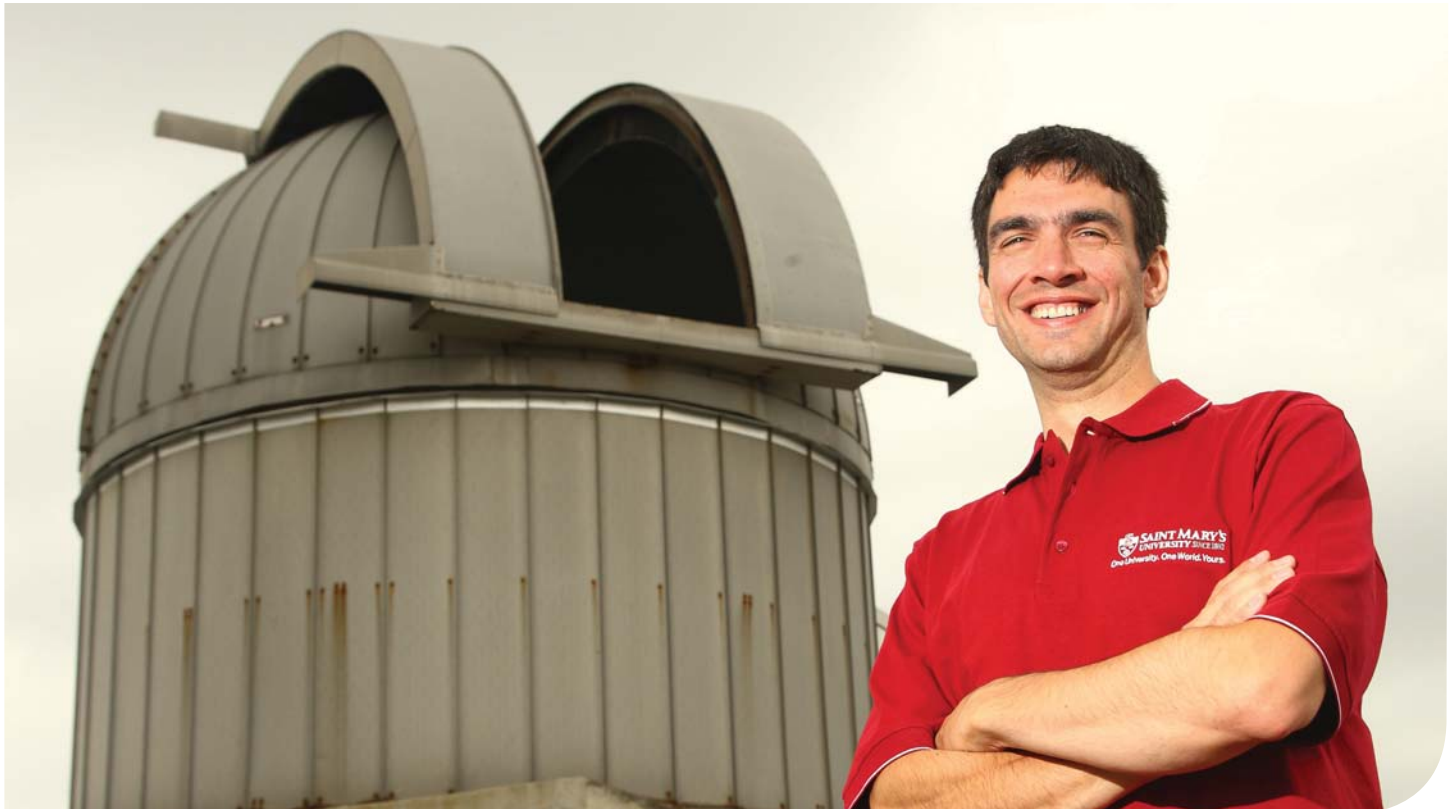


# SEEK

## SCIENCE AT SAINT MARY'S

FALL 2011

STRAWBERRY FIELDS | STUMP DWELLERS | DNA DETECTIVES | CHARLIE SHEEN | NO CAN DO | GOOD VIBRATIONS | BUZZ IN BIOLOGY | MR. BIG



## Looking For Good Vibrations in Outer Space

When Dr. Luigi Gallo gazes out into the night sky the 38-year-old Saint Mary's astrophysicist is looking for what's not there.

As a teacher and researcher with the Canadian, Japanese, and European Space Agencies, Dr. Gallo has been studying giant, matter-devouring black holes since 2002. Celestial enigmas most often formed in the wake of a collapsed star, black holes may be millions of times larger than our sun, but they are only detectable by studying the material that they suck from the space around them.



One University. One World. Yours.

Dr. Gallo's research effort was ramped up in recent months when he was named to lead a team of Canadian scientists working on a half-billion dollar, Japanese-led space mission charged with launching a powerful X-Ray telescope by 2014. Unlike the Hubble Space Telescope that gathers optical light, Astro-H will observe X-rays that are emitted by high-energy objects like black holes and supernovae.

The role of the Canadian team led by Dr. Gallo is to create a system that monitors vibrations of the satellite as it moves through space, and to provide astronomers with information to collect crisp, clear images free of distortion and blurring.

As a member of the science working group, Gallo will have priority access to the data, giving

his graduate students unprecedented opportunities to be some of the first astronomers in history to study black holes with the new, high-precision instruments and telescopes onboard Astro-H.

"It's a really awesome way to train future space scientists," says Dr. Gallo. "The possibilities of what we could learn from this satellite are incredible. Not only will we be viewing certain characteristics of black holes for the first time, but we will also be seeing them with a degree of accuracy and precision unparalleled in space telescope history."

Note: Saint Mary's University is home to the only astrophysics undergraduate and graduate/Ph.D. programs east of Quebec City.



*Dr. Andrew MacRae assembles a section of petrified stump*

## Return of the Stump Dwellers

As the repository for 300 million year-old land-dwelling life forms, the famous fossil cliffs at Joggins have fascinated paleontologists and geologists for almost two centuries. Just when it seemed that there was nothing left to discover, the site has yielded an exciting secret to a team of intrepid researchers from Saint Mary's University: the bones of tiny lizard-like animals that lived and died in rotting stumps.

The discovery itself is not really new. In the 1800's scientists documented the discovery of tiny bones of early reptiles and other vertebrates in tree stumps. But there have been very few bone-bearing stumps recovered in the last century, and until very recently, the only way to test for the presence of these microscopic bones was to destroy the stumps.

Now, thanks to experiments with staff at the Victoria General Hospital, Saint Mary's researchers

are using CT scans to visualize in 3D how the bone is distributed in the stump material. "Initial results have been promising," says Saint Mary's geologist Dr. Andrew MacRae. "This exciting work provides a window into how these creatures were preserved. They may not look that unusual, but they're the closest link we have to the ancestry of all modern reptiles, birds and mammals, which makes them pretty important creatures to understand."

## DNA Detectives Hot on the Trail

Whether it's catching a killer or saving a whale, Saint Mary's new genetic profiling and analysis facility will benefit Nova Scotia in many ways.

"Our new DNA sequencing equipment has countless applications," says Dr. Tim Frasier, a Saint Mary's Biology professor and a specialist in the protection of marine mammals. In addition to his work using genetic analysis to learn more about ecology, conservation and marine mammal behaviour, Dr. Frasier has a keen interest in the use of genetic data in forensic cases and says that DNA typing is changing forensics as a whole.

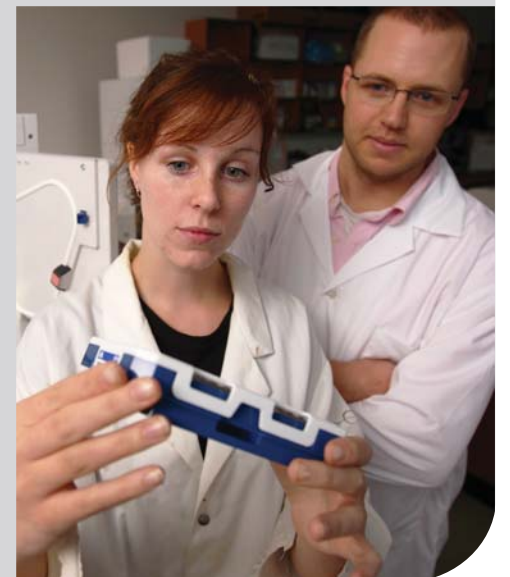
For now, however, most of the researchers in the new Frasier Lab at Saint Mary's use genetic analysis to study wildlife populations and better understand their biology in order to discover why some endangered marine mammal species are not recovering.

One of the saddest examples is the North Atlantic Right Whale, which remains critically endangered, despite 70 years of international protection. The hope is that research at Saint Mary's will identify the role played by genetic factors in this tragic situation.

Saint Mary's new DNA equipment will also shed light on other aspects of animal biology, including population structure, social structure, reproductive success, and mating patterns.

Whether it's used to save a species, protect the planet or catch a bad guy, genetic analysis is a cutting edge tool.

*Dr. Tim Frasier with student*



## When Chemistry Meets Conservation

When a heritage group was trying to put together a future restoration plan for a historic building in downtown Halifax, it turned to a Saint Mary's University chemist for help.

Dr. Christa Brosseau has been blending science and art since 2007 so she readily agreed to a chemical analysis of the Morris House. Using surface-enhanced Raman spectroscopy (SERS), a technique she learned when she was a post-doctoral fellow at Northwestern University in Illinois, Brosseau analyzed small samples of paint and wallpaper in the Morris House.

"We found a quite heavy presence of lead-based paints which isn't surprising considering the house was built in the 1760s," says Dr. Brosseau. "As well, there was an early form of wallpaper in the attic which dated to about the 1850s. It was a very primitive way of making wallpaper by using a simple roller printing process. The green in the four-leaf clover pattern turned out to be chrome green which is an early green pigment consistent with that time period."

Analysing the Morris House was a collaborative effort that involved art conservator Elizabeth Jablonski, Dr. Brosseau's research assistants Scott Harroun and Joel Bergman, the Ecology Action Centre and the Heritage Trust of Nova Scotia. Dr. Brosseau has a history of involvement in collaborative projects that include working with the Art Institute of Chicago to analyze such items as a burial cloth from Peru, a pastel sketch by Mary Cassatt and a watercolour by Winslow Homer. As she explains, chemistry can aid art conservation in many ways—from identifying materials used in an artwork and explaining why colours may have faded, to helping develop new restoration methods.

"Sometimes we're just curious about what exactly is in a painting so we can preserve it for future generations," Dr. Brosseau says. "Sometimes we're interested in being able to authenticate an artwork or contribute to the provenance or the historical record of the object." As far as she knows, Dr. Brosseau is the only person in Canada currently using SERS to analyze art objects. But she's likely not the last.

Conservation projects capture the mind, she says. "There's just such fascination for the future chemists of the world in this kind of a project."

## Strawberry Fields Unearthed

Strawberry Fields may be forever, but a Saint Mary's math professor has recently applied the tools of his trade to change our understanding of the way the song was recorded. And suddenly, it all adds up!

"We've known for some time that in Strawberry Fields the tempo and pitch changes slowly," says Dr. Robert Dawson. Dr. Dawson worked with his colleague, Dr. Jason Brown at Dalhousie University to unearth the creative solution applied by Beatles' producer George Martin when it turned out that John Lennon's two favourite takes of the song were recorded at two different tempos and in two different keys.

"These days there is inexpensive software that makes it possible to change the speed of a recording without changing the pitch," explains Dr. Dawson.

With no such tools available when this song was recorded in 1966, George Martin produced it in the approximate key of B-flat major, manipulating

the recording speed in a ground-breaking editing feature that fused together the two disparate tracks. The result is a recording hailed by Rolling Stone Magazine as one of the 500 greatest songs of all time.

"In one minute the first part of the song rises by a semi-tone," says Dr. Dawson. "Only someone with perfect pitch would notice."

Despite the fact that he plays the recorder and the EWI, an electronic wind instrument that can mimic a saxophone, Dr. Dawson does not have perfect pitch, but he does have a keen interest in the way that music works, so he dug deep into Strawberry Fields to derive a mathematical formula that represents George Martin's musical intervention.

"There's a lot of math involved in music," says Dr. Dawson, who teaches one lesson in differential equations by having his students at Saint Mary's examine the discrepancy in the sounds produced by a clarinet and a flute.



## Science Awards Received since Fall 2010

Every year, our Faculty of Science receives a significant amount of funding and a slew of awards that acknowledge innovative research and exceptional teaching skills. Here are a few of the top awards received this year:

- Environmental Studies professor Dr. Jeremy Lundholm was honoured with the prestigious "Research Award of Excellence" from the North American Green Roof Industry Association. Dr. Lundholm spearheads research at the Green Roof Testing Facility at Saint Mary's where he studies plant community composition and diversity effects.
- Dr. Georgia Pe-Piper of the Geology Department at Saint Mary's received the 2011 Career Achievement Award of the Volcanology and Igneous Petrology (VIP) Division of the Geological Association of Canada (GAC). She was chosen in recognition of her outstanding accomplishments in the field of volcanology and igneous petrology.

- Dr. Rituparna Kanungo (Astronomy & Physics) has received \$105,000 per year from the NSERC Subatomic Physics Program. Dr. Kanungo also received this year's NSERC-DAS Award which is valued at \$40,000/per year for 3 years.
- Dr. Robert Singer was awarded the NSERC Biomaterials and Chemicals Strategic Research Network for \$5,300,000 from 2010-2015 as a Co-investigator with 14 other researchers.
- Chemistry professor, Dr. Jason Clyburne has received \$119,000 from the Natural Sciences and Engineering Research Council of Canada (NSERC) to look at ways to safely remove carbon dioxide (CO<sub>2</sub>) from industrial emissions. This award matches funds Dr. Clyburne received last year from EnCana Corporation. The new funds will help develop a working ionic liquids prototype to see if the work in the lab can function commercially in the field.
- Geology professor, Dr. Jacob Hanley has been

awarded the prestigious William Harvey Gross medal from the Geological Association of Canada. The award is bestowed annually by the Mineral Deposits Division (MDD) to a geoscientist under 40 years old who has made a significant contribution to the field of economic geology in Canada.

- Dr. Cathy Conrad and her team of researchers and partners have been awarded a five-year Community University Research Alliance (CURA) grant of \$994,831 for CURA H2O, research into community-based integrated water monitoring and management in Nova Scotia.
- In January 2011, a project lead by Dr. Christa Brosseau received \$64,358 from The Canada Foundation for Innovation (CFI) to support a research project that may create a better understanding of degenerative diseases such as Alzheimer's and Parkinson's.

## Bug Creates a Buzz in Biology

The next time there's controversy naming the new family pet, consider Saint Mary's University Biologist, Dr. Doug Strongman, a Taxonomist who had to think of a suitable name when he discovered a new genus and species of fungus in the hindgut of a juvenile mayfly.

Turns out it's tougher to name a new fungus than a Pug puppy, even for Doug Strongman, one of about ten people in the world who study fungi found in aquatic insects.

The first hurdle is coming up with an appropriate name for something so small. "When I name a new fungus I try to convey something about the character of the beast," says Dr. Strongman. "This can be hard, particularly with microscopic things that all look very similar."

It's against the rules to use the same name twice, so the next challenge is finding a name that has never been used before. "I'm running out of ideas," admits Dr. Strongman, who has discovered and

named 35 of the world's 350 species of one type of fungus.

Two of these discoveries were made a few years ago in Halifax's Blue Mountain-Birch Cove Lakes Wilderness Area during a Saint Mary's University Bioblitz, a race against the clock in which teams of scientists and students have one day to locate and identify as many species of birds, reptiles, plants, insects and mammals as they can find.

During the event, which Dr. Strongman describes as "a 24-hour taxonomic extravaganza," he identified and named *Trifoliellum bioblitzii* – or *T. bioblitzii* as it is known to its friends – a new genus and species which gets its moniker in part for unique, asexual spores and also in part for its discovery at the Saint Mary's Bioblitz.

Despite the intricacies of naming a new discovery, Doug Strongman is fueled by the sheer excitement of seeing something in nature that no one has seen

before – even something as inconspicuous as a fungus.

"This is a real buzz," he says. As well, he wants to promote the importance of biodiversity in maintaining healthy ecosystems. "As humans we like to know what other organisms we share our environment with," Dr. Strongman says. "But also it's important to know what's around us and what it's doing. If we disrupt the natural world around us all kinds of bad things can happen."



## Engineering Students Put a New Spin on Beer Cans

The originality of their prototype design earned a team of Saint Mary's senior engineering students second place in this year's Atlantic Engineering Competition in Moncton.

In a 12-hour, timed task, team members John Anderson, Joel McCully and Andrey Kostylev put their theoretical knowledge to practice by creating a device that gathers beer cans from the

bottom of a swimming pool.

Following completion of the task, the team prepared a written report and made a formal presentation that was judged by a panel of professional engineers.

Other participants in the competition included Dalhousie University, University of New Brunswick, Cape Breton University, University of PEI,

Université de Moncton and Acadia.

Saint Mary's offers a 2-year Diploma of Engineering as part of the Dalhousie Associated University Engineering System. Students who complete the diploma gain automatic entrance to Dalhousie University where they finish their Engineering degrees.

## The Charlie Sheen Appeal

Maryanne Fisher isn't a big Charlie Sheen fan, so the Saint Mary's Psychology professor was as surprised as anyone else when CBS picked up a comment she made about Sheen on the blog she writes for Psychology Today.

In explaining why we love to hate Charlie Sheen, Fisher commented that people like to hear about the misfortune of others--- or in her words, "to see tall poppies fall."

An expert in popular culture, Dr. Fisher is currently working on two books, one about the role of women in human evolution and another on how women compete for men, a topic that grew out of her dissertation.

Last year, she wrote *The Complete Idiot's Guide to the Chemistry of Love*, taking hard, complex chemistry and boiling it down to create an appetizing brew. In fact, it was her very readable research into romance novels and hormones that netted her the blogging spot for Psychology Today.



## The Citizen Behind Citizen Science

At first glance the WET-PRO field kit looks like a giant first-aid kit—a rugged suitcase packed with equipment such as a digital weather station, a GPS, turbidity monitor, sample bottles, field testers, and a pH pen. A removable accordion bag contains a more basic kit that is easier to carry to remote lakes and watersheds.

"It's got everything that a professional scientist would need to conduct accurate water tests," says Saint Mary's Geography professor, Cathy Conrad, who developed the WET-PRO field kit. Dr. Conrad hopes that one day it will become the world standard for water quality monitoring, "but it's also very easy to learn to how to use."

Once the kit passes through prototype testing, it will have a big market in emerging nations in Africa and elsewhere where clean water is a major health issue.

"Our first goal is to make sure it works really well in Nova Scotia, and then we'll see if we can make it work in other parts of the world," says Dr. Conrad.

She's getting marketing support from the Saint Mary's University Industry Liaison Office, and from other sources such as Environment Canada and Fisheries and Oceans Canada. The Nova Scotia Department of the Environment has also expressed an interest.

Dan Hutt, a scientist with Defence Research & Development Canada (DRDC), believes that empowering an army of citizen scientists with the WET-PRO system will have a dramatic effect on environmental science around the world.

"It's part of a new way of doing environmental science," he says. "It's like predicting the weather. If you have a lot of data, you have a much better picture of what's going on. It's a big planet."



## Introducing Mr. Big

Saint Mary's psychology professor, Dr. Steven Smith was Mr. Big with the media when reporters following a high-profile murder case asked him about the "Mr. Big" technique that is sometimes used by police to extract confessions.

In a Mr. Big sting, undercover police investigators pose as members of a criminal gang in order to lure people suspected of a serious crime into a world of fake crime. The undercover officers pay the suspects for minor jobs like money counting, promise them more work and tell them that the crime boss — the so-called Mr. Big — can make any case against them disappear if they reveal all the details and re-enact the crime.

According to Dr. Smith, one of the few psychology researchers who has studied the Mr. Big technique, 95 per cent of those targeted by Mr. Big stings are convicted because they do just that.

"It's not a big step to go from confessing to the crime to re-enacting," says Dr. Smith. "Once you're over that hump of actually confessing, it's really a small step to re-enact."

Smith says that in 2004, the RCMP used the Mr. Big technique 350 times across Canada. One of the most recent examples was the



high-profile murder of a young Nova Scotia girl. Her mother pleaded guilty after giving details of the crime to police officers posing as organized crime bosses.

Although it seems impossible that anyone could fall for such a trick, Dr. Smith explains that people who harbour secrets are often looking for a way out. "People implicated in police stings are often in desperate situations," he says. "They want to believe that they have a friend---and not only a friend, but a way out."

The Mr. Big technique is legal, but Smith believes there should be significant physical evidence of a crime before using it because of the psychological pressure to embellish a crime during a sting.

"We know that the Mr. Big technique puts a lot more pressure on a person than a typical police interview would," he says, "so the likelihood of a false confession has got to be higher."

## Mark Hornsby: His Research Took Flight



*Mark Hornsby checks health of a starling chick*

There will be no more peering through binoculars at nest boxes for Mark Hornsby. And no more weighing and banding of baby birds. The Biology grad is off to Queen's University in Ontario where his Masters work will focus on the impact of sunlight on fish habitat and reproduction.

"Working with fish will not be the same as working with birds," says Hornsby, who spent two summers monitoring starlings in the 45 nest boxes erected around the Saint Mary's campus. "But the mentality of fieldwork and the lab dynamic that I learned here will leave me in a great position to succeed there."

In his third year at Saint Mary's, Hornsby began doing hands-on research into whether the male European starling knows the extent of nest parasites merely by looking at eggs in the nest. After two summers in the field and countless hours of lab work, he discovered that the male starling will start bringing more food to the nest when the eggs have

more spots---a symptom of parasites transferred from deposits left when the adult bird sits on them. "We want to find out what the male starling understands from these spotted eggs," says Hornsby.

As part of a research team that included his supervisor, biology professor Colleen Barber, and several other students, Hornsby set up the Saint Mary's nest boxes and began monitoring them with binoculars in the spring of 2010. As well as recording the number of parasite spots on eggs, the team weighed the starling chicks as they hatched and checked them for parasites. They also banded the male and female adults in order to tell them apart.

In addition to learning new skills and techniques, Hornsby found it both fun and fulfilling to deal with baby birds all summer. "To get the actual experience of practical research was amazing," says the 21-year-old. "It is very satisfying to create results that other people will use and build on."

## Saint Mary's Welcomes Young Scientists

The McNally Building was hopping for three days last spring as 40 bright young science students descended on the Main Auditorium. The grade 7 to 12 students were part of the Team Nova Scotia Showcase, a three-day event that gives this region's 40 science fair winners the chance to build their confidence before representing Nova Scotia in the national championship round in Toronto.

The showcase, presented by NSYES! Nova Scotia Youth Experiences in Science, featured projects that ranged from Robotics and Alternative Energy to Aromatherapy and Sound Localization.

The showcase's visitors included 200 Grade 8 students who arrived at Saint Mary's on May 8 for a full-day of science activities. Students from Cornwallis Junior High, Gorsebrook Junior High and Graham Creighton Junior High had a chance to participate in hands-on demonstrations, attend interactive presentations and check out the province's top 40 science fair projects. It was a jam-packed day of physics demonstrations, mock crime scenes, fossils and liquid nitrogen ice cream!



## The Dr. Adam Sarty Experience

Dr. Adam Sarty fights physics phobia with missionary zeal, de-mystifying the discipline by leaping from his desk to mimic weightlessness, throwing watermelons from a third storey balcony to demonstrate a point about gravity and freezing balloons to show how volume is proportional to temperature.

“Physics is neither hard nor mysterious,” says the Saint Mary’s University physics professor. “It is an extraordinary way of organizing and describing all that we see around us every day. And yes, physics is fun.”

Dr. Sarty joined Saint Mary’s in 2000 and his classes quickly became the talk of the campus. Since then, he has received more than \$1.5 million in funding to support his research and almost a dozen awards for teaching and leadership. His most recent honour is receiving a 3M National Teaching Fellowship – the highest teaching honour in Canada---based on his excellence in teaching, educational leadership, and the scholarship of teaching and learning. Across Canada, only 10 professors receive this award each year.

“I feel very honoured to be recognized in this way, and to have had so much help and support over the past decade from Saint Mary’s and my

family,” said Dr. Sarty. “This recognition reflects the importance that Saint Mary’s places on supporting teaching to ensure faculty achieve their vision of providing the best instruction for our students.”

Dr. Sarty’s deep and enduring connection with his students begins in their first year of study. While maintaining an excellent research program in nuclear physics, Sarty insists on teaching a large first year class each year.

“He inspires his students to love learning physics,” says David Gauthier, Saint Mary’s Vice President Academic and Research. “He treats his students as equal participants in the classroom and uses sophisticated, effective and fun technologies to keep students engaged, learning and coming to class.”

Thanks to social media, this engagement does not need to end with graduation. The popularity of Dr. Sarty’s style of teaching has inspired a group of former students to create a Facebook fan page entitled, “The Dr. Adam Sarty Experience.”



*Dr. Adam Sarty was recently named as one of Canada’s top 10 professors*

## Students Get New Green Degree Option

There’s no question that the environment needs help, so it’s Saint Mary’s to the rescue with a new green degree in Environmental Studies. Rooted in the social sciences, humanities and natural sciences disciplines, the new Bachelor of Environmental Studies (BES) degree is a four-year interdisciplinary program in the Faculty of Arts.

Students taking the BES degree will gain the skills needed to explore, analyze and critique many of the environmental issues facing our world. Their studies will include challenges involving the management and protection of natural resources and options for achieving sustainable socioeconomic development. A BES will prepare them for careers in a wide variety of fields, including environmental management, environmental consultancy and environmental policy analysis and development.

“We really need more people who are skilled in environmental issues and understanding

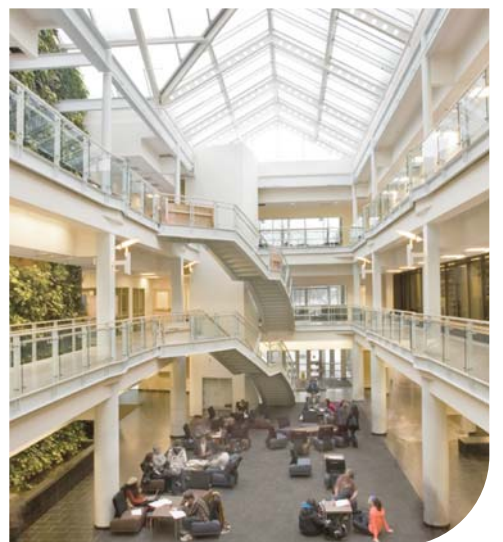
things from a multi-disciplinary perspective,” says Dr. Cathy Conrad, a Geography professor at Saint Mary’s. Dr. Conrad is pleased that the BES will allow a wider variety of students to learn about the environment. “It expands the options for students who are keen on exploring their interest in the environment, but aren’t necessarily science-oriented.”

The BES will create a better sense of identity and unity for students engaged in these areas of study. As well, The School of the Environment will include a research institute which will bring more awareness to the leading-edge environmental research taking place at Saint Mary’s.

“This is a research and learning environment that will bring visibility to the very diverse and cross-cutting work that is being done on the environment,” says Dr. Esther E. Enns, the University’s Dean of Arts.

As the first degree of its kind offered in Atlantic Canada, the BES offers Saint Mary’s students a

unique experience. Graduates of the program will even wear a different hood at convocation. A decision hasn’t been reached regarding the colour of that hood, but green would seem a logical choice.



# Why Study Science at Saint Mary's?



## Small Average Class Sizes

Because of our focus on active learning, we try to keep classes small, even for first-year courses.



## Opportunities to Learn Outside the Classroom

Field courses, internships, co-op positions and study abroad programs promote valuable, experiential learning.



## Undergraduate Research Opportunities

A rapidly growing pot of research dollars allows Saint Mary's students to get ahead by becoming involved in research early in their academic careers.



## State of the Art Facilities

With the completion of the new Atrium Building, all of our science facilities have either been built or renovated in the past five years.

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