



## Donors Give Gift of a Lifetime

**F**OR STUDENTS IN U OF G'S human anatomy program, the human body is the best learning tool. The program wouldn't exist without donors and their families.

"It's their most precious gift," says Premila Sathasivam, laboratory supervisor in the Department of Human Health and Nutritional Sciences. "They're very much part of our family."

Human body dissections are often performed in medical schools but rarely in undergraduate programs. Many of the students in the human anatomy program plan to pursue post-graduate studies in medicine and other fields.

But the students aren't the only ones who benefit from the knowledge they gain through dissections. They lead an outreach program for local high school, college and university students as well as emergency first responders.

Students are often surprised by how the human body differs from textbook diagrams and plastic models.

"It's so different than studying from a textbook," says Eleni Brennen, a third-year human kinetics student. "I have a coloured atlas which shows the dissections, but even that is nowhere near studying the body."

After suffering a number of sports-related injuries, Brennen wanted to study human anatomy to learn how injuries happen. That knowledge will help her



Laura Van Den Bosch, centre, a fourth-year advanced human anatomy student, shows a heart to her parents Vince and Cathy during an open house for friends and family.

become a physiotherapist who understands what her clients are going through, she says.

The students also learn from their donors' health problems: some have tumours, others have hernias. One donor had heart bypass surgery.

Students in the human anatomy program held their second annual open house on Feb. 12 and more than 80 of their family members attended. "I was very impressed and proud of how all the students were able to translate their obvious in-depth anatomy knowledge into layman's terms so we could not only appreciate

what they have been studying but also how it applies to our everyday world," says Ernie Yip, parent of a fourth-year student.

A celebration of life was held April 3 to honour the donors and their families. "It's exciting to celebrate the donors because you become connected to them when you work with them," says Holly Clark, a third-year human kinetics student. "It's like a partnership."

For more information, contact Sathasivam at [psathasi@uoguelph.ca](mailto:psathasi@uoguelph.ca) or call the 24-hour human body donation line at 519-400-4630.

# CBS Welcomes You to Alumni Weekend



**A**S WE BEGIN 2012, Alumni Weekend is an important time for the University of Guelph – we reconnect with old friends, reminisce on years past and share our vision for the future of our institution.

To those alumni who are planning on visiting us in June, we look forward to seeing you. For those alumni who have been thinking of coming back, I encourage you to make Alumni Weekend a priority.

Come to the annual CBS Alumni Association's annual general meeting and breakfast on June 16, followed by a tour of the Biodiversity Institute of Ontario. Other building tours will highlight the significant growth and expansion of our teaching and learning spaces, with the Science Complex housing many CBS

faculty and students.

Join us on Saturday evening at the milestone dinner in Creelman Hall to connect with former classmates and faculty members. After dinner, attend the alumni pub and enjoy retro pricing from the 1980s.

If you have any questions about participating in Alumni Weekend, please contact Annie Benko, CBS alumni advancement manager, at 519-824-4120, Ext. 54568, or [abenko@uoguelph.ca](mailto:abenko@uoguelph.ca).

As you'll read in this issue of the *Zygote Plus*, we have much to be excited about in CBS, and I welcome you to be part of the celebration.

MICHAEL EMES  
DEAN, CBS

## Two More Years for CBS Dean

**T**HE UNIVERSITY has extended the term of Prof. Michael Emes as dean of CBS by two years to June 2014.

The goal is to align the completion of his term as dean with the completion of a multi-year review of the University's science programs and the end of The BetterPlanet Project campaign.

"Michael has been integral to initiating and developing relationships currently underway as part of The BetterPlanet Project, and it is important to have him continue to provide clear and consistent direction," says Maureen Mancuso, provost and vice-president (academic). "His institutional knowledge will also be tremendously helpful during the science review."

The University is embarking on a process of determining where and how it should focus its science teaching and research endeavours to best take advantage of its strengths and future opportunities. The process will include assessing current science programs and how effectively they are administered and managed.

Emes was appointed CBS dean in 2002 and re-appointed in 2007. He arrived at Guelph during the early development of the Science Complex and was heavily involved in the restructuring of the college.

Before coming to U of G, he spent 21 years at the University of Manchester, first as a faculty member in the botany department and then as dean of research in the largest unified school of biological sciences in the United Kingdom.

## The BetterPlanet Project



## Tiny Songbird Makes Big Journey

**T**HE NEXT TIME your kids ask, “Are we there yet,” tell them about the northern wheatear. The tiny songbird, weighing less than two tablespoons of salt, flies from the Arctic region of the Western Hemisphere all the way to sub-Saharan Africa and back, according to a new study including integrative biology professor Ryan Norris.

“They are incredible migratory journeys, particularly for a bird this size,” says Norris of the Alaskan migratory songbird that travels some 29,000 km across ocean and desert. “Think of something smaller than a robin but a little larger than a finch raising young in the Arctic tundra and then a few months later foraging for food in Africa for the winter.”

Previously, songbird migration was difficult to study because geo-locators were too big or heavy to attach to such small birds. New smaller devices now allow scientists to track flights over several months and over long distances. Scaled for body size, the wheatear flies one of the longest round-trip migratory journeys of any bird in the world. The study was published online in *Biology Letters*.



Northern wheatear

# Amoebas Help Detect Disease



John McLean

**I**T SOUNDS LIKE SOMETHING from a horror movie: a blob that engulfs its prey with slime. But there’s no need to panic – this blob is just a single-celled organism, and it can help detect disease outbreaks before they start.

Researchers in the Department of Molecular and Cellular Biology are using amoebas as a disease detection tool. Amoebas feed on bacteria, fungi and viruses, but some of these disease-causing organisms can survive within the amoebas after being eaten.

“Can we use the presence of this amoeba as an indicator of what pathogens are present in the environment?” asks master’s student John McLean, who is working with Prof. Lucy Mutharia to answer that question.

Disease outbreaks often strike without warning. That’s because pathogens can live a sheltered life within amoebas until

the time is right for them to emerge and cause an outbreak. When environmental conditions are less than ideal, amoebas form a protective membrane and encase themselves within a cyst.

While living inside the amoeba, bacteria are protected from many types of disinfectants, including chlorine. “If you understand what pathogens are surviving within certain amoebas, you could potentially be able to disinfect them better,” says McLean.

The research also has human applications. The bacteria that cause Johne’s disease in cattle, for example, produce similar symptoms to Crohn’s disease in humans. “There’s a lot of research that suggests that this bacteria may be implicated in human Crohn’s disease,” says McLean. “It’s often found in people with Crohn’s disease.” Amoebas can be used to collect the bacteria from clinical samples.



# This Fish Tale Doesn't Hold Water



The mangrove rivulus can live out of water for up to two months.

**T**AKE A LOOK AROUND Patricia Wright's office, and it's obvious that she's a fish lover: various types of fish art adorn her walls, including a fish-shaped hat. The integrative biology professor speaks of her research subjects as if they were her own children: "I love these little guys," she says of the mangrove rivulus. The two-centimetre-long tropical fish can live out of water for up to two months at a time. During the dry season, the fish live in moist, rotting tree trunks.

"We're interested in how amphibious fish cope with environmental extremes and what mechanisms they have to

breathe air out of water," says Wright.

Underwater, fish use their gills to breathe, but when the mangrove rivulus finds itself on land, it shuts down its gills and breathes through its skin. Inside its gills is a feather-like structure called a lamella, which is responsible for gas exchange. If the fish finds itself out of water for a week, its gills fill with cells. When the fish returns to water, the cells disappear and the gill functions normally.

The mangrove rivulus can also lay fertilized embryos without a mate. Researchers believe that living in a harsh terrestrial environment makes it difficult

to find a mating partner, which forced the fish to develop alternative means of reproduction.

Out of 10,000 species of fish worldwide, 370 can breathe air, including the mud minnow that lives in Ontario. But why do some species of fish breathe air? The answer may lie in low water oxygen levels, also known as hypoxia.

"Fish that are challenged in a low-oxygen environment will come up to the surface and try to take advantage of richer oxygen in surface waters," says Wright. "The next step to skimming the surface is to actually gulp air."

# Greenhouse Offers Oasis in the Sky



**S**TAND OUTSIDE THE Science Complex and look up. That warm glow emanating from the greenhouse glass on the roof hints at the tropics. Yes, there's a research greenhouse called the phytotron up there, but there's more.

From climate change simulations to applied evolution studies to research meant to help feed the world, various studies are unfolding in a 13,000-square-foot suite packed with greenhouse units and growth chambers that allow researchers to run experiments under controlled conditions.

In all, about 100 researchers use the rooftop facility for projects including nitrogen in crop plants, flowering plant genetics, starch and protein metabolism, control of invasive plants, plant evolution and cold tolerance in grapes.

"We're providing the environment they need to study plants," says coordinator Michael Mucci, who joined the facility when it opened in 2005. "We can control temperature, light, humidity and carbon dioxide to whatever the researcher needs."

Take Prof. Steven Rothstein, Molecular and Cellular Biology (MCB). His studies of nitrogen use in corn and rice occupy about one-quarter of the growth chambers at one end of the facility. "We could not do our research without the phytotron," he says. "We have used it to screen rice lines for improved use of nitrogen fertilizer, which has both economic and environmental benefits."

As with most other users, he comes from CBS. About 35 research projects



Phytotron staff Tannis Slimmon and Michael Mucci

are based in the phytotron. Those involve 21 faculty labs, including 18 from two CBS departments: MCB and Integrative Biology. Another busy researcher up here is MCB professor Joe Colasanti, who uses about 10 per cent of those growth chambers to study genetics of plant flowering, especially in corn.

About half of the phytotron is occupied by 45 growth chambers, including several as big as walk-in freezers. Not that anything would freeze here. Growing rice needs a temperature of about 29 C and 70-percent humidity. "I feel like I'm in the tropics somewhere," says Mucci.

The chambers are controlled to keep

temperatures between about 10 C and 45 C. A constant roar comes from the facility's refrigeration units; normally people working here wear ear protection.

Water and fertilizer are supplied automatically; as with other variables, they're electronically controlled from the phytotron's central office.

Light in the chambers comes from a mix of fluorescent and incandescent bulbs (both are needed to provide a full range of light wavelengths for photosynthesis to occur). Energy-efficient bulbs produce light about half as intense as summer daylight – enough for plants to make themselves plenty of food.



# Bacteria Keep Us Healthy



Emily Vis

**I**F YOU HAVE A HEALTHY gastrointestinal tract, you can thank your gut bacteria for keeping things running smoothly. Researchers in the Department of Molecular and Cellular Biology are looking at ways of extending the beneficial effects of probiotic bacteria by keeping them in the gut for longer periods of time. Since probiotic bacteria pass through the body during digestion, they need to be consumed on a daily basis to keep their numbers up.

“What we’re trying to do is enhance their retention in the gut by gut biofilms found in the mucosal linings throughout the gastrointestinal tract,” says master’s student Emily Vis. She is studying the motility of probiotic bacteria, which is important in biofilm formation, as well as

the nutrients they need. Expressing certain motility genes may enhance the bacteria’s ability to form biofilms.

The health benefits of probiotic bacteria go beyond promoting regularity, says Vis. Researchers believe they displace pathogens, which may help prevent infection and various types of diarrhea, including those caused by rotavirus, traveller’s diarrhea and antibiotic-induced diarrhea. “A lot of people suffer from it because antibiotics kill all the beneficial bugs in your gut,” says Vis.

Yogurt may contain  $10^{10}$  probiotic bacteria, but depending on how long it’s been sitting in your fridge, many of the bacteria may have died by the time you eat it. The bacteria are also available as supplements.

Vis wants probiotic bacteria to stay in the body for as long as possible. “The longer the better,” she says. People with irritable bowel syndrome, she adds, need to consume trillions of probiotic bacteria per day as part of their treatment, which is inconvenient and expensive. The research could lead to a pill containing bacteria that last longer in the body.

Vis says bacteria are often misunderstood because they get media coverage only when they cause disease outbreaks and deaths. Only a small percentage of bacteria are harmful to humans. “I don’t think the beneficial bacteria are looked at as much as they should be,” she says. “Most people look at what’s bad about bacteria, but there are so many bacteria that are good for you. We’d be in a much worse place without bacteria.”

## Some Fats Are Good for You

**A** NEW HEALTH CLAIM advising consumers to replace dietary saturated fats with polyunsaturated and monounsaturated fats to reduce cholesterol has connections to the University of Guelph.

Prof. David Ma, Department of Human Health and Nutritional Sciences, was asked to serve as the scientific adviser for the application by the Vegetable Oil Industry of Canada.

The claim – three years in the making – was approved by Health Canada in late February. It’s the ninth claim to be accepted by the federal agency since the process became formal in 2003.

The claim may now be included on food labels and other packaging to communicate health benefits to Canadians.

“It is certainly not a radical health claim in any regard, but it fills an important void,” says Ma. “It provides an educational message regarding what to consume as opposed to what not to consume.”

Previous health claims approved in Canada warn consumers to lower their saturated fat intake but do not offer alternatives, he says. “This tells people to replace saturated fats with healthy monounsaturated fats and polyunsaturated such as olive, canola and soybean oil. The potential beneficial effect is the reduction of blood cholesterol.”

More than 40 per cent of Canadians have high cholesterol, which is a risk factor for heart disease.

## Get Ready for CBS AA Events

SOMETIMES YOU just know you're in for something fantastic, and this is how the year has started for the CBS Alumni Association. Our first event of the year, the CBS career and networking night was, for lack of better words, an amazing success. The evening dedicated to students and alumni coming together to talk about where a biology degree from Guelph could take them was simply inspiring.

Our alumni had a chance to mingle and network before the huge number of students in attendance took over the evening with great questions and discussions about what happens after their degree is completed. Thanks to everyone who attended and made the night so wonderful.

We're expecting this momentum to continue for the rest of the year – we certainly have a lot of great events coming up.

Our next event is an alumni favourite – our family-friendly get-together at the Royal Botanical Gardens on May 27. It is a day filled with good food, great people, a visit to the fishways and hiking, plus a chance to learn the basics of disc golf in preparation for our homecoming event in September.

Our AGM on June 16 begins at 9 a.m. If you are interested in attending either event, contact me at [abenko@uoguelph.ca](mailto:abenko@uoguelph.ca).

ANNIE BENKO

CBS ALUMNI

ADVANCEMENT MANAGER

# Prof Studies Causes of Back Pain

A BACK INJURY CAN happen in a matter of seconds, but the pain can last for months, or even years.

“A lot of people have back pain,” says Prof. Stephen Brown, Department of Human Health and Nutritional Sciences. Time often heals minor back injuries, but more serious injuries can lead to chronic pain. Spinal and abdominal muscles help prevent back injuries and play an important role in recovery during rehabilitation. These muscles also provide stability.

“The spine is very unstable,” says Brown. “If there were no muscles around the spine, the spine would essentially collapse under our own body weight.”

Brown is studying muscle structure: the bigger the muscle, the greater the force it can produce. He uses measurement tools such as laser diffraction to study sarcomeres, the basic units of muscle tissue.

Muscle fibres around the spine and abdomen are unlike those found elsewhere in the body, he adds. The abdominal wall consists of four muscles, three of which overlap. “It helps pressurize the abdominal cavity, which also transmits forces around the entire torso to stabilize the spine and prevent injury.” The back muscles are independently innervated and tightly bound together by connective tissues.

Musculoskeletal disorders are on the rise, he says, which could be due to both an increase in self-reporting and our sedentary lifestyles. Common causes of back injury include heavy lifting and twisting. “Weekend warriors” who overexert



Prof. Stephen Brown

themselves playing sports are susceptible to injury, says Brown, because they haven't prepared their back muscles during the week. The prevalence of severe back injuries may also increase with age.

So do back injuries cause muscle problems or vice versa? “I think it's a combination of both,” says Brown. “I think that dysfunctional muscles can cause back problems and back problems can certainly cause dysfunctional muscles.” People with back pain often use their muscles incorrectly to compensate for their injuries when they should really use all of their muscles in unison. “That's probably the best way to rehabilitate any back injury that involves muscles.”

# He's Rooted in Nature



David Galbraith

**D**AVID GALBRAITH WAS exposed to nature long before he learned how to walk or talk. Before he was born, his parents purchased a piece of land on the shore of Lake Huron just south of Kincardine, Ont. They built a cottage on the property the year he was born. He grew up by the lake, catching frogs and gazing at the stars. Having a father who was an amateur astronomer and a cottage neighbour who was an amateur entomologist further instilled his fascination with the natural world.

As the head of science at the Royal Botanical Gardens (RBG), Galbraith works with researchers studying 10

square kilometres of natural habitat at RBG, including wetlands and forests that are home to more than 50 at-risk species. “We are Canada’s biodiversity hotspot in terms of plant species diversity,” says Galbraith, B.Sc. ’82 and M.Sc. ’86.

Visitors of all ages enjoy exploring RBG’s trails and observing the wildlife. Seeing children interact with nature always puts a smile on his face. “There’s nothing more delightful than having a little wild bird perch on your finger,” he says. “When I get a chance to see that, it absolutely touches the heart.”

Located in Burlington, Ont., RBG offers a variety of habitats, thanks to its

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Editor: Susan Bubak  
Contributors: Lori Bona Hunt,  
Shiona Mackenzie and  
Andrew Vowles

CBS Contacts:  
Annie Benko  
Alumni Advancement Manager  
Tel: 519-824-4120, Ext. 54568  
Email: [abenko@uoguelph.ca](mailto:abenko@uoguelph.ca)

Maryam Latifpoor-Kepearoutis  
Senior Development Manager  
Tel: 519-824-4120, Ext. 53655  
Email: [mlatifpo@uoguelph.ca](mailto:mlatifpo@uoguelph.ca)

proximity to Lake Ontario, and the Carolinian and Great Lakes Laurentian forests.

As an undergrad, Galbraith was drawn to U of G’s marine biology program, having admired the work of ocean explorer Jacques Cousteau. Zoology professor Ron Brooks hired Galbraith as a summer student. He spent four weeks in Algonquin Park, where he studied the population ecology of snapping turtles, which inspired him to pursue a master’s degree in wildlife biology. After completing his PhD at Queen’s University and post-doc studies in the United Kingdom, he joined RBG in 1995.

Even as technology infiltrates our lives, nothing can replace the sights, sounds and smells of nature. “Botanical gardens play an important role in plant conservation,” says Galbraith. “They give people a concentrated exposure to nature.”