



# Career Cornerstone News

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### Inside this issue:

<i>Steering STEM Cells with Magnets</i>	1
<i>Maine's Offshore Floating Wind Turbine</i>	1
<i>New Chip Quickly Identifies Infections</i>	2
<i>Degree Profile: Atmospheric Science</i>	2
<i>Spotlight on Coops and Internships</i>	3
<i>Nature's Clues to a Better Bird Bot</i>	4
<i>Educating and Empowering Girls</i>	4



## Steering STEM Cells with Magnets



Magnets could be a tool for directing stem cells' healing powers to treat conditions such as heart disease or vascular disease. By feeding stem cells tiny particles made of magnetized iron oxide, scientists at Emory and Georgia Tech can then use magnets to attract the cells to a particular location in a mouse's body after intravenous injection. The type of cells used in the study, mesenchymal stem cells,

are capable of becoming bone, fat and cartilage cells, but not other types of cell such as muscle or brain. They secrete a variety of nourishing and anti-inflammatory factors, which could make them valuable tools for treating conditions such as cardiovascular disease or autoimmune disorders.

Magnetized iron oxide nanoparticles are already FDA-approved for diagnostic purposes with MRI (magnetic resonance imaging). Other scientists have tried to load stem cells with similar particles,

but found that the coating on the particles was toxic or changed the cells' properties. The nanoparticles used in this study have a polyethylene glycol coating that protects the cell from damage. Another unique feature is that the Emory/Tech team used a magnetic field to push the particles into the cells, rather than chemical agents used previously.

The particles are coated with the nontoxic polymer polyethylene glycol, and have an iron oxide core that is about 15 nanometers across.

Find out more about science and engineering careers at [www.careercornerstone.org](http://www.careercornerstone.org).

## Maine's Offshore Floating Wind Turbine

The University of Maine's Advanced Structures and Composite Center recently connected the VoltturnUS 1:8 offshore wind turbine to the electrical grid. VoltturnUS is the first grid-connected offshore wind turbine in North America. The technology is the culmination of more than five years of collaborative research and development conducted by the University of Maine-led DeepCwind Consortium. The 65-foot-tall turbine prototype is 1:8th the scale of a 6-

megawatt (MW), 423-foot rotor diameter design. It is the first floating turbine of its kind in the world. The unique floating hull design was made using advanced material systems.

Following this test deployment, the next step for the team is to build two 6 MW VoltturnUS floating turbines to be moored off Maine's Monhegan Island in 2016. Design for these giant

turbines is currently underway, funded in part through a DOE competition called the Advanced Technology Demonstration Program for Offshore Wind.



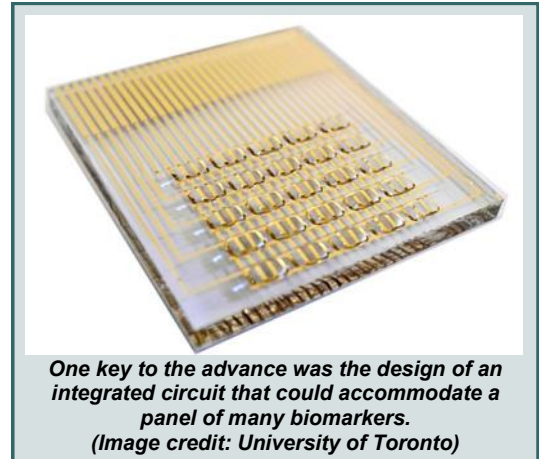
(Image Credit: University of Maine)

## New Chip Quickly Identifies Infections

A University of Toronto team – including researchers from Electrical and Computer Engineering and the Institute of Biomaterials & Biomedical Engineering – has created an electronic chip that can analyze blood and other clinical samples for infectious bacteria with record-breaking speed. Life-threatening bacterial infections cause tens of thousands of deaths every year in North America but current methods of culturing bacteria in the lab can take days to report the specific source of the infection, and even longer to pinpoint the right antibiotic that will clear the infection. The new technology, can

identify the pathogen in a matter of minutes, and looks for many different bacteria and drug resistance markers in parallel, allowing rapid and specific identification of infectious agents.

The researchers developed an integrated circuit that could detect bacteria at concentrations found in patients presenting with a urinary tract infection. Overuse of antibiotics is driving the continued emergence of drug-resistant bacteria,” said Shana Kelley (Pharmacy and Biochemistry), a senior author of



*One key to the advance was the design of an integrated circuit that could accommodate a panel of many biomarkers. (Image credit: University of Toronto)*

the study. “A chief reason for use of ineffective or inappropriate antibiotics is the lack of a technology that rapidly offers physicians detailed information about the specific cause of the infection.”

## Degree Profile: Atmospheric Science

Atmospheric science is the study of the atmosphere. Atmospheric scientists, commonly called meteorologists, study the atmosphere's physical characteristics, motions, and processes, and the way in which these factors affect the rest of our environment. The best known application of this knowledge is forecasting the weather. In addition to predicting the weather, atmospheric scientists attempt to identify and interpret climate trends, understand past weather, and analyze today's weather. Weather information and meteorological research are also applied in air-pollution control, agriculture, forestry, air and sea transportation, defense, and the study of possible trends in the Earth's climate, such as global warming, droughts, and ozone

depletion. Atmospheric scientists who forecast the weather are known as operational meteorologists; they are the largest group of specialists. These scientists study the Earth's air pressure, temperature, humidity, and wind velocity, and they apply physical and mathematical relationships to make short-range and long-range weather forecasts. Their data come from weather satellites, radars, sensors, and stations in many parts of the world. Some atmospheric scientists work exclusively in research.

According to the U.S. Bureau of Labor Statistics, the median annual earnings of atmospheric scientists is about \$81,290. The middle 50 percent earned between \$55,140 and \$101,340.



Atmospheric scientists hold about 9,400 jobs in the United States. The Federal Government is the largest single employer of civilian meteorologists, accounting for about 34 percent. Others work for professional, scientific, and technical services firms, including private weather consulting services; radio and TV stations; air carriers; and state governments.

Find out more about a career as an atmospheric scientist at [www.careercornerstone.org](http://www.careercornerstone.org).

## Spotlight on Coops and Internships

Internships and Cooperative Education (Coops) provide students with a great opportunity to gain real-world experience while still in school. In addition to giving students direct experience in the field they are considering, interaction with others in the field can help provide perspective on career path options.

According to a recent survey by the National Association of Colleges and Employers (NACE), nearly two-thirds of graduating seniors from the Class of 2013 took part in an internship or a cooperative education assignment during their years pursuing a bachelor's degree. Since employers report that the main focus of both their experiential education programs is to recruit entry-level college hires, it's not surprising they say that their interns and co-ops spend most of their work time on meaningful tasks. Overall, employers say that their interns/co-ops spend just 1.9 percent of their time working on non-essential business functions. In

addition, 57.9 percent of their work time is spent on a combination of analytical or problem solving (35.9 percent) and/or project management (22 percent) tasks. The rest of the time is spent on communications (19.1 percent), logistics (12.2 percent), and administrative or clerical tasks (8.9 percent).

NACE also predicts that the number of internships is expected to increase by 2.7 percent in 2013. The rate at which employers made full-time offers to their co-op students rose dramatically by 10 percent this year, increasing from 38.8 percent to 48.8 percent. NACE also reports that just over 80 percent of respondents have plans to offer some type of benefits to their interns, with almost three



*Coops and internships provide students with hands on experiences in their field of study. Often these experiences lead to job offers and also frequently are paid with some benefits. Most importantly they provide a chance to experience what it is like to work in the field, and will help a student make better career and employment choices post graduation.*

quarters having plans to offer benefits to co-ops. The most popular benefits continue to be the least expensive, with planned social activities, paid holidays, and recognition for work service time topping the lists.

The Career Cornerstone Center provides guidance and more details about co-op and internship programs at [www.careercornerstone.org/coopsint.htm](http://www.careercornerstone.org/coopsint.htm).

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## Nature's Clues to a Better Bird Bot

"The best way to prevent a small drone from spying on you in your office is to turn on the air-conditioning," says David Lentink, an assistant professor of mechanical engineering at Stanford University. That little blast of air, he explained, creates enough turbulence to knock a hand-size UAV off balance, and possibly send it crashing to the floor. A pigeon, on the other hand, can swoop down busy city streets, navigate around pedestrians, sign posts and other birds, keep its path in all sorts of windy conditions, and deftly land on the tiniest of hard-to-reach perches. "Wouldn't it be remarkable if a robot could do that?" Lentink wondered.

If robots are to become a bigger presence in urban environments, they will need to. In order to build a robot that can fly as nimbly as a bird, Lentink began looking to nature. Using an ultra-high-speed Phantom camera that can shoot upwards of 3,300 frames per second at full resolution, and an amazing 650,000 at a tiny resolution, Lentink can visualize the biomechanical wonders of bird flight on an incredibly fine scale.

Hummingbirds, often spotted darting from flower to flower on the Stanford campus, beat their wings about 50 times per second, nothing but a green blur to human eyes. But Stanford students Andreas Peña Doll and Rivers Ingersoll filmed the birds performing a never-before-seen "shaking" behavior: As the bird dived off a branch, it wiggled and twisted its body along its spine, the same way a wet dog would try to dry off. At 55 times per second, hummingbirds have the fastest body shake among vertebrates on the planet – almost twice as fast as a mouse. The shake lasted only a fraction of a second, and would never have been seen without the aid of the high-speed video.

Search-and-rescue is one of the more attractive applications for robotic planes, particularly scanning a wide urban area for survivors after a natural disaster. The unpredictable environment will demand robots that can better deal with changing conditions. Mini-



*Students use a special high-speed camera to discover new, never-before-seen intricacies of flight and slow motion video to analyze flight parameters for future applications. (Image Credit: Stanford University)*

copters and planes often stall at steep angles, or when they get caught in a gust of wind. They have difficulty avoiding other airborne objects, and fly clumsily near buildings. Lentink and his students have already begun applying the lessons they've learned from birds to various robotic designs.

"Hummingbirds are amazing at hovering, but it's not a very efficient form of flight," said Waylon Chen, a graduate student in Lentink's lab. "A swift flies a lot, so it has a very efficient wing platform, but its legs are too short to land. As we lay out the goal of our robotic design, we can pick and choose which natural mechanisms will be useful, and incorporate only those."

## Educating and Empowering Girls

Produced with support from the Ford Foundation, a new film, "Girl Rising," tells the stories of nine girls from nine different countries who share a determination to attend school and improve their lives. From their homes in Afghanistan, Cambodia, Egypt, Ethiopia, Haiti, India, Nepal, Peru and Sierra Leone, the girls confront obstacles that limit their opportunity and restrict their potential, including early marriage, gender violence and discrimination, and lack of access to healthcare. Amid these challenges, the girls pursue education as a means to improve not only their own lives, but the lives of their communities and the world at large. The girls' stories were adapted for the screen by distinguished writers from each of the nine countries. More details are at <http://girlrising.com>.

