



Chemistry News

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Professor Barbara Cole, graduate student Nilmini Gedivinne, and Professor Raymond Fort.

Chemistry Graduate Student Nilmini Gedivinne Helps Find Link Between Anti-Flu Drug and Evergreen Trees

In a place so well known for its forests of coniferous trees that it's been anointed the Pine Tree State, it is hard to comprehend the vast number of needles on Maine's evergreen trees.

That's why a recent discovery, made by a team of University of Maine researchers, about the needles of some of Maine's coniferous trees and how they are related to the key ingredient to a powerful anti-flu drug, is so significant.

Nilmini Gedivinne, a UMaine Ph.D. candidate in the chemistry department, along with chemistry professors Raymond Fort and Barbara Cole, has found the needles of some species – including the white pine, which is Maine's state tree – are able to store molecules of shikimic and quinic acids in high concentrations and for long periods of time.

Those needles are much more accessible, and much cheaper, than the current standard source of those acids.

Shikimic and quinic acids are both starter molecules for Tamiflu, an oral drug that was used during recent worldwide outbreaks of bird flu and H1N1. A product of the Roche pharmaceutical company, Tamiflu is the commercial version of oseltamivir phosphate, an orally active neuraminidase inhibitor. Neuraminidase – the “N” in H1N1 or any other strain of flu – is a protein that when inhibited does not allow the virus to penetrate cells and replicate.

Gedivinne also found the acids to be present and easily extractable from needles of spruce, fir and tamarack.

She presented her research, which began about four years ago when Fort and Cole received a \$10,000 seed grant from the Maine Technology Institute, to an August meeting of the American Chemical Society in Boston.

All plants and bacteria produce shikimic acid, which is the more potent of the two acids. The world's primary resource for shikimic acid, however, is the star anise plant. Although shikimic acid is found in much higher concentrations in star anise than conifer needles, star anise is grown in only remote regions in China, rendering it costly and not readily available. During the 2005 bird flu outbreak, worldwide shortages of Tamiflu were based on a paucity of star anise.

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Aubert Hall Features Bright, New Laboratories

University of Maine chemistry students are busier than ever conducting experiments in the newly modernized labs at Aubert Hall.

Thanks to the improved ventilation that was included in the renovations, students now can perform experiments that previously were off-limits because of inadequate air flow.

“We had stopped doing some experiments because of the fumes,” said Bob Kirk, teaching associate and laboratory supervisor.

Also as part of the construction project, equipment was updated, new cabinets were installed, and leaky windows were replaced. The new windows match the original ones in the beautiful, 100-year-old brick building. Finally, “break-out” rooms with tables and chairs and computers were attached to each lab.

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Students conducting chemistry experiments in one of the newly renovated labs in Aubert Hall.



Greetings from Dean Hecker

The College of Liberal Arts and Sciences prides itself on embracing change and seeking new opportunities for growth. With the help of faculty, we can find innovative ways to move forward. Recently, I announced five action items that summarize the ways in which I would like to see our college grow.

- Create opportunities for active learning and problem solving that are cost-effective and sustainable
- Increase opportunities for students to participate in research
- Support and promote innovative interdisciplinary education and scholarship
- Increase funding from external sources to support teaching, research, and outreach missions
- Increase graduate offerings by taking advantage of areas of existing strengths and developing unique interdisciplinary opportunities.

We already have begun a concentrated effort to explore ways that we can use new technologies to engage students in active learning. Over the next years we will be developing more detailed plans on how we will move ahead on the action items. The phrase we like to use when talking about students' experiences in the College of Liberal

Arts and Sciences is "learning that lasts a lifetime." Our commitment is to create the opportunities that allow students to develop the skills that prepare them for a lifetime of learning.

Meanwhile, our faculty continues to make their collective mark. Their excellence was recognized recently when two of three Presidential Achievement awards went to CLAS professors: Kathy Olmstead, professor of journalism, was recognized for public service, and Owen Smith, professor of art and new media, was hailed for research and creative achievement. Receiving the highest honor was James Acheson, professor of anthropology, named 2009 Distinguished Maine Professor.

Antiflu drug *from page 1*

It takes 30 kilograms of star anise to produce one kilogram of shikimic acid, which makes up around six percent of the weight of star anise. That single kilogram of shikimic acid can cost around \$700.

Although shikimic acid makes up only around three percent of the dry weight of the coniferous tree needles, those needles have the benefits of being plentiful, easily accessible, and cheap. As Gedivinne found through her research, the essential acids, which make up more than three percent of the dry weight of the needles, are also easily extractable through a process similar to brewing tea, although on a larger scale.

Gedivinne tested the bark and foliage from seven tree species obtained from the University of Maine Research Forest. The species, which varied in age from 12 years to 27 years, were white spruce, Norway spruce, black spruce, eastern white pine, red pine, balsam fir and tamarack.

She collected, ground and stored the needles at -18 degrees Celsius. The ground needles were freeze-dried before analysis.

The scientists' next challenge is refining the extraction technique in order to garner large amounts of shikimic acid from pine needles. Progress on that front could open up a whole new arena for Maine's timber industry.



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Greetings to alumni and friends of the Chemistry Department!

I hope you enjoy reading about some of the exciting things that have been happening in the Chemistry Department in the past year - from innovative research and laboratory renovations to award winning students and new faculty. We are pleased to report that renovations of Aubert Hall have continued with significant upgrades to the general chemistry teaching labs. Chemistry doctoral candidate Nilmini Gedivinne, working with chemistry professors Barbara Cole and Ray Fort, has isolated an active ingredient in Tamiflu from pine needles. Undergraduate chemistry major Brenna Walsh was selected as the Outstanding International Graduate in the College of Liberal Arts and Sciences. Brenna's research with chemistry Professor Brian Frederick and physics doctoral candidate Rachel Pollock involved multiple trips to the Oak Ridge National Lab in Tennessee. New faculty member Dr. Rebecca Rowe has done an outstanding job teaching hundreds of students introductory and organic chemistry. We were sorry to see Linda Maynard, our loyal secretary, retire. But we are pleased to report that she is enjoying her retirement immensely!

Dr. Alice Bruce, Chair
Department of Chemistry

Aubert Labs *from page 1*

"Now students have a meeting room where they can sit and talk, and the teaching assistant can take people in and out of the lab to discuss the experiments," said Kirk. "We wanted to replicate a real-life lab as much as possible.

"These new labs are among the best in the state," he said.

Thanks to the construction project which was funded through a voter-approved bond, three out of seven labs in Aubert Hall have been renovated and break-out space was constructed to accompany a fourth lab. The new labs are sunny and bright with plenty of room to accommodate the 16 students who typically occupy the space.

"Most labs in old buildings are dingy," said Kirk. "We've tried to make our labs pleasant and friendly."



Bob Kennedy

A Note from the President

Since enrolling at the University of Minnesota as a liberal arts major more than 40 years ago, I've spent virtually every day of my professional life studying or working at public universities. My extensive experiences at these institutions have fortified my belief that the liberal arts provide a vital and important foundation for educational attainment and fulfilling careers. UMaine's College of Liberal Arts and Sciences is larger than all of Maine's private liberal arts colleges combined and it is home to many internationally recognized faculty. We are pleased to share these stories of both faculty and student accomplishments.

Brenna Walsh '10 of Nova Scotia Named Outstanding International Graduate

Brenna Walsh '10 was named Outstanding International Graduate by the College of Liberal Arts and Sciences last spring. The Dartmouth, Nova Scotia, native who earned a bachelor's degree in chemistry, was cited for her strong academic record, her involvement in scientific research, and her dedication to the cross country and track and field teams.

"I was honored by the recognition," said Walsh, now a doctoral student in chemistry at McGill University in Montreal.

A member of the Honors College and captain of the cross country team and co-captain of the track and field team, she maintained a highly disciplined training and academic schedule throughout her four years.

"I had a really good experience at UMaine," she said. "Every year got better."

Walsh, an ambitious student who thrived on complex, detail-laden projects, was selected by chemistry Professor Brian Frederick to work with the interdisciplinary research group of physicists, chemists, and chemical engineers developing catalysts to convert wood into fuels and chemicals through UMaine's Forest Bio-Products Research Institute (FBRI).

As a member of the research team,

she accompanied Professor Frederick and doctoral student Rachel Pollock to Oak Ridge National Lab in Tennessee to conduct a series of experiments.

Walsh said she was excited by the unique research opportunity that typically only is afforded to graduate students.

"This was a really prestigious thing," she said. "I never imagined I would have these kinds of research experiences as an undergraduate. I am grateful to UMaine and to Brian."

Calling Professor Frederick and Rachel Pollock her "mentors," Walsh said both were unfailingly supportive and encouraging.

"As busy as they were, they always were willing to work around my busy

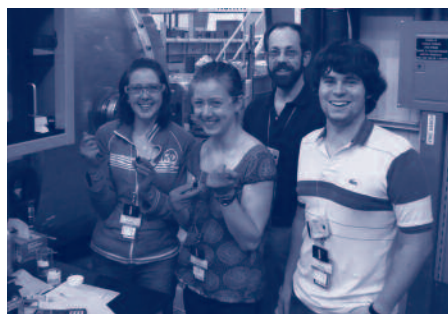
track schedule. Brian has the ability to take on many more tasks than most individuals can handle. Still, he always found time to help me revise my thesis and thoroughly explain how to use the scientific instruments."

She came through with flying colors, according to Professor Frederick. "She had the ability to handle research opportunities way beyond what most undergraduate students are capable of," he said. "She learned to operate highly sophisticated equipment and became an essential member of the research team. Her diligent preparation and meticulous experiment skills, both at home and at Oak Ridge, were essential to the success of my team."

Pollock called Walsh "an amazing asset" and said she couldn't have done the experiments without the younger student's help.

Walsh, whose Honors Thesis was based on her Oak Ridge research, is writing a journal article about the cutting-edge experiments in which she was involved. She continues to reflect upon her experience at the national lab where she used complicated equipment to measure the scattering of neutrons.

"There were scientists from all over the world doing experiments," she said. "It was the first time I got a sense of the enormity of the science research that goes on across the globe."



Working at the Oak Ridge National Laboratory, Oak Ridge, Tenn. are, front row, l-r: Rachel Pollock and Brenna Walsh and, second row, l-r: Chemistry Professor Brian Frederick and Jason Fry of the University of Indiana

Ph.D Student Rachel Pollock Performs Cutting Edge Research at National Lab

Conducting research at the Oak Ridge National Laboratory in Tennessee can be hectic, but it's also exciting and gratifying, said doctoral student Rachel Pollock.

Working with chemistry Professor Brian Frederick, Pollock, who's earning her Ph.D. in physics, is part of the 35-member research team developing

catalysts to convert wood into fuels and chemicals through UMaine's Forest Bio-Products Research Institute (FBRI).

She and Professor Frederick travelled to the national laboratory three times over the last year, accompanied by then undergraduate Brenna Walsh '10. Surviving on little sleep and catch-as-catch-can meals, the group would spend

three to five days each visit performing cutting-edge experiments with neutron scattering.

"We're doing work no one else is doing," Pollock said. "A lot of times you come into a Ph.D program where people are doing similar research. But we're doing things that are really exceptional."

Faculty Spotlight: Chemistry Professor Rebecca Rowe

University of Maine Chemistry Professor Rebecca Rowe once wanted to be an accountant. But she changed her mind after observing good teachers in action.

"I got to have some really phenomenal teachers in graduate school," she said. "They presented the subject matter in a way that excited me. I could sit in their classes for 90 minutes and the time would go by in a flash. I was never bored. They had wonderful communication skills and they knew how to get their points across in a variety of ways. Sitting in class and watching them is when I decided - I want to do this, too! Later, when I became a teaching assistant, these wonderful professors became role models for me. They taught me how to teach."

Professor Rowe taught at UMaine part-time from 2001 to 2003 and came on board full-time in 2008. She taught at

Colby College for the five intervening years, but continued to teach summer and evening classes at UMaine. Throughout her career she has continued to hearken back to the type of instruction she got from her own teachers and to use the teaching tools she learned from them.

"I always try to make chemistry relevant to students' lives," she said. "It's not hard to do. For example, when I teach my non-science course, I talk about the chemical structure of the food they eat. And, since lots of my students want to be veterinarians, I like to use examples that include animals. When I teach about naturally occurring compounds, I point out that horses don't eat brown leaves because they contain a chemical component that's toxic."

Professor Rowe has another teaching trick. "I try to incorporate as many senses as I can into the classroom," she said. "Research shows that the more senses you use in your learning, the better you'll understand the concepts and the longer you'll retain them. So I use lots of visual aids and I encourage students to talk and

ask questions in class so we can launch a discussion about the material. I also try to get students to read out loud while they study. When you read out loud you're speaking, seeing, and hearing the material and it keeps your mind from wandering. Concentrating on reading the words helps you understand the concepts."

Learning by doing is another tool that Professor Rowe employs. She makes it a habit to give students lots of practice problems and practice exams outside of class. "The only way to do well in chemistry is to practice - it's like learning to play a musical instrument. So that means you have to do problems - as many and as often as you can."

Professor Rowe's students know they have an open invitation to stop in at her office for extra help. "I try to bribe them," she said with a smile. "I tell them, 'I have candy and juice at my office. Come see me. It's not scary.' Sometimes I bring my dog Cooper, a four-year-old Bichon Frise. Students tell me they really came to see Cooper, not me."



Linda Maynard

Secretary Linda Maynard Retires After 42 Years

After more than four decades helping run the University of Maine Chemistry Department, secretary

Linda Maynard has retired.

"I want to spend more time with my husband, family and friends, and our seven-year-old cat, Princeton," said Maynard who began work at UMaine in 1968.

"I absolutely loved everything about

my job. The years went by in a flash. I'll miss the faculty, staff and students. They are my second family!"

Maynard, who has worked under nine different department chairs, said the biggest change was the switch to computers in the 1980s.

"When I first started working here I was dealing with the typewriter and mimeograph machine. Then along came the computer and photocopiers! Life was easier, but it took a while to get used to the new technology."

Her days were chock full, according to Maynard, whose duties included typing exams, helping professors with various projects, and registering students. Sometimes students had a problem with their schedule and they'd come in nervous and upset. But she'd take them under her wing.

"There was no greater reward than helping students," she said. "I always loved seeing them leave the office with a smile on their face knowing they were happy."



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