



NORWICH
UNIVERSITY™

A New Wave of Research



SHARING A MISSION

2008 marks the beginning of the eighth year of Norwich University's partnership with the Vermont Genetics Network (VGN), which supports faculty and student research with funding from the National Institutes of Health (NIH).



Norwich is one of five Baccalaureate Partner Institutions (BPIs) in Vermont that work with the network, based at the University of Vermont under Dr. Judith Van Houten, principal investigator. VGN oversees the awarding of grants and fellowships with \$16.5 million from NIH's IDeA Networks of Biomedical Research Excellence (INBRE).

Over the past three years under INBRE, the network has provided more than \$945,000 for research projects, equipment and technology at Norwich. And during 2008-2009, seven Norwich professors will receive more than \$325,000 – \$280,000 of it for ongoing projects, the rest for two pilot projects combining the skills of VGN veteran Karen Hinkle in biology and network newcomer Darlene Olsen in mathematics.

In addition to grants for faculty and student research, the network over these nearly eight years also has provided funds for renovations of Norwich laboratories, and sent VGN staff and faculty to Norwich with a wide array of instruments to work with students and instructors on cutting-edge experiments as part of their course work.

Along with helping Norwich's faculty researchers to compete for national funding for biomedical research, the network also encourages undergraduates to consider careers in the field. Among recent Norwich graduates, Kendall Black credits her work on VGN projects with helping her gain her current position as a research assistant in the laboratory of David Robbins at Dartmouth College's Department of Pharmacology and Toxicology.

"Doing research is a lot different than doing labs in a class," says Black, a 2007 graduate who majored in biology. "It definitely prepared me. Working with these professors kept me interested. They got me in the frame of mind of doing research 9-to-5. They're all so motivated.

"They're very driven people."

As the university's VGN coordinator, Dr. Edward Carney directs traffic for Norwich's faculty and student researchers.



At the ceremony where President Richard Schneider, student researcher Timothy Blood and Dr. Van Houten cut the ribbon dedicating Norwich's new Molecular and Integrative Biology Research Laboratory in September of 2007, Dr. Carney summed up the shared mission this way:

"The goal of VGN to enhance the culture of research at Norwich, and support ways to perpetuate it, complements the goals set forth in the university's 2019 Document, which looks to the future of this great institution."



THE TIDE TURNS

A significant sea change in Norwich's culture of scientific research washed ashore in 2001.

Right around the time that Alison Fisher joined the faculty with a newly-minted PhD in biochemistry, the University of Vermont-based Vermont Genetics Network (VGN) began offering tens of thousands of federal dollars from the National Institutes of Health (NIH) to science professors and undergraduate students with intriguing research projects at Norwich and four other Vermont colleges.

Almost seven years later, Dr. Fisher is now a tenured associate professor, and VGN is providing her, her undergraduate assistants, and six other Norwich faculty members and their students, with hundreds of thousands of dollars a year to conduct research related to advances in the biomedical arena.

"Norwich has a large share of the VGN funds," Dr. Fisher says.

"Norwich faculty are working hard to get these grants."

Dr. Fisher started probing the mysteries of how, when and why plants flower in 2001, with a faculty summer-research grant that VGN awarded through an earlier NIH initiative: the Biomedical Research Infrastructure Network (BRIN). That first year, she studied the biochemistry of how plants accumulate and volatilize selenium.

In 2002-2003, VGN awarded Dr. Fisher a BRIN grant to buy equipment for the project she has pursued ever since: using chemistry, genetics, and molecular biology to explore how the reproductive systems in plants respond to more – and less – daylight.

Throughout their research, Dr. Fisher and a succession of undergraduate assistants have focused on ethylene, the only plant hormone known to take the form of a gas. While ethylene factors into the germination, ripening and aging of plants, and helps them respond to stress – from changes in the weather to attacks by pathogens – scientists are still trying to understand how it factors into photoperiodic flowering.

"This project will probably never be done," Dr. Fisher says. "Each experiment brings up



more and more questions, more and more experiments that should be done."

Dr. Fisher and her students have used a variety of experiments on Japanese morning glory – *Pharbitis nil* – and thale cress – *Arabidopsis thaliana* – to promote and inhibit the production of ethylene under various conditions of dark and light. One student has been extracting RNA from genetic mutants of *Arabidopsis* (which Dr. Fisher describes as "the lab mouse of the plant world") to explore which genes control the production of ethylene.

In the summer of 2008, student assistants will help Dr. Fisher study the molecular details of ethylene's regulation of photoperiodic flowering in *Pharbitis* and *Arabidopsis*. While she probably could do that kind of work more quickly on her own, "one of the main reasons I do this research at Norwich is to provide research opportunities for undergraduates," Dr. Fisher says. "I am happy to work with any student who is interested in the science."



That enthusiasm on the part of Dr. Fisher and her Norwich colleagues to bring undergraduates into their research beyond the classroom fits into the VGN's goal of promoting a "sustainable" culture of research, according to Teri Hart, program director for the network.

"We're very, very pleased with how Norwich responds to the goals we set for them," Hart says. "There's a lot of support from the top down at Norwich. They're right on board with what we had hoped for."

GUIDING THE NEXT GENERATION

For Karen Hinkle, it all began with the incubating shaker she bought with a \$10,000 grant from the Vermont Genetics Network in 2003 – at the start of her first year as an assistant professor of biology at Norwich.

The partnership, as well as the scale and the pace of research opportunities continues to blossom for Dr. Hinkle, her colleagues and their students. Over the ensuing 4½ years, VGN has awarded her more than \$200,000 in grants for the research projects she conducts along with undergraduate students with a yen for molecular biology and physiology. She currently is wrapping up three years of

research on the genes that trigger the secretion of stomach acid in embryonic mice.

"[VGN's support] has allowed me to really think about what research questions I'm interested in, as opposed to being worried about equipment and supplies," Dr. Hinkle says. "The VGN grants have allowed all of us to ask the questions we want to ask, and not be limited by resources.

"That's what science should be."

In addition to grants for research projects, VGN also sends experts from the University of Vermont to classrooms and laboratories at Norwich and other Vermont institutions. Through this outreach program, they expose faculty and students to cutting-edge microarray technology that shows how genes change in organisms ranging from yeast to cows. At the end of Norwich's microarray workshops in the fall of 2005 and 2007, the VGN experts donated tens of thousands of dollars worth of equipment — from test-tube racks and pipettes to centrifuges and spectrophotometers — for the use of all Norwich faculty and students. Some of that equipment now occupies the new Molecular and Integrative Biology Research Laboratory, which Norwich built in a former storeroom of the Biology Department with a \$104,000 grant from VGN.

"It has provided a place where we can start an experiment, and not have to take it down," Dr. Hinkle says. "When we were in the classroom labs, we were constantly having to take things down. We also didn't have enough storage space for the equipment we bought with the grants we were getting.

"A separate lab facility is something that most universities that do research have. So this is awesome."

The new lab opened just in time for Norwich junior Emily Poulin to join Dr. Hinkle's current VGN project as a paid assistant.

"I always liked biology in school, but I didn't know where it was going to take me," says Poulin, a biology major who also participated in the VGN's microarray workshops. "Then I found that I love doing research, so I'm taking every opportunity I can."

Students who have graduated since working with Dr. Hinkle on VGN projects are taking their experience to the next level. With as much pride as she shows in a tour of the laboratory,



she goes down the list and cites where they're working as research technicians now — including the University of Massachusetts-Worcester, the Boston University Medical Center, and Dartmouth Medical School's Department of Pharmacology and Toxicology.

"It's important to have that kind of opportunity," says 2007 graduate Kendall Black, the Dartmouth technician. "Norwich is a small school, and they're trying to rev up the research. In a smaller school, where it's not as intimidating, it can be a good place to grow."



THE MIND'S EYE

Not so long ago, Associate Prof. Carole Bandy was relying mostly on pencil, paper and the memories of the human subjects of her psychology research.

This coming year, with a \$70,000 grant from the Vermont Genetics Network and two pieces of state-of-the-art equipment purchased over the last two years with almost \$50,000 from VGN, Dr. Bandy and Dr. Kevin Fleming will ramp up their study of how and why people — particularly veterans of combat — respond to what they see as threats.

"VGN has been a miracle for us," says Dr. Bandy, a member of Norwich's psychology faculty since 1995. "This has moved our research in psychology forward 30 years in terms of the quality of what we can do."

Quality, and quantity: Using Norwich's new eye-tracking and brain-imaging equipment, Drs. Bandy and Fleming have studied the ways that Norwich cadets and non-military undergraduates — mostly of Norwich, a few from Middlebury — reacted to a series of images. In June of 2008, continuing their collaboration with Assistant Prof. Matthew Kimble of Middlebury College, they will study 20 active-duty military personnel and veterans, 20 cadets and 20 non-military undergraduates.

"What is special about this grant is that it allows us to establish parallel labs at both institutions in order to share our research expertise and resources," says Dr. Fleming,



an associate professor who joined the faculty in 2006. “Matt is a clinical psychologist trained in neurophysiology who does research on PTSD and veterans. Carole is a social psychologist who works on problems related to stereotyping and social cues used in impression formation and person perception. And I am a cognitive psychologist with training in neuroscience and expertise in eye-tracking who does research on face processing and language. Together, we can share our expertise and conduct more sophisticated research designs than any of us could imagine alone.”



VGN grants come with a requirement that researchers seek funding from federal agencies in addition to the National Institutes of Health (NIH). Dr. Bandy adds that she, Dr. Fleming and Dr. Kimble are looking at a variety of options, including the U.S. Department of Defense.

“There are opportunities for us as a team to work with veterans,” Dr. Bandy says. “For a military school, this is a perfect direction for our research to take.”

During the current phase of the project, Norwich student Charmaine Morris worked under a concurrent research grant from VGN. A member of the university's Corps of Cadets, she had asked Dr. Fleming about research opportunities after a discussion in Dr. Fleming's course on cognition. The resulting experiment was “The Recognition of Emotion and Facial Expressions in the Brain via Perceptual and Biological Perspectives.”

“One of the bonuses of work like this is that we are now able to provide more research opportunities here for our brightest students,” Dr. Bandy says.

Those are the kinds of opportunities that she could scarcely imagine offering students even three years ago.

“These two wonderful pieces of equipment are serving as the launching pad for a research project for the next 10-15 years,” Dr. Bandy says. “It is a total transformation. We knew about the equipment we needed, but the price was completely out of our league until VGN funding became available.

“Social and clinical neuroscience is the future of psychology.”

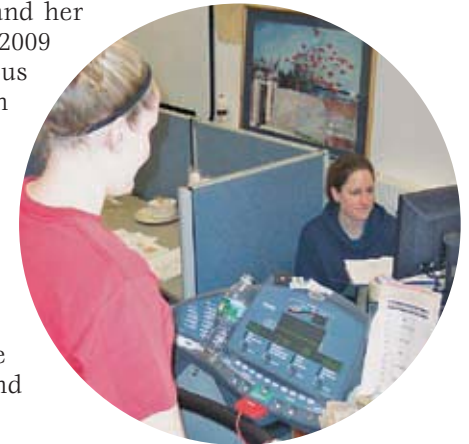


SWEAT EQUITY

Her PhD project followed Elizabeth Wuorinen to Norwich from Michigan in 2005. And within a year, she found support to continue her research into how exercise influences appetite and weight change — first from the university, and soon after from the Vermont Genetics Network.

With the \$70,000 that VGN awarded her in March of 2008, Dr. Wuorinen and her student assistants will spend 2008-2009 looking at how exercise affects women between the ages of 35 and 50.

“This is the final age group of women that I have studied from ages 18-65 years,” says Dr. Wuorinen, an assistant professor of physical education. “I will be measuring hormonal and metabolic fuel availability in the women while they are sedentary and during exercise.”



During the 2007-2008 cycle, the Norwich researchers have been putting eight women, ages 18-35 and relatively heavier than the 2006-2007 group of the same age, through their paces. After fasting and resting since 10:00 the night before, each subject comes into the laboratory at 7:00 a.m. for three separate sessions of 4½ hours each – one of sitting still, one of low-intensity exercise and one of high-intensity exercise.

Throughout each session, the subjects answer questions about their appetite — how hungry or how full they feel at given times — while researchers periodically draw blood for future testing of the levels of a variety of hormones associated with exercise and hunger. In the middle of the trial, each subject receives a variety of foods, with instructions to eat as much or as little as they like. And upon completion of the meal, the researchers secretly weigh the leftovers to measure how much the subject ate.

As her study evolves, Dr. Wuorinen aims also to look more closely at how the time of day affects appetite in her exercising subjects.

“This field is wide open,” she says. “There are so many things we can actually examine. The ultimate goal is to discover how to stop the rise in obesity.”



CATALYTIC SHORTCUTS

With a start-up grant from the Vermont Genetics Network, Assistant Prof. Natalia Blank is buying equipment and chemicals, and paying Norwich students to help in her search for ways to make biologically-active compounds useful in synthesizing pharmaceuticals and natural products.

With the larger grant that VGN awarded her for 2008-2009, Dr. Blank will buy a high-performance liquid chromatograph (HPLC) that she expects will benefit her research, her students, the university's Department of Chemistry and Biochemistry — and, in a small way, the planet.

"It means that the students can run the equipment, rather than me gathering samples here and going to Dartmouth to run [analyses on] the equipment there," says Dr. Blank, who came to Norwich after earning her PhD in organic and organometallic chemistry at Dartmouth in 2005. "They will see how the sample gets into the machine and then see the results. They will be able to analyze their own results. They'll be able to take ownership of their own experiment.

"If not for the students, I don't know if I'd still be doing this."

"This" is a line of research she began while pursuing her doctorate: how to custom-make a pure chiral organic molecule that will catalyze another reaction, creating a product in fewer steps and with fewer potentially harmful elements.

"The way it has been done takes a lot of labor, a lot of money and a lot of time," Dr. Blank says. "We still have a ways to go."

Dr. Blank and her student assistants — three or four will work with her during 2008-2009 — are further along than they would have been, thanks to the network.

"I don't think I'd get the same amount of funding, at a school of this size, without them," Dr. Blank says. "Having VGN allocating money to particular institutions, you have a better chance."



SAFETY IN NUMBERS

While Darlene Olsen has lent her mathematical expertise to fellow Norwich professors on past scientific research, she wasn't looking for a biology-related project for 2008-2009.

Then Dr. Edward Carney, coordinator of Norwich's VGN programs, came looking for a number-cruncher to help fellow Assistant Prof. Karen Hinkle with her new line of research — probing the molecular and cellular impacts of a chemical used to kill a predatory fish in rivers

feeding Lake Champlain and the Great Lakes.

"He would leave literature with me and kept coming back," Dr. Olsen says. "He was really encouraging to both of us.

"If it wasn't for him, I wouldn't even have tried for it."

VGN is funding Dr. Hinkle's part of the pilot project with \$25,000. In the coming year, the network will support Dr. Olsen at a similar level, to compare three techniques for using DNA data to predict how genes group themselves in the laboratory model that Dr. Hinkle will use to test the chemical.

"There's potential, in terms of public health, that the findings will be significant," Dr. Olsen says.

Dr. Hinkle welcomes the assistance.

"With her expertise in math and my knowledge in biology, our collaboration can go a long way," Dr. Hinkle says. "She's going to become a regional expert in micro-array statistical analysis."

Dr. Hinkle adds that she hopes to see other colleagues at Norwich follow their example of cooperation, as Norwich, in concert with the Vermont Genetics Network, moves forward in its commitment to its faculty and research.

"We'll be working together on a cross-departmental core that hopefully will be a platform for many people to use," Dr. Hinkle says.

SPRINGBOARD FOR SUCCESS

In the summer of 2008, Norwich student Timothy Blood will take the Medical College Admission Test (MCAT). How did he get there?

With Norwich Prof. William Barnard as his mentor, and with a research fellowship from the Vermont Genetics Network (VGN), Blood spent part of the summer of 2007 in northern Vermont, paddling a canoe around lakes and slogging his way up streams in search of freshwater sponges. He also studied the DNA sequences of those sponges at VGN's facilities at the University of Vermont — and saw a future for himself in biomedical research.

"This helped me further down the line, definitely," Blood says. "I love research. I love figuring out how things work and why they work."

Norwich and the genetics network will continue to open these kinds of doors for university faculty and students, in a highly-competitive environment for research funding. For more information about VGN, visit <http://www.uvm.edu/~vgn/>.



INSTITUTIONAL CONTACTS

Norwich University

Edward Carney, PhD
VGN Coordinator
Charles A. Dana Professor of Biology
802-485-2342 ~ carneye@norwich.edu

David Westerman, PhD
Associate Vice President for Research
Charles A. Dana Professor of Geology
Office of Academic Research
802-485-2980 ~ westy@norwich.edu



NORWICH
UNIVERSITY™

Expect Challenge. Achieve Distinction.

Vermont Genetics Network

Judith Van Houten, PhD
Principal Investigator
George H. Perkins Professor of Biology
802-656-2922 ~ Judith.VanHouten@uvm.edu



Vermont Genetics Network
IDEA Networks of Biomedical Research Excellence

