



SCIENCE

SHAPE THE WORLD



UNIVERSITY OF ALBERTA
FACULTY OF SCIENCE

ualberta.ca/science

SCIENCE BY THE

THE UNIVERSITY OF ALBERTA FACULTY OF SCIENCE IS A RESEARCH AND TEACHING POWERHOUSE DEDICATED TO SHAPING THE FUTURE BY PUSHING THE BOUNDARIES OF KNOWLEDGE IN THE CLASSROOM, LABORATORY, AND FIELD. THROUGH EXCEPTIONAL TEACHING, LEARNING, AND RESEARCH EXPERIENCES, WE COMPETITIVELY POSITION OUR STUDENTS, STAFF, AND FACULTY FOR CURRENT AND FUTURE SUCCESS.



STUDENT SUCCESS

7

DEPARTMENTS

9

CENTRES AND
INSTITUTES

2

NETWORKS OF NATIONAL
CENTRES OF EXCELLENCE

GLYCONET AND THE CANADIAN
MOUNTAIN NETWORK

FACULTY AND FACILITIES



Tenure-track
faculty members



Canada Research
Chairs



Faculty members
named fellows of
the Royal Society
of Canada



Order of Canada
Recipients



3M National
Teaching Fellows

111

labs and facilities
enhance the learning
and research experience
of our students

1.4

kilometres of ice core samples in our Canadian Ice Core Archives, representing **more than 10,000 years** of evidence of changes to our climate. The ice core archives are complemented by our new Permafrost Archives Science Laboratory, the first of its kind in North America.

NUMBERS

>>NUMBERS FROM 2019<<

6,200
UNDERGRADUATE STUDENTS

1,200
GRADUATE STUDENTS

104

From Afghanistan to Zimbabwe, our graduate and undergraduate students represent **104 different countries**

60

Undergraduate programs in 39 subject areas

3rd

Our paleontology program is ranked 3rd in the world, according to the Center for World University Rankings.

5th

Our geology program is ranked 5th in the world, according to the Center for World University Rankings.

3rd

Our artificial intelligence and machine learning research is ranked 3rd in the world since 2000, according to metrics-based CSRankings.

APPROXIMATELY

\$5.7M

AWARDED ANNUALLY

THROUGH STUDENT SCHOLARSHIPS AND AWARDS

300

More than 300 employers recruit our undergraduate students through the Science Internship Program each year.

ENGAGEMENT

15,000

people and community members participate in our public programming each year, including summer camps, school visits, museums and collections, events, and lectures.

1.5M

learners around the world have taken our Massive Open Online Courses

ALUMNI AND DONORS

46,000+

ALUMNI WORLDWIDE

41,842 BSc graduates
6,715 MSc graduates
3,870 PhD graduates

NEARLY
3,500
Annual donors

30,000

alumni, friends, and government officials receive the Faculty of Science magazine, *Science Contours*, twice each year.

SCIENCE

A photograph of a man with a long, grey beard and a woman smiling in a laboratory. The man is on the left, wearing a blue checkered shirt. The woman is on the right, wearing a light blue lab coat. They are standing in front of shelves filled with petri dishes, some of which have colorful sticky notes attached to them. The background shows laboratory equipment and shelves.

TRANSFORMING
TOMORROW'S
FUTURE...

TO TODAY'S REALITY

RESEARCHERS IN THE FACULTY OF SCIENCE ARE LEADING THE WORLD IN DEVELOPING AND REDEFINING NOVEL SOLUTIONS TO SOCIETY'S MOST PRESSING PROBLEMS. AMONG THE BEST IN THE WORLD, OUR LABORATORIES, FACILITIES, AND FIELD LOCATIONS ARE PARAMOUNT TO OUR REPUTATION FOR EXCELLENCE, ENABLING OUR STUDENTS AND RESEARCHERS TO REMAIN AT THE FOREFRONT OF NEW DISCOVERIES AND KNOWLEDGE.

ARTIFICIAL INTELLIGENCE

With applications as diverse as enhanced medical diagnoses to disaster prediction, artificial intelligence is a continually growing area of research with the potential to transform all facets of society, and we are leading the way. Ranked third in the world since 2000 for artificial intelligence and machine learning research, according to CSRankings.org, the University of Alberta garners international attention for our boundary-pushing work in these important fields. With our partnerships and collaborations with DeepMind, the Alberta Machine Intelligence Institute (amii), and numerous financial institutions and tech companies, our scientists are researching around the clock to address some of society's most urgent needs, including smarter technologies and safer societies.

HEALTHY PEOPLE, HEALTHY PLANET

Tackling tough topics from ALS to Zika virus, and everything in between, including Alzheimer's, bovine spongiform encephalopathy, Chronic Wasting Disease, dementia, HIV, stroke, schizophrenia, tuberculosis, Parkinson's, and others, Faculty of Science researchers are addressing the human and animal planet's most pressing health problems, one disease at a time. And with personalized healthcare becoming a daily reality, the UAlberta advantage in studying the human body on a molecular level—through genomics, proteomics, metabolomics, and glycomics—is making tomorrow's future today's reality.



TED ALLISON (L) AND MICHELE DUVAL (R) ARE SEARCHING FOR TREATMENTS TO SLOW THE NEURODEGENERATIVE DECLINE CAUSED BY ALS.

BRIGHT FUTURE, SUSTAINABLE SOLUTIONS

Scaling up beyond the human body, we are fiercely focused on not only healthy people but also a healthy planet. Our economic geology professors are exploring novel and sustainable solutions in resource extraction with a commitment to the responsible characterization, extraction, and environmental monitoring of these resources. Our researchers are also honing the future of energy, with a focus on developing new technologies as well as finding solutions for the challenges presented by our legacy energy systems. With continued changes to the climate, many of our scientists are taking interdisciplinary approaches to gain a greater understanding of the causes and effects of our rapidly changing environment.

- + With **geothermal projects** led by researchers including Martyn Unsworth and Jonathan Banks, our scientists are forward focused on using extant oil and gas wells to pump hot water from under Earth's surface to create alternative power sources.
- + With a vision to creating less energy intensive solar power, scientists like Jillian Buriak and Arthur Mar are zeroing in on alternative materials in the drive to creating a **24-hour solar cell**.
- + With the goal of **reducing the carbon footprint** of oil refinement and creating useful biofuels from oil and gas production waste products, scientists including Steven Bergens and Lisa Stein are creating possibilities to not only lower the environmental footprint but also raise the usability of biofuels.

SASHA WILSON INVESTIGATES THE BALANCE BETWEEN ECONOMIC AND ENVIRONMENTAL ASPECTS OF GEOLOGY, FOCUSING ON CARBON SEQUESTRATION AND METAL RECOVERY.





UNDERSTANDING THE PAST, SHAPING THE FUTURE

University of Alberta paleontologists are world leaders when it comes to interpreting the mysterious clues left by our prehistoric past to help us better prepare for future evolution on Earth. With expertise in both vertebrate paleontology (dinosaurs, fish, lizards, snakes, birds, and more) and invertebrate paleontology (creatures that do not possess spinal chords), our scientists' daily discoveries have helped cement Alberta's global reputation for greatness in evolutionary biology. And with our ecologists examining interactions of organisms with one another and their environment, we are leading the charge on preserving biodiversity on our ever-changing planet.

REDEFINING THE CLASSROOM



THE FACULTY OF SCIENCE ASPIRES TO BE AS BOLD IN ITS APPROACH TO STUDENT SUCCESS AS IT IS IN ITS GROUNDBREAKING RESEARCH. WE HAVE AN AMBITIOUS PLAN TO ENRICH THE STUDENT EXPERIENCE AND CHALLENGE STUDENTS TO THINK BEYOND WHAT IS CURRENTLY POSSIBLE, TO PUSH BOUNDARIES. WE AIM TO INSPIRE AND EDUCATE THE NEXT GENERATION OF SCIENTISTS TO MAKE OUR SOCIETY BETTER NOT ONLY THROUGH THEIR CAREERS BUT ALSO AS GLOBAL CITIZENS.

- + We offer **more lab contact hours** in first-year undergraduate courses than any other university in Canada.
- + We offer one of the most comprehensive and extensive **undergraduate field school experiences** in Canada. Our students have unparalleled access to the most coveted field locations in the world, thanks not only to the university's physical proximity to unique learning sites, but also to the international partnerships fostered all over the globe through researcher and faculty connections.
- + In an increasingly globalized science community, **study-abroad opportunities** like our Southern African Field School not only provide our students with rich first-hand fieldwork experiences, but they also introduce students to the global science network much earlier in their careers.
- + A team of roughly 50 University of Alberta students was the first to launch Alberta into space. Fueled by a successful crowdfunding campaign, **AlbertaSat's Ex-Alta 1 satellite** orbited Earth more than 8000 times over 18 months, collecting invaluable data to monitor space weather. The team is now working to launch Ex-Alta 2 in 2020, with a mission to monitor and predict wildfires.
- + Our **Student Innovation Centre** provides students with a collaboration space—modelled after business incubators and startup offices—that encourages creativity and innovation. The iGEM team (who took gold at the 2018 International Genetically Engineered Machine Competition) make use of the innovation centre to create innovative solutions to combat *Nosema*, the most widespread disease affecting honey bees in Canada.
- + The **Science Internship Program** allows students to integrate work experience for 4, 8, 12, or 16 months into their degree, helping them develop real world skills before they've even graduated, making them even more marketable as they set off on their career journey.
- + Thanks to offerings like the Undergraduate Research Initiative, NSERC summer grants, and our research certificates, our students have opportunities to conduct coveted undergraduate research opportunities, providing them with a **competitive edge** over their peers.

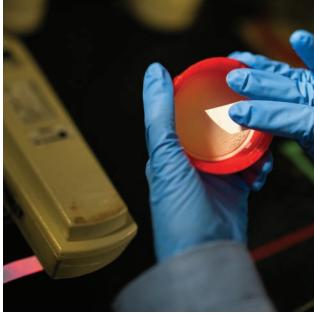
EACH SPRING, PHILIP CURRIE LEADS AN UNDERGRADUATE PALEONTOLOGY FIELD SCHOOL AT THE DANEK BONEBED IN EDMONTON, UNCOVERING CRITICAL CLUES TO UNDERSTANDING OUR PREHISTORIC PAST.



SCIENCE

EXPLOSIVE DISCOVERIES

THROUGH HER WORK WITH SPINOFF APPLIED QUANTUM MATERIALS (AQM), ALUMNA CHRISTINA GONZALEZ IS WORKING TO REVOLUTIONIZE GLOBAL SECURITY SCREENING.



WHEN IT COMES TO INNOVATIVE SOLUTIONS TO SOCIETY'S CHALLENGES, THE FACULTY OF SCIENCE IS SECOND TO NONE. WE ARE NOT ONLY HOME TO AN EXPANSIVE ARRAY OF CUSTOM EQUIPMENT AND SERVICES, OUR RESEARCHERS ARE ALSO ON THE CUTTING EDGE OF NOVEL WORK IN MANY INDUSTRIAL SECTORS, WORKING WITH INDUSTRY LEADERS IN RESEARCH AND DEVELOPMENT AND ASSISTING WITH TRAINING. WE ALSO PROUDLY HOST A MULTITUDE OF CENTRES AND INSTITUTES, INDUSTRIAL PARTNERSHIPS, AND SEVERAL SUCCESSFUL SPINOFFS THAT ARE LEADING HUMANITY'S COLLECTIVE PATH FORWARD INTO THE FUTURE.

- + Led by physics professor Robert Wolkow, spinoff company **Quantum Silicon Inc.** (QSi) is driven to discover greener, faster, smaller technology to enable faster, lighter, and more energy efficient computers. QSi's artificial-intelligence-enabled quantum manufacturing and atomic-scale devices use a fraction of the amount of physical space and about a thousand times less electricity.
- + Focused on heavy-metal-free, biocompatible silicon quantum dots and semiconductor nanoparticles for a broad range of applications in sensing, energy, displays, security, and bio-imaging, spinoff company **Applied Quantum Materials** (AQM)—led by chemistry professor Jon Veinot—recently received a nearly half-million-dollar stamp of approval from Alberta Innovates to develop solar windows.
- + In an industry collaboration with alumnus Chris Doornbos and his Calgary-based company **E3 metals**, Dan Alessi (associate professor in the Department of Earth and Atmospheric Sciences) and his research associates are preparing production of the greenest lithium on the planet.
- + The University of Alberta has an impressive track record of glycomics expertise, from Ray (Sugar Ray) Lemieux to David Bundle, Todd Lowary, Chris Cairo, John Classen, Matthew Macauley, and Ratmir Derda, among others in the Department of Chemistry. The Faculty of Science is proud to host two glycomics powerhouses, including the **Alberta Glycomics Centre** as well as **GlycoNet**, the National Network of Centre of Excellence, housed here on campus, to better understand the most abundant biomolecule on the planet—sugars—one of the fundamental building blocks of our bodies.
- + An interdisciplinary network dedicated to the sustainability of mountain environments and communities across the country and around the world, the **Canadian Mountain Network** (CMN), hosted at the University of Alberta unites academics, practitioners, community members and innovators from across Canada. With funding through the Networks of Centres of Excellence Program, CMN acts as catalyst for improving Canada's ability to identify and respond to changing conditions in its vast mountainous regions.
- + Co-hosted in the Faculty of Science and directed by biological sciences professor Janice Cooke, the NSERC **TRIA Network** (Turning Risk Into Action for the Mountain Pine Beetle Epidemic) is dedicated to protecting Canadian forests through science-based strategies to control spread of the mountain pine beetle in Canada.
- + Science spinoff **48Hour Discovery** founder, chemistry professor Ratmir Derda believes that molecular discovery should not be the rate-limiting step for developing drug therapeutics and diagnostics. The company offers ligand screening services at a revolutionary price, with unprecedented turnaround time to revolutionize the pharmaceutical and biotech industries.
- + **The Metabolomics Innovation Centre**, led by David Wishart, biological sciences and computing science professor, is leading the science world in this emerging field of "omics" research, specializing in the near global analysis of small molecule metabolites found in living organisms. Applications are already being seen in a broad range of disciplines including pharmaceutical research and development, agricultural food and safety, and disease diagnostics.

MAKING SCIENCE ACCESSIBLE



THROUGH OUR COMMUNITY ENGAGEMENT INITIATIVES, WE PROVIDE PEOPLE OF ALL AGES, ABILITIES, AND BACKGROUNDS WITH OPPORTUNITIES TO LEARN ABOUT SCIENCE FROM OUR KNOWLEDGEABLE RESEARCHERS, TEACHERS, AND STUDENTS. IT IS ABOUT INSPIRING THE BROADER COMMUNITY—BEYOND THE STUDENTS WHO ENROL AT THE U OF A—TO DEEPEN THEIR UNDERSTANDING OF SCIENCE SO THEY CAN CRITICALLY QUESTION WHAT THEY HEAR, READ, AND SEE WHILE NURTURING THEIR PASSION FOR THE WORLD AROUND THEM.

COMMUNITY ENGAGEMENT

- + Next generation scientists: each summer, nearly 2,000 budding scientists ages 6 to 18 join us for **Science Summer Camps** to learn about artificial intelligence, computer programming and design, chemistry, forensics, nature, space exploration, robotics, and more.
- + Lighting the night: nearly 60,000 Albertans subscribe to **Aurora Watch**, a free alert service that advises when the Northern Lights will be visible in Edmonton's capital region.
- + Space rocks and pieces of our planet: see fragments from space in Canada's largest university-based collection of meteorites in addition to one of the oldest systematic mineral and rock collections in the country, accessible through the our **Mineralogy / Petrology Museum**.
- + Digging deep: Our **Dino Lab** supports the world's 3rd ranked paleontology program. One year's worth of field work, discovering and excavating bones from below Earth's surface, adds up to ten years' worth of work back in the lab, making volunteer support a critical need.
- + Limitless skies: The state-of-the-art **University of Alberta Observatory** is open for public viewing every week and is available for field trips and group bookings.
- + Math matters: student support in mathematics extends far beyond campus borders. Mathematics professor and innovative instructor Vincent Bouchard facilitates two-week-long math summer camps with the Ermineskin Cree Nation at the Maskwacis Cree Reserve.
- + Learning for life: more than 1.5 million learners around the world have taken our **massive open online courses**, in subjects ranging Astro 101, Bugs 101, Dino 101, to Mountains 101, and from software design and architecture to planning and programming video games to reinforcement learning. Beyond free or low-cost access to anyone with an internet connection, many of these courses are available for credit to UAlberta students, providing a flexible way to complete courses at their own pace from right in their living rooms.



OUR YOUTH AND SCHOOL OUTREACH PROGRAMS INSPIRE THE CURIOSITY OF NEXT GENERATION SCIENTISTS TO MAKE SENSE OF THE WORLD AROUND THEM, EXPERIMENT WITH THEORIES, AND LEARN PROBLEM SOLVING AND CRITICAL THINKING SKILLS.



NOT ONLY DOES LISA WILLIS EXPLORE THE DIFFERENCES BETWEEN AUTOIMMUNE DISEASES IN MEN AND WOMEN THROUGH HER GLYCOMICS RESEARCH, SHE IS ALSO FIERCELY FOCUSED ON BUILDING DIVERSITY AWARENESS WITH HER COLLEAGUES ACROSS THE SCIENCE SPECTRUM.

12

EQUITY, DIVERSITY, INCLUSION

- + Fostering diversity in science brings new perspectives, insights, and innovation to our classrooms and to our research—intrinsically improving the work that we do and the programs we offer. For the Faculty of Science, improving the **representation of women and marginalized groups** has been a priority for more than a decade.
- + In 2005, we appointed esteemed diversity champion **Margaret-Ann Armour** ('70 PhD, '13 DSc) to the newly created position of Associate Dean (Diversity)—the first of its kind at the University of Alberta. As associate dean, Armour focused unwaveringly on increasing the diversity in our faculty. Under her tenure and tireless efforts from 2005 until shortly before her passing in May 2019, the representation of women in our faculty ranks rose from 14 to 22 per cent.
- + After her passing, Armour's legacy lives on, and we know that improving diversity requires a focused and intersectional approach. Beyond our focused efforts on fostering equity, diversity, and inclusion and counteracting the historical decrease in diversity as scientists move up the ranks from undergraduate to graduate to professoriate, the faculty supports Women in Scholarship, Engineering, Science, and Technology (WISEST) and is also **home to several grassroots initiatives and student groups** that champion diversity, including Ada's Team and UAlberta Working for Inclusivity in Chemistry.



FACULTY OF SCIENCE

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