular, of the 104 graduates, 16 had GPAs above 3.8, and seven of those had GPAs above 4.0 – most impressive!

ORIE’s M.Eng. program leads the College in size of applicant pool and selectivity. This year, of our 910 applicants, we selected an incoming class of 99 students, comprising an encouraging national/international and male/female mix – 30 U.S. citizens and 27 women. Even through the current economic downturn, our job placement has been strong: among our 2011 graduates, only two remained on the job hunt this summer, and median starting salaries were around $75,000.

A longstanding goal of ORIE – perhaps our single highest priority – has been to increase the size of our remarkable Ph.D. program, the fundamental research and teaching glue of any elite department, and the incubator for our profession. We have had some success matching students with interested junior and mid-rank faculty with research support, and both the underlying high-caliber student applicant pool and faculty interest in advising are ample; we continue to work at the last and most difficult hurdle to growth: funding constraints. Looking further ahead, an anonymous benefactor has designated ORIE as the beneficiary of a legacy pledge of $2,100,000. In the future, this remarkable generosity will help create a pipeline of ORIE Ph.D. Fellowship support on which we can rely and build.

Thank you for keeping in touch with us through our new-look ORIE Newsletter. We would love to hear back from you. One of the greatest pleasures of my job is learning how you - the alumni we have tried to help launch - are thriving out there.

Until next time,
Adrian Lewis
Director, ORIE

Did You Know?
45% of our 2010 graduates work in the NYC Metro area.
16% are employed in the Mid-Atlantic region and 14% work internationally.

Follow ORIE on Facebook & LinkedIn
- See what’s happening within the department
- Connect with classmates & faculty
- Meet current students (become a mentor!)
ORIE Launches New Website • www.orie.cornell.edu

On December 14, ORIE’s new website launched. In it you’ll find:

- Easier access to news
- Faculty & Student Spotlights
- Quick access to ORIE Colloquiums/Events
- Easy-to-use navigation
- Keep in touch/stay up to date
- Alumni: add a class note
- See how you can get involved/reconnect with ORIE

Please take a few moments to check it out. You can also go to www.orie.cornell.edu/alumni/ and submit an alumni note.