Comfort Mintah says she finds it easier to study math as a master’s student at U of G than in South Africa, where she attended the African Institute for Mathematical Sciences (AIMS). That’s because the institute offers an intense program of instruction that concentrates one semester of classes into three weeks. The academic network now has five schools in Cameroon, Ghana, Senegal, South Africa and Tanzania, with a sixth scheduled to open in Rwanda in fall 2016.

“What stands out to me with AIMS students is the energy and enthusiasm they bring to their work,” says Prof. David Kribs, Department of Mathematics and Statistics, and international academic adviser for AIMS. He has taught at AIMS-Ghana and South Africa, and his colleague Prof. Rajesh Pereira has taught at AIMS-Tanzania.

Admission is limited to 50 students per centre each year, but more than 2,000 students from across Africa apply annually. They must have a bachelor’s degree in a mathematical discipline to be eligible. It’s a new approach to teaching in Africa, which traditionally sent many of its best students abroad to pursue higher graduate education, says Kribs.

AIMS receives funding from the governments of Canada and the United Kingdom and local governments in Africa, as well as corporate sponsors such as MasterCard. The University of Guelph is both a sponsor and an academic partner, sending faculty and students to teach there.

Mintah is the first student to graduate from AIMS and pursue a master’s degree at U of G. “It was amazing,” she says of attending AIMS. “You have to really work hard and not be an average student, but an excellent student.”
As I approach my 10th and final year as dean of CPES, I want to use my remaining messages to simply say “thank you” to our alumni, students, faculty and staff.

The college has thrived under many challenges in the last decade, but it has excelled at taking advantage of opportunities to position itself to become stronger over the years to come.

Our undergraduate programs have been revamped to be more adaptable to present-day expectations in industry, government and post-secondary education. Our research and graduate programs place us at the international and national level in all areas served by the college.

All of this has been achieved by the hard work and dedication of our faculty, staff and students.

I also want to thank our alumni who have added immensely to this bright future during my tenure as dean. Gifts and donations that support students, faculty and staff through scholarships, research support and equipment fund enhancements have allowed our academic mission in CPES to move to a wonderful higher level.

As we approach the end of another academic year, I am reaching out to you further to keep this great college in your thoughts and deeds. I ask for your continued support to maintain the excellence achieved in this college for years to come.

Thank you.

Tony Vannelli
Dean, CPES

Physics Chair Enjoys New Role

Since becoming physics chair in 2015, Paul Garrett has gained an even greater appreciation of his department and the people who make it succeed.

“We have an absolutely fantastic research program in this department,” he says. “There’s a number of people here who are truly world leaders in their field.” His own research focuses on nuclear physics, using the TRIUMF subatomic physics labs in Vancouver and other facilities around the world.

As the new physics chair, he says one of the department’s biggest strengths is its people. “We have a very collegial department. The faculty genuinely like each other. We get along very well. It’s a very friendly, supportive atmosphere. That’s not true in all departments.”

After joining U of G in 2004, Garrett taught physics classes, supervised graduate students and postdocs, and served as associate director of the Guelph-Waterloo Physics Institute.
Awards Honour Alumni

The School of Engineering held its sixth annual Honours and Awards Banquet in November 2015 to celebrate the achievements of its graduates and friends.

The 2015 honorees were:

- **Young Alumnus of Honour**: Alexis Wagner, B.Eng. ’14
- **Mid-Career Award**: Deborah Goudreau, B.Sc.(Eng.) ’97
- **Award of Excellence**: PepsiCo Canada
- **Medal of Achievement**: Robert Burnside, BSA ’64, M.Sc. ’66

“When the director called me I was shocked and greatly honored,” says Alexis Wagner, who was named Young Alumnus of Honour. “I am humbled that my mentors at Guelph took the time to nominate me for the award, and that the committee supports the work I have done over the past year to help my community and our country.”

The 2014 biological engineering graduate works as a brewing group manager at Labatt Breweries of Canada. She also received the W.C. Winegard Medal, U of G’s top undergraduate convocation award, in 2014 for her academic and extracurricular achievements. As a student, she played varsity field hockey, served on the Engineering Society and volunteered in the community.

“My education at the University of Guelph inspired me to dream a bigger dream for myself,” says Wagner. “The interdisciplinary focus of engineering at Guelph parallels the way that we need to think to address the world’s grandest challenges. I still have so much to learn and so much I want to accomplish, but I could not be more grateful for the critical thinking skills I garnered at Guelph and the mentors that continue to support my aspirations.”

To nominate someone for the 2016 awards, contact Karry Kwan, CPES alumni advancement manager, at karrkwan@uoguelph.ca, or call 519-824-4120, Ext. 56769.

---

New Faculty Join School of Engineering

In response to U of G’s growing engineering student population, the School of Engineering welcomed several new faculty in 2015, including:

**Syeda Tasnim**
**Research focus**: clean energy conversion using thermoacoustic devices, energy and sustainable building, energy storage and phase change process, and porous media modelling.

**Mostafa Elsharqawy**
**Research focus**: desalination, geothermal heat pumps, salinity gradient energy, heat and mass transfer, porous media, pore network modelling, thermophysical properties, exergetic analysis, heat and mass exchangers, and bubble columns.

**Kourosh Mohammadi**
**Research focus**: water resources management projects, groundwater modeling, GIS applications in water resources and irrigation, numerical methods and environmental studies.

**Ashutosh Singh**
**Research focus**: molecular dynamics of food components, high electric field processing of thermo-sensitive food products, and development of new food products and processes.
Physician Honoured for Student Care

University students face unique health challenges, and Dr. Dorothy Bakker is one of many health professionals at U of G’s Student Wellness Services who can help. She was named Regional Family Physician of the Year by the Ontario College of Physicians in recognition of her work with U of G students since 2001.

“I just love students,” says Bakker. “Students are incredibly fascinating, interesting individuals. They are at a very interesting time in their lives where they’re transitioning from adolescence to adulthood. Those emerging adults are discovering and learning about who they are. Sometimes the journey isn’t easy.”

Medicine wasn’t her first choice of professions. As an undergrad at U of G, Bakker studied chemistry and was encouraged by her professors to become a doctor. She spent four summers doing research with Prof. Bruce Holub, Department of Human Health and Nutritional Sciences, conducting studies on the effects of omega-3 supplements on kidney disease patients.

She then spent 10 years in community family practice before joining U of G.

Bakker was named Regional Family Physician of the Year by the Ontario College of Physicians in recognition of her work with U of G students.

Mental health is one of her areas of interest, giving students skills and resources to help them cope. “The majority of students I see have problems with anxiety – lots of anxiety.”

Stress is nothing new to student life, she says, recalling what it was like to be a student herself, but it’s more socially acceptable to talk about mental illness now and more resources are available to deal with it.

Research Job Out of This World

Hawaii is a popular tourist destination, but it’s also an ideal place to simulate life on other planets for future space exploration. That’s what Eric Boucher recently did at the Pacific International Space Center for Exploration Systems (PISCES) in Hawaii.

“It’s the best analog site in the world,” he says of Hawaii’s Mauna Kea. “It’s actually geo-chemically identical to Mars.” He worked on site analog characterization, which involves finding locations in Hawaii that replicate environments found in space. He also helped co-ordinate outreach activities, such as the STEM Aerospace Research Scholars program, which invites local female high school students to the facility to learn about the aerospace industry.

“We teach them how cool science is and how much fun it can be,” says Boucher, a bachelor of arts and science student in physics and political science.

He is the recipient of a 2014 Loran Scholarship and the David Mirvish Chancellor’s Scholarship, both of which are awarded to students who demonstrate excellence in academics, leadership and extracurricular activities. The scholarships enabled him to participate in the student research program at PISCES.
Data Helps Boost Farm Efficiency

OLD MACDONALD’S FARM is going high-tech with the help of sensors that can monitor livestock and crops. Prof. Rozita Dara, School of Computer Science, is working on “precision agriculture” technology that can help farms become more efficient. Precision agriculture uses a combination of algorithms, sensors and computers to collect and analyze data, which can help farmers improve the welfare of their livestock, enhance production and boost crop yields.

Most cows are equipped with radio frequency identification (RFID) tags that collect biometric information, such as heart rate, blood pressure and feeding habits. Some robots, for example, can detect whether a cow has eaten recently and withhold food until the animal gets hungry again, which saves on feed costs.

With her background in data mining and analysis, Dara can help farmers interpret the data collected by sensors on their farms to maximize production and minimize costs. “Some of them generate data every few seconds,” she says of the sensors. That information is analyzed and interpreted to help farmers make the best decisions for their farm operations.

Sensors can also detect infectious diseases in their early stages to help prevent transmission and minimize the use of antibiotics. Mastitis, for example, causes inflammation in the udders of dairy cows, which can be fatal in severe cases. The disease costs dairy farmers in the United States up to $2 billion per year in lost livestock and milk production. Milk from infected cows must be discarded.

“Our goal is to analyze big data collected from the robotic sensors to find patterns which could be used to detect mastitis earlier,” says Dara. Early detection can help improve animal welfare by preventing the disease from progressing into an extremely painful condition for the cows. Administering antibiotics as soon as the disease is detected can reduce the amount needed to treat it.

EVENT DRAWS WOMEN IN COMPUTING
Opening doors to computing careers was the aim of the Canadian Celebration of Women in Computing, held in Ottawa in January. The event gave female computing students the opportunity to network with mentors and recruiters in high-tech industries. About 500 people attended, including students, faculty and industry representatives.

“All of these industries sent their very high-level executives: managers, VPs and CEOs to this event,” says Prof. Rozita Dara, School of Computer Science. “Students look at them as role models.”

Workshops covered emerging job trends in computing, information technology and software engineering to show students the variety of jobs that exist in their field.
Student Inventions Can Help Save Lives

Students in biological and biomedical engineering put their ideas on display during a bio-instrumentation trade show attended by industry representatives at U of G. The health-related prototypes included an assistive walker for elderly users and a sensor that alerts firefighters when they’re at risk of cardiac arrest.

“Statistics say that elderly patients often forget to use their walker,” says Andrea DiNardo, a fourth-year biological engineering student, who developed the walker with classmates Keerthi Sukhavasi and Shoaib Syed. Patients with Alzheimer’s disease or other forms of dementia are more likely to forget their walker, she adds, putting them at greater risk for falls.

The device uses a bracelet that alerts the wearer when he or she is too far away from their walker. The alert consists of a flashing light or vibration for those who are visually impaired.

Fourth-year biological engineering students Kendra Prudeau, Megan Smith and Megan Stajkowski developed a sensor that monitors the heart rate and body temperature of firefighters to detect those who are at greater risk of cardiac arrest. When their physiological strain index (PSI) gets too high, the device sends a signal to the fire chief to remove the firefighter from the blaze. Once recovered, the firefighter can return.

The inspiration for the device came from Prudeau’s boyfriend, who is a volunteer firefighter.

“The biggest risk is cardiac arrest,” says Prudeau, adding that it kills up to 58 per cent of firefighters. “The higher the PSI, the greater the chance of cardiac arrest.”

Class Project Aims to Boost Water Availability

A group of fourth-year engineering students put their knowledge to the test outside the classroom when they traveled to Quelcata, Bolivia, to develop ways to help alleviate the town’s water shortage.

“Going to the indigenous village and checking it out, we could get a good understanding of what the needs of the village were from their perspective,” says Colin Gibson, one of the students on the team.

They researched the area to identify the causes of the water shortage, due mainly to a decrease in rainfall. The river that runs through the town had dried up, and the pump that drew water into a reservoir from a well 170 metres underground broke down in 2010.

The subsistence farmers grow a limited number of crops, including potatoes, quinoa and other types of grain. “By gaining access to water, our hope would be that they can use that to grow some different kinds of crops,” says team member Jake Whittamore.

The student team, including Tamarra Lewis and Ethan Brown, plan to find ways to repair the water pump or harvest rainwater from rooftop runoff when they return to Quelcata with the help of fundraising.

“Once we all got down there, we no longer thought of it as a school project,” says Gibson. “We were a lot more focused on how we could design something that could actually work to help these people who are struggling.”
Teacher Keeps Learning

When Alex Michaelides was a student, he had no intention of becoming a teacher, but now that he has been teaching chemistry at Glenview Park Secondary School in Waterloo, Ont., for the past few years, he loves it. “There’s no way I wanted to be a teacher,” he says. “I thought forensics was more interesting.” His opinion changed when he became a teaching assistant while studying chemistry at U of G and found that he enjoyed working with students. Now that he has students of his own, he tries to instill them with the same enthusiasm for science that he had as a student.

“Staying current on what’s new in science and chemistry teaching – that keeps things interesting,” says Michaelides of his approach to teaching. His lessons are inspired by the science magazines he reads as well as science teacher conferences and professional development.

He admits that it’s difficult for some students to grasp chemistry, so he tries to help them visualize it through hands-on activities such as building models, doing labs and demonstrations. He also looks for opportunities to incorporate current technology and apps to further enhance their learning.

Inquiry-based learning is another tool he uses in his classes, inviting students to design their own experiments.

“We especially push the inquiry-based learning in the Grade 9 and 10 courses to help kids get more excited about science and to start thinking about some of the senior courses like chemistry, biology and physics.”

U of G Research Played Role in Nobel Prize in Physics

University of Guelph scientists are part of a team of Canadian and international researchers whose studies have won a Nobel Prize in Physics, according to an announcement made by the Royal Swedish Academy of Sciences.

The Nobel Prize is shared by Art McDonald, a physics professor at Queen’s University who directed the Sudbury Neutrino Observatory (SNO) in the 1990s, and Takaaki Kajita, head of the Super-Kamiokande Collaboration based at the University of Tokyo.

Data collected and analyzed by U of G physicists at SNO helped establish that neutrinos have mass.

The Guelph team consisted of professors emeriti Jimmy Law, Robin Ollerhead and Bernhard Nickel; retired professor John Simpson; researchers Pillalamarr Jagam, Diane Reitzner and Jian Xiong Wang; and PhD students Tom Andersen, Marc Bergevin, Myung Chol Chon and Nathaniel Tagg.

Neutrinos like those generated by the sun are among nature’s most elusive particles. The SNO lab detected their presence and showed, contrary to what many scientists believed, that these particles have mass.

“It turned out that the initial assumption dating from 1930 that the neutrino was massless didn’t work,” says Law.

SNO is a unique neutrino telescope that is the size of a 10-storey building. It’s located two kilometres beneath the earth in a nickel mine near Sudbury, Ont., making it the world’s deepest underground laboratory.

SNO is the only facility in the world that can detect neutrinos accurately, thanks to the giant sphere filled with ultra-pure heavy water that contains heavy hydrogen. Neutrinos passing through break up the deuterium into a neutron and a proton, which is crucial to the measurement process.

Guelph scientists were part of the original group helping with research and development and the construction of the SNO detector. They also helped in design, construction and operation of SNO’s sophisticated instruments and in data analysis.
Keith Driver could be described as a fish out of water – and so could the fish he raises in land-locked Iowa. The environmental engineer turned fish farmer was working in the oil and gas industry when he consulted on a refinery project in South Africa.

He and his business partner suggested aquaculture as a more environmentally sustainable alternative and began researching options. When they heard about an opposing-flow tank system in Florida, its developer sent them to a farm in Iowa that was using the technology. The fish are raised in 10,000-gallon tanks, and 93 per cent of the water is recycled.

“It was perfect,” says Driver, B.Sc. (Eng.) ’97. “It was exactly what we were looking for. We ended up buying the farm.” They’re currently in the process of raising $56 million to expand VeroBlue Farms, making it the largest sea bass aquaculture facility in North America.

At U of G, he was a teaching assistant for water and wastewater management courses. Raising fish appealed to him because it was a means of producing a high-quality protein source without the use of hormones and other chemicals. When his wife was pregnant, she avoided eating fish because of concerns about mercury contamination. Farm-raised fish that live indoors aren’t exposed to the same toxins that fish encounter in the environment.

“Fish is a protein source that’s sustainable and that doesn’t have the environmental footprint of any of the other proteins, so it was a good fit for an environmental engineering program,” says Driver. Compared to beef, which can require 1,600 gallons of water per pound to produce, fish only need about three gallons of water per pound.

He chose to raise barramundi, the most popular white fish in Australia, for its high nutritional value and omega-3 fatty acids. A female sea bass can produce up to three million eggs per month, and it takes only six months for the fish to reach market size. The farm also raises steelhead trout, as well as king and Atlantic salmon.

Driver calls Atlantic salmon his “ego fish” because it’s considered to be difficult to grow on land. “There’s me and a handful of folks who are growing it on land in an effort to prove that we don’t have to do it in our oceans with the environmental costs that come with that.”