

RESEARCH • INNOVATION • ENTERPRISE

ORNITHOLOGY

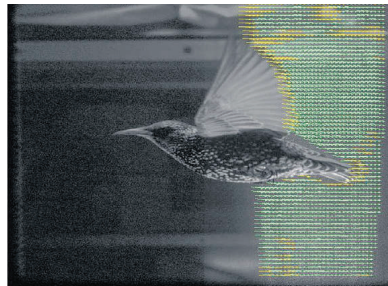
Taking flight, bird studies offer far-reaching insights

Even for a Canadian, the northern wheatear is well travelled. As the songbird with the longest migration in the world, the tiny species flies some 30,000 kilometres twice a year between its breeding grounds in Canada's Arctic and its wintering territory in sub-Saharan Africa.

Soon we may know the exact route it takes, as well as the effects of the changing climate, development and pollution on its flight. Fitted with radio transmitters on tiny harnesses, such birds will be tracked from space as part of a "transformative" effort to learn more about declining bird populations, says Christopher Guglielmo, a biology professor and co-director of the Advanced Facility for Avian Research (AFAR) at Western University in London, Ont.

AFAR, a \$9.2-million facility opened in 2009, jointly financed by the Canada Foundation for Innovation (CFI) and the Ontario Research Fund, is used by the university's biology, psychology and engineering faculties to study subjects like bird behaviour, biomechanics, physiology and aerodynamic-

Next year, a new \$3.4-million project will allow scientists to move into the natural environment, tracking even the smallest birds, such as thrushes, using digital telemetry arrays in Ontario and Atlantic Canada.



Birds in flight are the objects of study in the hypobaric climatic wind tunnel at Western University. SUPPLIED

ics. It includes the world's first hypobaric climatic wind tunnel, where researchers study birds in flight in different wind, temperature, light, pressure and humidity conditions.

Next year AFAR Takes Flight, a new \$3.4-million project supported by the CFI in partnership with

the University of Guelph and Acadia University, will allow scientists to move into the natural environment, tracking even the smallest birds, such as thrushes, using digital telemetry arrays in Ontario and Atlantic Canada. On a global scale, the birds will be followed by a network of low-

orbit satellites and the International Space Station, when AFAR teams up in 2015 with the Max Planck Institute for Ornithology in Germany in its International Cooperation for Animal Research Using Space (ICARUS) initiative.

Dr. Guglielmo notes that ICARUS could help explain the sharp drop in the numbers of grassland birds such as bobolinks, aerial insectivores such as swallows and shorebirds like the red knot, which breeds in the High Arctic and winters in Patagonia.

Some 80 per cent of bird deaths can occur during such migrations, he notes. "It's not enough to document the trends, we have to go into the field to try to understand the mechanisms."

Birds have long been harbingers of compromised ecosystems, from canaries once used to test the air in coal mines to peregrine falcons that taught us the dangers of DDT. But they have also proven valuable in studying other areas, such as brain networks, Dr. Guglielmo says, where they act as useful models for memory and language learning in humans.

FOOD SECURITY

Diagnosing bees in search for answers to collapsing colonies

Honey bee colonies are dying around the planet, with bees from one-third of all colonies disappearing each year since the Colony Collapse Disorder appeared in 2006. "Annual colony losses of 30 per cent to 40 per cent are now routine globally, and can go as high as 100 per cent," says bee biologist Mark Winston, author of *Biology of the Honey Bee*.

The loss of these essential pollinators is potentially devastating to the world's food supply, so accurately mapping and analyzing bee health is critical. The National Bee Diagnostic Centre (NBDC) in northern Alberta, launched by the Grande Prairie Regional College Centre for Research and Innova-

"As a national centre, we've started to get a larger picture of the disease presence in Canada, which will enable industry to make informed decisions and help beekeepers better manage their colonies."

Dr. Bruce Rutley
National Bee Diagnostic Centre



Researchers at the National Bee Diagnostic Centre at Grande Prairie Regional College are trying to find out what is harming bee colonies. SUPPLIED

tion in September 2012, aims to do just that.

While much research has been aimed at identifying a single cause, the most recent and comprehensive research points to systemic harm: "1,000 little cuts"

such as mono-crop agriculture, which reduces nutrient diversity and pesticides that, while thought to be harmless in minute exposures, make bees more vulnerable to viruses and mites, says Dr. Winston.

"There are three different categories of suspect causes: biological, chemical and nutritional," says Bruce Rutley, director of the NBDC. "We're focusing on identifying the biological causes — we have the only laboratory in Canada specializing in bee diagnoses."

Beekeepers across the country send samples of their stock to the lab, which detects the presence or absence of numerous pest pathogens or parasites.

"As a national centre, we've started to get a larger picture of the disease presence in Canada, which will enable industry to make informed decisions and help beekeepers better manage their colonies," says Dr. Rutley.

THIS CHANGES INDUSTRY.

Our commitment to research, innovation and technology set in motion 10 years ago has made SAIT Polytechnic Canada's number one research college today.

SAIT is setting new standards in applied research and innovation. Take, for example, the laser induced breakdown spectrometer, LIBS. One of the first in Canada, this technology precisely blasts a tiny piece of solid material to provide instant composition analysis.

For our industry partners LIBS means access to new approaches that boost productivity and profit. For our students this means leading-edge learning opportunities.

SAIT is proud to be named Canada's Top Research College for 2013.



THIS CHANGES EVERYTHING.
SAIT.ca

Engineering
a better tomorrow

Electrical and computer engineering researchers at the University of Alberta are leaders in fields as diverse as communications, health, energy and the environment, enabled through state-of-the-art micro and nanotechnology facilities at the U of A nanoFAB, an open-access cleanroom environment for micro/nano fabrication and characterization.

Collaborating with industry, government and academics around the world, and supported by funding agencies including the Canada Foundation for Innovation, our researchers address some of society's most pressing challenges.

Roger Zemp is exploring Micro-Electromechanical Systems (MEMS) ultrasound transducers to develop medical imaging technology that will provide doctors with more precise patient diagnoses.

Mahdi Tavakoli's leading-edge work on telerobotics for surgical and therapeutic applications could enable physiotherapists or surgeons to provide direct care to patients in remote locations.

Karthik Shankar is exploring innovative ways to reduce greenhouse gasses through the use of nanostructured semiconductor for solar cells and photocatalytic reduction of CO₂ gas.

Ashwin Iyer is engineering the properties of metamaterials—artificial materials designed to have novel electromagnetic properties. Applications for metamaterials cross many fields, including medical imaging, sensing and wireless communications.

Yasser Mohamed's research into smart grids is vital to ensuring the continued stability and flexibility of our electrical power grid systems as they absorb the growth of renewable energy sources.

www.engineering.ualberta.ca
www.nanofab.ualberta.ca



FACULTY OF
ENGINEERING



UNIVERSITY OF
ALBERTA



nanofab

University of Alberta
Department of
Electrical and Computer
Engineering professors
Karthik Shankar,
Roger Zemp, Ashwin
Iyer and Mahdi Tavakoli
are at the forefront of
research, developing new
technologies to improve
our quality of life.