

science contours

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THE COMPETITIVE EDGE

20 years
of the Science
Internship Program ▶

Science Contours is published twice a year by the Faculty of Science office to provide current information on the many activities of faculty and alumni. The magazine is distributed to alumni and friends of the Faculty.

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Up close

A thin section of the Bruderheim meteorite, as studied by Chris Herd (earth and atmospheric sciences), curator of the UAlberta meteorite collection. Formed 4.5 billion years ago during the birth of the solar system, it crash landed in the small community of Bruderheim in 1960. Nearly 700 fragments weighing more than 300 kilograms have been recovered in what is considered the most significant meteorite fall in Canadian history. Read more at ualberta.ca/sciencecontours.



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Celebrating our donors





Chain reaction

A new UAlberta study has shown that toxic levels of methylmercury are traveling up the food chain from lichens to humans via caribou. Lichens serve as a primary food source for caribou, which are in turn the biggest land game animal used as traditional country food by Arctic peoples. Read more about PhD student Kyra St. Pierre's research at ualberta.ca/sciencecontours.



Personality contest

UAlberta biologists have discovered that young red squirrels' personalities become more similar over time. Young squirrels tend to have more extreme personalities, but as they mature, their behaviour becomes more average—aggressive squirrels mellow out over time, while meek ones become more hostile. Read more about alumna Amanda Kelley's ('14 MSc) research at ualberta.ca/sciencecontours.

Pride in our people

IT HAS BEEN ANOTHER INCREDIBLE YEAR for the Faculty of Science, and one of my jobs is to brag about our success. Let me give you a couple of highlights about how we continue to be at the forefront of research and media attention and how our focus continues on providing our students a competitive edge for future success. I hope these examples and the other stories highlighted in this issue of *Contours* give you as much pride in your alma mater as it gives me as Dean.

January was an incredible media month, with three blockbuster stories that resonated around the world. Michael Bowling and his colleagues in computing science announced that they solved two-player poker: the computer now plays this game perfectly. This story has become the biggest research media event in the U of A's history, edging out the previous champion—another science success story—Graham Pearson's 2014 story on ringwoodite (water in diamonds). Following after poker in rapid-fire succession came stories on the world's oldest snake (Michael Caldwell and his team, biological sciences) and "dragon" dinosaurs (Philip Currie and his team, biological sciences). I read the BBC News daily, and it was a delight to one day see that the top two stories on their science page came from the University of Alberta!

Also announced earlier this spring, the Department of Chemistry will be home to GlycoNet, part of the new national Networks of Centres of Excellence for the study of glycomics. From the NCE website: "Carbohydrates play a pivotal role in virtually all biological processes, which makes them key to solving many health

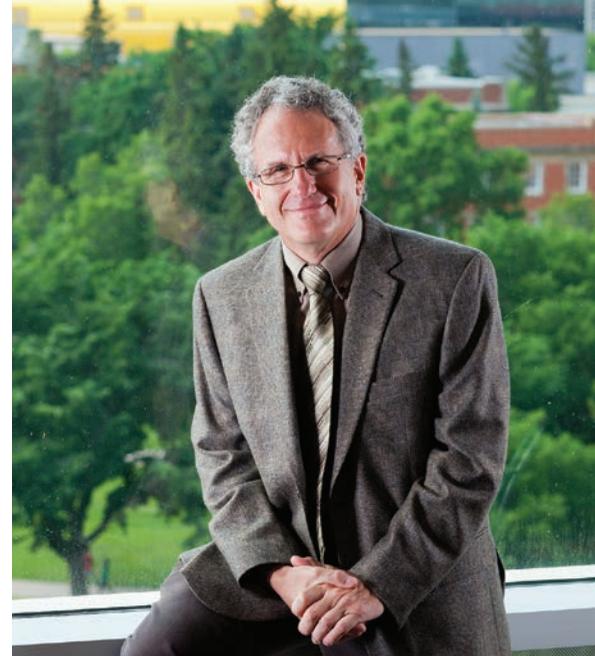
issues. Glycomics—the study of sugars in biological systems—has led to the commercialization of several carbohydrate-based drugs, including ones that fight influenza, blood clots, diabetes, seizures and migraines." Under the leadership of Todd Lowary, the Canadian glycomics community banded together to create this network of collaborative research. GlycoNet has now been funded for \$27.3M over the next five years (and can be renewed). Todd did a superb job bringing the community together to create something that was greater than the sum of the parts. It follows my personal mantra:

*United we grow
Divided we status quo*

Both of these examples highlight how we are continually focused on developing our strengths and inspiring our students and guiding our future alumni by giving them the opportunity to study with the best and brightest research minds at the forefront of science.

This issue highlights the Science Internship Program (SIP), recently renamed from the Industrial Internship Program. It is the 20th anniversary of the program, which started out targeted to 50-100 placements for specialization and honors students. Room to improve, in my opinion. This year we have expanded the program, and our goal—alongside the others in our new strategic plan that I introduced in the last issue of *Contours*—is a five-fold increase in the number of students participating. Employer reviews of our SIP students are outstanding! Interested in helping give a student a real-world work experience? Contact our Student Life and Internship Advisor at science.internship@ualberta.ca for more information and to get involved.

This issue of *Contours* is also a thank you to everyone who contributed financially to the Faculty of Science in the



past year. Your generosity supports our research programs, helps us attract the very best students, and facilitates our offering of a leading edge and innovative teaching experience. It is humbling for me to be the person who helps realize your vision for the future of the Faculty of Science and the University of Alberta. Our community deeply appreciates your support.

The one thing you all share is your University of Alberta Faculty of Science student experience. As you read through the following pages, I invite you to reflect on the journey that brought you to where you are now.

And finally, a welcome to our incoming president, Dr. David Turpin, who will reside in biological sciences. This change in leadership gives us pause for reflection on all that has been achieved in the past decade under the guidance of Indira Samarasekera and also provides an opportunity to renew our shared vision as we work toward future success for the Faculty of Science and the University of Alberta. As he emphasized in a town hall with our faculty this spring, Dr. Turpin believes that the University of Alberta is poised for the next great step. I think I speak for all of my colleagues when I say that we are looking forward to Dr. Turpin's vision as we work to develop our strengths and move the Faculty of Science and the University of Alberta to the next level of greatness. 🍀



Artist's conception of three of the four newly identified ancient snakes (Illustration by paleo-artist Julius Csotonyi, '98 BSc '02 MSc).

International team discovers oldest known snake fossils

Fossilized remains of four ancient snakes have been dated between 140 and 167 million years old – nearly 70 million years older than the previous record of ancient snake fossils – and are changing the way we think about the origin of snakes, and how and when it happened.

"The study explores the idea that evolution within the group called 'snakes' is much more complex than previously thought," says lead author

Michael Caldwell (biological sciences). "Importantly, there is now a significant knowledge gap to be bridged by future research as no fossils snakes are known from between 140 to 100 million years ago."

This new study makes it clear that the sudden appearance of snakes, some 100 million years ago, is reflective of a gap in the fossil record rather than an explosive radiation of early snakes. As is always the case, the distribution of these newer

oldest snakes and the anatomy of the skull and skeletal elements, makes it clear that even older snake fossils are waiting to be found.

"Based on the new evidence, and through comparison to living legless lizards that are not snakes," explains Caldwell, "the paper explores the novel idea that the evolution of the characteristic snake skull and its parts appeared long before snakes lost their legs."

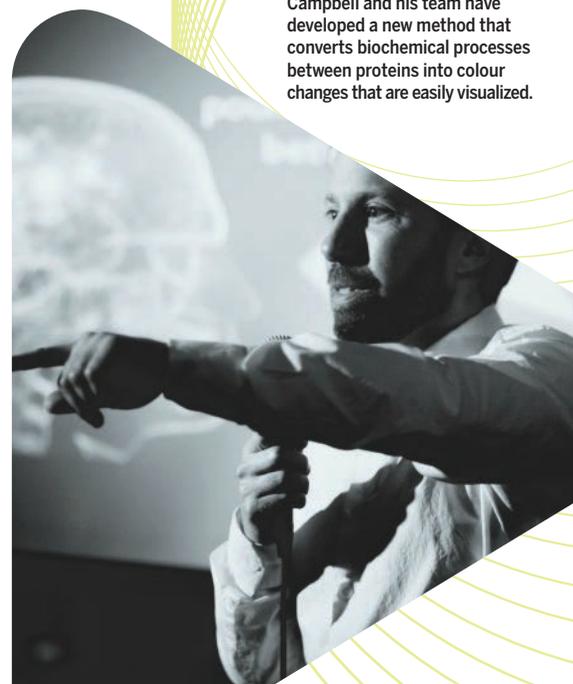
Colour-changing proteins shed light on inner workings of live cells

The detection and imaging of protein-protein interactions in live cells just got a lot more colourful, thanks to a new technology developed by University of Alberta chemist Robert Campbell (chemistry) and his team. Campbell has created a new method that converts biochemical processes into colour changes that are easily visualized. This method is a new tool for cell biologists and neuroscientists to use to address questions ranging from fundamental mechanisms in cell biology to the underlying causes of mental illness to the discovery of novel therapeutics.

"Strategies for converting fluorescent proteins into active biosensors of intracellular biochemistry are few in number and technically challenging," comments Campbell. "With this development we can immediately image activity happening at the cellular level, offering an alternative to existing methods for detecting and imaging of protein-protein interactions in live cells."

By adding this dynamic new dimension to fluorescent proteins and engineering them to be biosensors that change their colour in response to specific biological events, Campbell has provided a tool for researchers to immediately pinpoint a major change at the cellular level, minimizing the need for extensive biosensor optimization and providing a versatile new approach to building the next generation of biosensors.

UAlberta chemist Robert Campbell and his team have developed a new method that converts biochemical processes between proteins into colour changes that are easily visualized.





The honourable Michelle Rempel (left) visits a UAlberta metabolomics lab with David Wishart (right).

Federal funding keeps UAlberta at forefront of metabolomics research

The University of Alberta's status as an important centre for research and its practical applications in the burgeoning field of metabolomics has received a boost thanks to new funding from the Government of Canada, which has announced an investment of nearly \$3 million toward state-of-the-art metabolomics assessment equipment for the U of A's

The centre will support translation of innovative biomarker discoveries into real-life applications.

new Metabolomics Technology Demonstration Centre, set to open in 2015.

"The Metabolomics Technology Demonstration Centre will provide Canadian researchers with cutting-edge infrastructure and technical expertise to support translation of innovative biomarker

discoveries into real-life applications," says David Wishart, a professor in the departments of biological sciences and computing science, and project lead at the Metabolomics Innovation Centre. "We are very excited to work with our collaborators to develop prototype tools and products that will be implemented and commercialized through industry partnerships."

Currently one-third of the world's metabolomics companies are located in Alberta. The U of A is already home to the Metabolomics Innovation Centre, a Genome Canada-funded science and technology centre with a mandate to provide services and technology development support for all Canadian researchers. The Metabolomics Technology Demonstration Centre will enable the development of prototype tools based on these efforts. The two centres will work closely to translate discoveries into methods, devices and kits that can be used in many applications, including clinical testing.

UALBERTA RESEARCHERS SOLVE HEADS-UP LIMIT TEXAS HOLD 'EM POKER.

In a world first, researchers in the Computer Poker Research Group at the University of Alberta have essentially solved heads-up limit Texas hold 'em poker with their program, called Cepheus.

"Poker has been a challenge problem for artificial intelligence going back over 40 years, and until now, heads-up limit Texas hold 'em poker was unsolved," says Michael Bowling (computing science), lead author and professor in the Faculty of Science, whose findings were published Jan. 9 in the journal *Science*.

In poker, players have imperfect information—they don't have full knowledge of past events, and they can't see their opponents' hands. The most popular variant of poker today is Texas hold 'em. When it is played with just two players and with fixed bet sizes and a limited number of raises allowed, it is called heads-up limit hold 'em.

The possible situations in this poker version are fewer than in checkers—which U of A computing science researchers solved in 2007, led by now dean of science Jonathan Schaeffer—but the imperfect-information nature of heads-up limit hold 'em makes it a far more challenging game for computers to play or solve.

Cepheus, created by Bowling, PhD students Neil Burch and Michael Johanson, and Finnish software developer Oskari Tammelin, is the first computer program to play an essentially perfect game of poker. Cepheus accomplished this goal with no human expert help, only being given the rules of the game.

"It was trained against itself, playing the equivalent of more than a billion billion hands of poker," says Bowling. "With each hand it improved its play, refining itself closer and closer to the perfect solution. The program was trained for two months using more than 4,000 CPUs each considering more than six billion hands every second. This is more poker than has been played by the entire human race."

Fun and games aside, Bowling notes that game theory has always been envisioned to have serious implications, including a surge in game-theoretic applications involving security, such as systems for airport checkpoints, air marshal scheduling and coast guard patrolling.

"With real-life decision-making settings almost always involving uncertainty and missing information, algorithmic advances—such as those needed to solve poker—are needed to drive future applications."

Think you can beat Cepheus?

You can query the program's strategy or play against it online at poker.srv.ualberta.ca



L-R, Michael Johanson, Michael Bowling (centre), and Neil Burch of the UAlberta Computer Poker Research Group





By Alan Shapiro / Photos by John Ulan

When Tony Briggs ('96 BSc)

thinks of his first taste of the University of Alberta, it's not his time as an undergraduate student that he recalls: his mind wanders to his childhood home, a small house on the U of A farm on present-day South Campus. His father—a professor and chair of what was then the Department of Plant Science—spent several years as farm director. “The university is literally in my blood,” jokes Briggs.

Briggs’ academic career has brought him full circle, from a BSc in biochemistry to his current positions as assistant professor in the Department of Strategic Management and Organization at the Alberta School of Business and

executive director of the Technology Commercialization Centre.

The decision to apply to science out of high school seemed obvious to Briggs. “I always thought it had a higher purpose—the ability to pursue science for science’s sake.” He chose biochemistry for his interest in genetics and the program’s reputation as the toughest in the sciences. Briggs quickly became involved in the student community, taking on a leadership role with the science undergraduate association. Through this involvement, he met Richard Peter, then dean of the Faculty of Science, whose mentorship Briggs remembers to this day.

Briggs used his summers to accumulate a wealth of diverse experience, including work in soil science, at a yeast

lab, at an agricultural company, and in oncology research. The biotech industry was booming, which formed one of the backdrops for his interest in practical scientific applications. His experience and drive took Briggs straight from his BSc into an MBA at the University of British Columbia.

Upon graduation, Briggs searched for opportunities in investment banking. As chance would have it, he landed instead at the U of A’s licensing department. At that time, intellectual property licensing was a small and emerging discipline

“I always thought it had a higher purpose—the ability to pursue science for science’s sake.”



“We tend to think that the university primarily delivers knowledge, accreditation, and career training. What we found is that the university is creating new relationships that pave the road for future innovation.”

that spanned the gap between science and business. Briggs’ foray into licensing gave him an avenue to learn about breakthroughs in plant science, chemistry, biotechnology, and a variety of other disciplines, while building his understanding of how new scientific discoveries are moved into the market.

From the U of A, Briggs transitioned to the licensing office at Harvard Medical School. The work there involved primarily early-stage technologies, still years away from medical practice. “Ironically,” he recalls, “I didn’t get into the U.S. with my MBA. I got in with my science degree. I had to prove that I was actually a biochemist.”

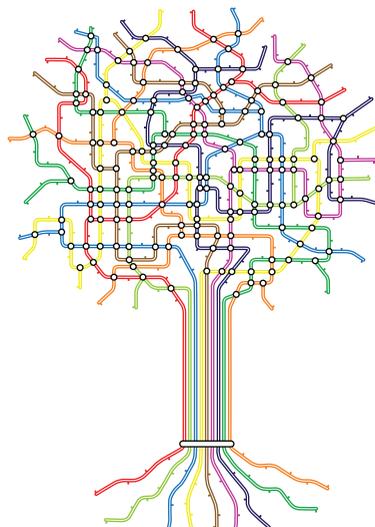
In his graduate research, Briggs pursued a variety of topics, from patents to

information systems. He credits science as the technical basis that enabled him to pursue his later research. Upon receiving his DBA degree from Boston University’s School of Management, Briggs returned to the U of A, where he now teaches courses in entrepreneurship, strategy, and innovation at the Alberta School of Business.

One of Briggs’ most significant contributions has been the University of Alberta Impact Study, released in 2013 and co-authored by Jennifer Jennings, a fellow business professor. Inspired by similar studies at institutions such as MIT and Stanford, the endeavour set out to capture the story of the U of A’s culture and to better understand its role within the community. One of the study’s key findings was that alumni listed relationships—particularly with faculty—as the experiences that left the most lasting impact.

“We tend to think that the university primarily delivers knowledge, accreditation, and career training. What we found is that the university is creating new relationships that pave the road for future innovation.” Briggs and his colleagues recognized the need to take an active role in setting organizational goals and defining an institutional culture.

Building on ideas from their research, Briggs and fellow business professor Michael Lounsbury set about designing an environment in which entrepreneurship on campus could flourish. The product was eHUB.



Located in HUB Mall, the space was created to promote and facilitate interaction among students from different programs and faculties. eHUB’s roles include creating teams, harnessing ideas into intellectual capital, and helping ventures secure early stage funding. Says Briggs, “We wanted to show people that it’s good to be entrepreneurial, that entrepreneurship on campus can positively affect the community and maximize the student experience.” Since its inception in 2013, eHUB has been a resounding success with extensive involvement now seen from students across campus.

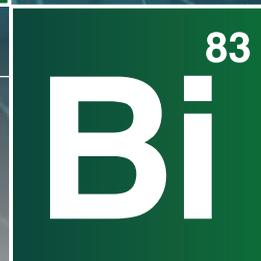
“There are narratives of the lone scientist and the lone entrepreneur figuring things out by themselves,” Briggs shares. “This just isn’t realistic. Today, everything takes a village.” His hope is that eHUB will continue to serve as such a village on campus, providing a safe space for students to explore their interests.

Briggs’ advice to his students is simple: “Follow your interests. As long as you study something that’s of interest to you, you’re not making a bad decision.” Just as important, in Briggs’ eyes, is committing to continue moving forward, allowing for failures and directional changes along the way. “I’ve bounced through a lot of different things, and I couldn’t be where I am right now without having gone through all of them. I really enjoy what I’m doing right now, and I still don’t quite know what’s next.” 🍀

Bringing
biotechnology
to the people



eaking



o



BY ADAM WILLIAMS

PHOTOS BY MATTHEW PLEXMAN

JUSTIN PAHARA ('06 BSc, '08 MSc) has always seen himself as a biotechnology entrepreneur. With his new startup company Synbiota, he's hoping to give everyday people the same entrepreneurial opportunities. Synbiota is all about making science and biotechnology accessible to the masses—even if he's not sure yet what they're going to do with it.

"Right now, life science is very much a corporate or academic endeavour," Pahara says. The world of biotechnology is filled almost exclusively with the likes of the military, large corporations, and universities. Pahara compares it to the world of computing in the 1970s and 1980s.

The goal of Synbiota is to break down these barriers, enabling individuals to work with biotechnology in their own homes, much like the Internet and personal computers enabled the public to make strides in computing and software design. Also like the early days of computing, it's anyone's guess where people will take the technology.

"We couldn't predict what would be created once computing and software went mainstream, once it got into the hands of people who weren't trained academics," Pahara says. "Biotechnology is going in the same direction."

Synbiota is the product of years of education, networking, and research for the two-time U of A alumnus, who grew up on a family farm just outside Lethbridge in Southern Alberta. Equipped with degrees in immunology and infection and in cell biology from the U of A, a PhD in biotechnology from the University of Cambridge, and having graduated from Singularity University as a Google Fellow, Pahara has come a long way from his first few years in Edmonton.

When asked for his advice for current students, Pahara advocates, "Just keep going until you find something you're passionate about, because it can come out of nowhere. For me, it came in my third year. I almost flunked out in my first few years



"Just keep going until you find something you're passionate about, because it can come out of nowhere."

at the U of A because I wasn't interested in anything in particular."

It was his experience participating in the International Genetically Engineered Machine (iGEM) program that changed Pahara's career aspirations for good. "iGEM was absolutely key in transforming my understanding of how science should be done," says Pahara. "Being part of the U of A iGEM team was the first time I worked with other passionate colleagues from very different walks of life. Since then, I have not worked on a 'traditional' research team."

A member of one of the first U of A groups to attend the International Genetically Engineered Machine (iGEM) competition in 2007, Pahara and his group, who nicknamed themselves the "Butanerds," won first prize in the environment category at the MIT-hosted event with their project, which involved altering a bacteria similar to *E. coli* to produce a clean and reliable source of the alternative biofuel butanol.

The experience also showed him how the non-standardized nature of science today often contributes to inefficiencies and can hinder progress. "It has been suggested that the majority of science research, representing billions of public dollars, is not reproducible. Billions of dollars and decades or centuries of people-hours are wasted," he

says. "Standardizing science and making it more open will change that. This is exactly what I am working towards."

With Synbiota, Pahara is running a company that he hopes can provide some of these same life-changing opportunities to the next generation of biotechnologists. "It's the early days of biotechnology, and it already touches billions of people's lives every day. It's still very closed off," he said. "We're working to break out from that situation so that a lot more people are able to alter humanity and change the world." 🌱



The International Genetically Engineered Machine (iGEM) competition gives students in biology, chemistry, computer science, and engineering the opportunity to put synthetic biology to use.

Over the course of a summer, undergraduates work as a team to create biological systems, which operate in living cells, out of a kit of more than 1000 biological parts. The idea is to engineer a system to serve a purpose or do something interesting.

The final products are presented at MIT, in Cambridge, Mass., at the end of the summer.

Past projects at iGEM have included bacterial biosensors used to detect arsenic, bacterial cells that can sense pollution, and red blood cell substitutes.

In 2013, the University of Alberta advanced to the world championship, winning the award for best presentation at the North American jamboree for their submission Mapmen: An improved bio-computing approach to the travelling salesman problem.

Any U of A science undergraduate is eligible to apply to be a part of the iGEM program. Between 20 and 30 students are selected from the pool of applicants, based on a variety of criteria.



For more information on iGEM, visit iGEM.org.

Opportunity knocking

GEOFF TATE'S WINDING JOURNEY FROM UNDERGRAD TO CEO

BY Adam Williams PHOTOS BY Alison Yin

GEOFF TATE'S ('74 BSc) career has always been about finding the next challenge—and having fun while doing it. Now the CEO of Flex Logix in Silicon Valley and formerly the CEO of Rambus—a technology startup Tate helped grow from four people to a company with market capitalization of more than a billion dollars—it's a strategy that has worked well for the University of Alberta alumnus.

"Life, to me, isn't about proud accomplishments. It's more about conquering challenges and having fun," says Tate. "The whole time at university, and after university, I have always just been chasing challenges and doing what motivated me. One thing leads to another."

Tate first attended the U of A in 1971, graduating with an undergraduate degree in computing science in 1974 before going on to do his MBA at Harvard University. A self-described businessman with a technical background, the

Edmonton native considered plenty of offers after retiring as CEO of Rambus before landing at Flex Logix, a young company established to design portions of microchips for chip producers. Though the startup is still in its early days—having just incorporated in 2014—Tate says he's enjoying his time.

Tate wasn't always a computer-science whiz. When he first started at the U of A, he had his sights set on a physics degree. He went through a few options before finally finding something that truly motivated him. "I think I

"The whole time at university, and after university, I have always just been chasing challenges and doing what motivated me. One thing leads to another."



was one of those kids who every year wanted to be something different—a paleontologist one year, an astronomer another year, and an atom-smashing physicist another year,” he explains.

When he hit upon his passion for computing science, a course he originally took as an option, he was reminded of how much fun he could have working with computers.

It wasn't Tate's first introduction to the computing world: as a high-school student, he had dipped his toes in the water of electronics when he was offered a spot in a program aimed at giving teens hands-on experience with the machines. Back then, computers were perceived as untouchable says Tate, but the program removed those barriers and set the foundation for what would become a career.

“I think, like a lot of students, it's somewhat of a random journey,” Tate says. “You kind have a general direction and things happen and you keep making course adjustments. For me, it ended up working out pretty well.”

It's that history, in part, which drove Tate's support of the Ross and Verna Tate High School Internship Program (HIP) at the U of A. The program, which gives students the opportunity to do a six-week summer internship centred around computing, essentially passes along the same introduction Tate was given as a young person in Edmonton.

And, when he was pitched the idea to establish the new **Ross and Verna Tate Science Entrepreneurship Award** at the U of A for science-based startup companies, he jumped on that idea too. “I have always been interested in entrepreneurship and think it is a

“The opportunities in industry for people with STEM backgrounds—Science, Technology, Engineering, Math—are tremendous. It's the best return on investment you're going to get out of a university education.”

great thing to give young people the chance to try.”

It aligns with the most important piece of advice he has for students: if it's a fit, get involved in the sciences. “The opportunities in industry for people with STEM backgrounds—Science, Technology, Engineering, Math—are tremendous,” he says. “It's the best return on investment you're going to get out of a university education.”

Tate's own journey, which began all those years ago as a high-schooler in a computer program, hasn't always taken the straightforward route but, as he says, it has always centred around doing what motivated and challenged him.

Embarking on a new challenge with Flex Logix is more of the same. “We took Rambus public, and my real dream is to turn Flex Logix into a public company. That doesn't happen overnight,” says Tate. “I would hope, sometime five to 10 years from now, that this becomes another large, public company. That would be really exciting for me. That's as far out as I can plan. Five years is forever. Past that, who knows.” **C**



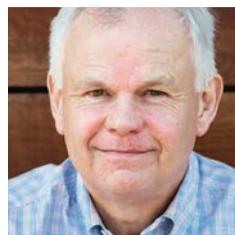
Student startup scores big

Neesha Desai and Kit Chen, PhD students in computing science, are the inaugural winners of the \$50k **Ross and Verna Tate Science Entrepreneurship Award** for their startup Alieo Games, an educational technology company. Alieo's first product—COW (Creative Online Writing)—is a novel educational tool intended to help students revise their creative writing. The majority of existing games in this area focus on math and reading, since writing is much more difficult for computers to do.

Chen and Desai see the award as validation from the community that they are on the right path. “Ideally in less than 10 years, we'll be able to give back to places that have helped support us getting here,” Desai says. “That would be ideal—that not only are we able to pay ourselves, but that there's money there that we can turn around and say, ‘We were there, we knew what it was like to be a student.’”



Learn more at alieogames.com.



THE INTERN EDGE

BY / Julie Naylor
PHOTOS BY / David Cooper /
Gretchen Ertl / Trudie Lee / John Ulan



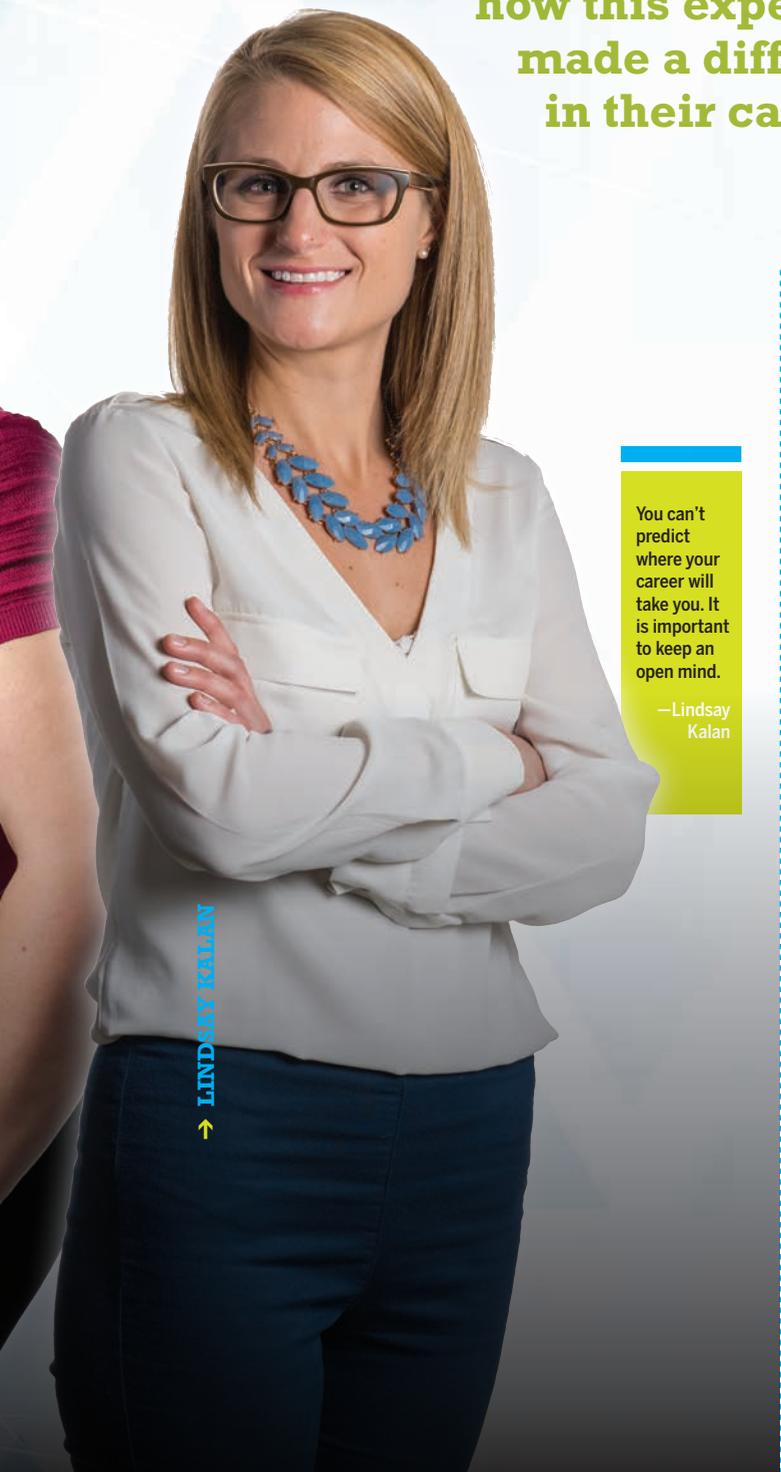
→ EDDIE CHAN

→ TRACY CORDNER

→ KYLE FOUGERE

→ SUSAN ELIA

The Science Internship Program (SIP, formerly the Industrial Internship Program) celebrates 20 years of placing students in relevant work experiences during their undergraduate years. Hear from five internship alumni on how this experience made a difference in their careers.



LINDSAY KALAN
↑

You can't predict where your career will take you. It is important to keep an open mind.

—Lindsay Kalan

EDDIE CHAN '06 BSc
(Computing Science)

Internship >

IBM Canada

Currently >

Software Engineer,
Elastic Path Software,
Vancouver



As a technical consultant at a leading e-commerce company, **EDDIE CHAN** has had the privilege of advising some of the biggest brands in the world for their online commerce solutions. However, his first foray into the industry came when he was selected to join 300 other interns from across the country at IBM Canada in Markham, Ontario while completing his undergraduate science degree.

“It was the first time I got to work on something that would be used by real users and people outside of the classroom,” says Chan. “What happens if you make a mistake? On a lab assignment you simply lose marks; in the real-world, you need to fix, communicate, and deliver a solution to your users. There are fewer shortcuts in the real world.”

Chan was also exposed to working with others on a team committed to the same goal, a refreshing experience that often brought to light the importance of cooperation between teammates with different roles, different levels of experience, different personalities, and even different motivations.

“I’d like to say that I’m close to where I planned to be, but I didn’t really plan very much at all in university,” comments Chan. “In hindsight, I was too focused on the immediate challenges like the next assignment and next exam. I didn’t think about my future very much.”



For Edmonton-born Chan, moving away for the internship forced him to be on his own away from home and make new friends. Managing it all gave him the confidence and desire to seek out even more challenges, like moving to Vancouver after graduating to start a career in a new city.

“I have many fond memories and friendships from my time in Markham,” he says. “One of those friends lives in Vancouver, which helped make my relocation after graduation a softer landing.”

Chan now enjoys business trips that allow him to experience different parts of the world and work with teams from a variety of different cultures and backgrounds. He stresses the importance of students focusing on not only getting the job done, but also making friends and pushing themselves to learn new things.

“You probably won’t remember every day-to-day thing you do” he remarks, “but you will remember the relationships and experiences you have during your internship.”

Chan stresses the importance of students focusing on not only getting the job done, but also making friends and pushing themselves to learn new things.

“Graduates with work experience earn more than their peers, have higher employment and full-time employment rates, and are more likely to have paid off debt two years after graduation.”

—Council of Ontario Universities, 2014

SUSAN ELIA '05 BSc (Geology)

Internship >
Suncor Energy

Currently >
Geologist,
Husky Energy,
Calgary



“I had exposure to the working field, the working culture, and office environment. As a result, I understood the expectations of a working professional.”

—Susan Elia

SUSAN ELIA's career journey wasn't without its initial bumps. She began her studies at the U of A as an undergrad in chemistry. “I was a horrible chemist but would have been a great lab tech.” After taking an introductory geology course, she completed her first BSc with a major in earth sciences and a double minor in chemistry and anthropology. She followed this with a BSc after-degree, specializing in geology.

“During my after-degree, an opportunity came up in the internship program with Suncor Energy. I applied and was successful,” said Elia. “I lived in Fort McMurray for that year, and it was a great experience both personally and professional. It was a year of great growth.”

Elia credits her success in the industry to gaining invaluable work experience while still an undergraduate. “It was the exposure to the oil sands in Fort McMurray (work experience) that helped elevate my candidacy above others in the initial screening/hiring process,” she says. “I had exposure to the working field, the working culture, and office environment. As a result, I understood the expectations of a working professional.”

She encourages all of today's students to apply for the internship program. “It will open doors and opportunities you didn't know were available and create networks for getting a job once you graduate.”

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TRACY CORDNER's decision to apply to the internship program was a purely practical one. "Honestly, I was really short on cash," she said. "I wasn't going to be able to afford my next year of studies."

She landed herself a spot in the Instructional Technology Lab in the Department of Psychology, under the watchful eye of Connie Varnhagen (who would later go on to receive a 3M National Teaching Fellowship).

"Connie sent me to all kinds of events and let me mingle with all kinds of professionals," recalls Cordner. "She involved me in many publications and presentations, which enabled me to have enough professional experience to be considered for my master's program at the Harvard Graduate School of Education. I am really indebted to her."

Since graduating from Harvard, where she studied technology in learning, Cordner has taken part in a variety of creative learning initiatives. Now with the Learning and Teaching Division of EDC (Educational Development Centre)—a company that designs,

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implements, and evaluates programs to improve education, health, and economic opportunity worldwide—she collaborates on curriculum development, inquiry-based teaching, and online mathematics professional development. She has also helped develop online applications designed to help students deepen their learning in many subject areas, including math, psychology, and critical thinking. She was runner-up in the Joan Ganz Cooney 2010 Literacy Challenge for a digital application known as *The Electric Brain*.

"I just finished my first mathematics curriculum—*Transition to Algebra*—that just won an award, and there is an accompanying book called *Making Sense of Algebra* that a lot of people are really excited about," she says. "I'm working on an innovative online professional development project right now called eCMI." With funding from the National Science Foundation, eCMI (Electronic Communities for Mathematics Instruction) engages groups of teachers in compelling mathematics through video conferencing and social media.

Cordner's advice for today's students considering the internship program? "Do it. Absolutely do it."



TRACY CORDNER '05 BSc (Psychology)

Internship > Instructional Technology Lab, Dept. of Psychology, University of Alberta

Currently > Instructional Designer, Education Department Centre, Massachusetts



KYLE FOUGERE '05 BSc (Atmospheric Sciences)

Internship >

Environment Canada

Currently > Meteorologist for Environment Canada, Edmonton



When KYLE FOUGERE started as an intern with Environment Canada more than 12 years ago, he set his sights on the position held by his supervisor as his dream job. Eight years following his graduation with a BSc, Fougere fulfilled that dream, becoming the head of the Severe Weather Program at the Prairie and Arctic Storm Prediction Centre in Edmonton.

“The internship played a huge role in landing my job out of university,” comments Fougere. “I learned a lot about the weather and weather forecasting while completing my internship, and I got to know the people who would be interviewing me for a job after completing my degree. Without the knowledge I gained while completing my internship, I really don’t know if I would have been able to get a job at Environment Canada after graduation.”

Fougere stresses the importance of finding people whose work you admire and trying to emulate their good habits. Talking to them about how they achieved their success and learning their habits can make it easier to create your own successes.

After years in the field, Fougere sees how hiring student interns “creates a pipeline of qualified candi-

“Hiring student interns creates a pipeline of qualified candidates who can then be hired after graduation.”

—Kyle Fougere



Fougere stresses the importance of finding people whose work you admire and trying to emulate their good habits.

dates who can then be hired after graduation. It is also a cost effective way to complete work that can be done by someone without a lot of experience in the field.”

He also attests firsthand how graduating with relevant work experience can increase your job prospects after university.



LINDSAY KALAN '06 BSc (Biological Sciences)

Internship > Banner Pharmacaps

Currently > Head of Research & Development, Exciton Technologies Inc., Edmonton



instrumental in allowing her to jump right into her thesis research in biochemistry at McMaster University.

She also credits the education she received at the U of A as an undergrad. “The education is second to none,” comments Kalan. “My program had more lab-based courses than similar departments at other universities, giving students much needed hands-on experience.”

Kalan is still in touch with people she worked with during her placement. Having that network allows her to stay connected with the science community in Alberta.

“I think one of the most important things I’ve learned is that you can’t predict where your career will take you and that it is important to keep an open mind,” she notes. “At the time I applied [to the internship program], I never imagined I would end up where I am now. In addition to having a good resume, I have learned that forming and maintaining strong relationships with colleagues, mentors, and contacts is just as important to exploring career opportunities.”

As the head of the research and development group for Exciton Technologies Inc., an Edmonton-based wound-care company focused on the creation of technologies for preventing and controlling infection, **LINDSAY KALAN** witnesses every day how basic science can be translated to new products and innovations.

“I wanted to pursue research in the field of infectious disease,” she comments, “specifically with a focus on development of novel antimicrobials that can combat antibiotic resistant organisms.”

During her undergraduate internship, Kalan landed a spot at Banner Pharmacaps in Olds, Alberta.

“I learned new laboratory skills, but the most important thing I gained was the ability to communicate and work on a team,” remarks Kalan. “I had to organize my own time in the lab and communicate with different departments effectively.”

She credits the lab experience she gained in both the internship and post-graduate research job as

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A matter of fact

Fighting snake oil with science

By Kristy Condon → Photos by John Ulan

Professor, policy advisor, voice of reason:

TIMOTHY CAULFIELD ('87 BSc, '90 LLB) wears a lot of hats, both in his formal role as an academic as well as through his efforts to bring some of the world's biggest pop cultural influencers under the microscope for their counsel in matters of science.

HIS JOURNEY AT THE UNIVERSITY OF ALBERTA began as an undergraduate student in psychology. “In my undergrad, I was really interested in brain chemistry and brain biology, which are actually huge right now, so maybe I should have stuck with that,” he notes with a laugh.

A growing interest in policy inspired him to pursue a career in health law. “I was always attracted to the controversial topics, so that’s what drew me to law school. I wanted to be able to argue with facts.”

By day, Caulfield is a professor in both UAlberta’s Faculty of Law and School of Public Health. He’s also the research director of the University of Alberta’s Health Law Institute (HLI), where he examines health law and science policy using an evidence-based approach.

Off the clock, however, Caulfield is the voice of reason for popular health and science, largely through his active presence in the media and on Twitter. He has also authored two books on the intersection of science and pop culture: *The Cure for Everything: Untangling the Twisted Messages about Health, Fitness, and Happiness*, and *Is Gwyneth Paltrow Wrong About Everything?: When Celebrity Culture and Science Clash*. The latter of these has dominated the mainstream media following its Canadian release in January and May release in the U.S.

“Debunking, for me, is both fun, and I think also really important,” says Caulfield. With the right mix of humor and hard facts, Caulfield’s commentary on pseudoscience and celebrity influence has elevated him to one of the biggest voices in Canadian science.

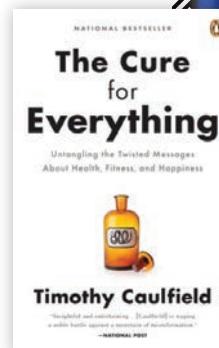
“Celebrities really do have an impact,” he explains—and the reasons are complicated. “I don’t think for the most part people even realize that they are being influenced by them [celebrities]. I don’t think people consciously make the decision to turn to someone like Gwyneth Paltrow for health advice, but she represents this image, this lifestyle that people can relate to.”

It seems ironic that in the 21st century—a time when accurate information based on real research is often just a click away—people are so quick to trust the endorsement of unqualified individuals, often at face value. At the same time, mistrust is rampant when it comes to critical social issues like vaccinations and global warming.

“Information is so free right now,” says Caulfield. “I think, though, that there is an erosion of trust. People are suspicious of ‘Big Pharma’ and ‘Big Food’. There’s a fear of industry and potential corruption. What people forget is that those issues don’t make the scientific process wrong. They highlight the need for good independent science.”

The science is there, but it’s confusing at best, if not contradictory. “Science is becoming so complicated. It used to be that, say, we build

“People take an exciting aspect of science—something that’s legitimately ground-breaking and amazing—and then they take that science and make a bogus product from it.”



Caulfield's two books scrutinize celebrity culture and the myth of the miracle cure.



“When everything sounds like magic, it can be easier to accept the bogus stuff along with the evidence-based science.”

an airplane—and you could explain the mechanics of it, how it works, and people could understand that. Now, you talk about stem cells and neuroscience, and it sounds like magic,” explains Caulfield. “So you can see how when everything sounds like magic, it can be easier to accept the bogus stuff along with the evidence-based science.”

And there, he says, lies the real issue. In a recent UAlberta study out of the Faculty of Medicine & Dentistry, researchers Mike Allen, Mike Kolber ('92 BSc), and Christina Korownyk ('98 BSc) looked at two televised medical talk shows, *Dr. Oz* and *The Doctors*, to record the recommendations made in each episode. They then followed up on the strongest recommendations to determine if there was evidence to support the claims. The results were telling—only about half the recommendations on *The Doctors* and just one in three of *Dr. Oz*'s recommendations could be supported by believable scientific evidence.

“There’s this phenomenon that I like to call medical and stem cell tourism, where people take an exciting aspect of science—something that’s legitimately ground-breaking and amazing—and then they take that science and make a bogus product from it.” Many of these originate in legitimate science (for example, the modest benefits of drinking green tea), and then create an unsubstantiated, supposedly health-improving product from it (like green tea diet pills).

Some of the “science” is fairly obvious to the average person. When Gwyneth Paltrow recommended an intimate V-steam treatment to cleanse the uterus, for example, plenty of eyebrows raised among even her most devoted followers. However, less dramatic treatments like undergoing a cleanse or adopting a particular diet may seem like reasonable alternative health care options, particularly when there is a low perceived risk of adverse effects.

“People will argue, for example, that although homeopathic remedies have never been scientifically proven to work, at least they aren’t harmful. That still doesn’t change the fact that they are proven not to work.”

On a highly visible platform like Twitter, Caulfield’s outspoken stance on celebrity pseudoscience leaves him open to criticism as well. “I don’t mind when people attack my ideas,” he stresses. “What I do mind is when people say that I’m narrow-minded. I’m actually very open-minded—if I have an idea about something, and you can convince me that I’m incorrect using evidence-based arguments, then I will change my opinion.”

He encourages informed individuals including students to add their own voices to the conversation. “Social media is not going away. Get involved, be part of the discussion, and strive to be as scientifically accurate as you can. Use the best available evidence.”

As far as Caulfield is concerned, he is happy to continue fighting the good fight—both online and in shaping science-informed policy. His advice for those just starting out on their careers: “I know this is a horrible cliché, but it’s true for me—love what you’re doing and love the journey. Enjoy the opportunity to learn. When you excel, the opportunities emerge, so find something that you love, and excel at it.”

BROADLY SPEAKING

Torah Kachur ('01 BSc, '08 PhD)
takes science to the airwaves

By Alan Shapiro Photos by John Ulan



Not many scientists would call the director of NASA's Jet Propulsion Laboratory to ask how superheroes fly. Then again, Torah Kachur isn't your everyday scientist. As a professor and science communicator, one of her core missions is to break the stereotype of the scientist in a white lab coat and engage the public with science. "Everybody needs a basic understanding of their bodies and their environments to interpret the news they hear every day," she says.

Kachur completed both her BSc and PhD in molecular genetics at the University of Alberta. While working toward her PhD, she became involved in outreach with the U of A's Women in Scholarship, Engineering, Science, and Technology (WISEST) program, which provides young girls exposure to career options in science and engineering. Her involvement with WISEST allowed her to share her research and passion for science with a broader audience.

On a whim, Kachur began to investigate careers in science communication and reached out to fellow alumnus Jay Ingram ('67 BSc, '09 DSc Hon.), past host of both CBC Radio's *Quirks and Quarks* and the Discovery Channel's *Daily Planet*. Ingram quickly became her personal mentor and opened the door for opportunities such as the Banff Science Communications program, a two-week retreat that brings together students, writers, and professionals from across Canada.

Her growing excitement, coupled with the friendships Kachur formed in graduate school, led to the birth



of the blog and video channel *Science in Seconds*, which gave her and fellow creators Rheanna Sand ('02 BSc, '12 PhD) and Brittany Trogen ('08 BSc) an outlet to share their ideas and an opportunity to learn about a broad range of interesting science topics. "I loved the bench work and problem solving of grad school, but I also loved learning about the universe, viruses, the Large Hadron Collider—*Science in Seconds* was my motivation to learn."

Upon completing her PhD, Kachur embarked on her teaching career, lecturing at both the U of A and MacEwan University. She now instructs multiple courses at both universities and teaches course review programs all across Canada. "Teaching allows me to self-



“THE VALUE OF A SCIENCE DEGREE IS MEASURED NOT IN KNOWLEDGE, BUT IN THE ABILITY TO THINK CRITICALLY AND APPLY SCIENTIFIC PRINCIPLES TO UNDERSTAND THE WORLD.”

ishly learn so much about such a wide array of topics.” Kachur also loves the constant exposure to different ways of teaching the same subjects.

One day, Kachur received a call from CBC Radio asking if she was interested in working as a science columnist. She learned that she had been recommended for the role by none other than Jay Ingram. “A week later, I’m in a radio studio, with no idea what I’m doing,” Kachur recalls. Her first column was a seven-minute segment about a human fossil discovered in Indonesia. Kachur remembers recording the sequence more than 20 times and feeling like everything went wrong.

Since then, Kachur has hosted a series on the science of waste, guest

hosted the award-winning national program *Quirks and Quarks*, and appeared as a science columnist on numerous local radio shows. While researching for her CBC superhero special *Kapow! The Science and Technology of Super Powers*, Kachur reached out to NASA to help her crack the secret of Superman’s flying abilities. “Physicists,” she learned, “are more than willing to take their science seriously in a ridiculous way.”

Radio hasn’t been an easy medium to master. In the classroom, Kachur uses pictures to communicate everything from relative size to complex details. On the air, words are the only tool at her disposal. One lesson she’s learned has been simply to use active verbs and descriptions. “Science is really

verb-less and adjective-less. Papers are good at conveying facts but not necessarily excitement.”

Though her friends and colleagues may disagree, Kachur attributes much of where she is today to sheer luck. For example, she admits that she’s never actually applied for a job—or even to graduate school, for that matter. After returning from four months of traveling, Kachur casually mentioned to her undergraduate research supervisor that she might be interested in continuing her studies. Less than a month later, her admission letter was in the mail.

Perhaps the biggest takeaway from Kachur’s science education has been the importance of confidence. “I can learn and understand something that I thought was difficult or impossible when I first began.”

Her advice for science students? “Don’t learn for a job. It doesn’t matter what you study, just that you study.” The value of a science degree, in her eyes, is measured not in knowledge, but in the ability to think critically and apply scientific principles to understand the world.

Kachur is currently on maternity leave, caring for her daughter, Tate. She continues to guest lecture and is working on a pilot for a new radio show on unexplained mysteries solved by science. 🌱

PhD grad Lindsey Carmichael ('99 BSc, '06 PhD) walked away from academia to become a children's book author—and she wouldn't change a thing



BY ALEX MIGDAL
PHOTOS SCOTT MUNN

{ An *Unlikely* Story }

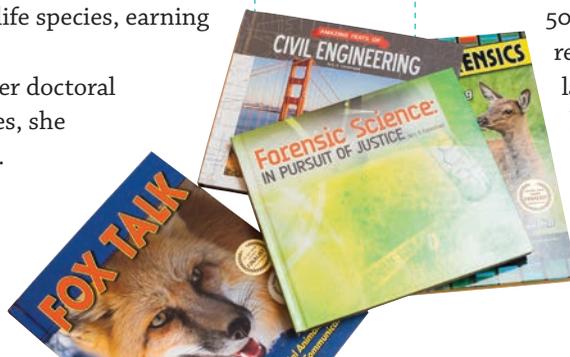
>> IN HIGH SCHOOL, Lindsey Carmichael decided to become a forensic specialist after being hooked by a true crime novel that outlined the first criminal case to ever use DNA profiling. Focused on her goal, she applied to the University of Alberta to study DNA fingerprinting techniques in wildlife species, earning an honors degree in genetics.

Years later, six months into her doctoral research on wolves and arctic foxes, she realized she had missed the mark.

Since her 2011 debut, Carmichael has authored 15 science books for children.

Academia, it dawned on her, was not in fact her most fundamental, enduring passion—it was writing. “I really, really missed it,” she says. “I was just not meant to be in a lab all day.”

Carmichael's PhD thesis allowed her to crank out 50,000 words in six weeks—a process she relished—but the mundane nature of her lab work stifled her creativity and fueled her impulse to share stories.



So she began to lead a double life: after spending the day doing research in her lab, Carmichael hunkered down at home to write short stories and novels. On a whim, she enrolled in a children's writing course through correspondence. Carmichael learned that demand was high for writers who could produce quality non-fiction literature for kids—her first clue that her science expertise could be used for more fulfilling pursuits.

After completing her thesis in 2006, which won the prestigious Governor General's Medal, Carmichael opted for a new day job: working retail at a bookstore. Acknowledging with a laugh, the self-described over-achiever says, "That's not an easy thing to explain to people."

While her peers wondered when she would find a "real job," Carmichael sold her first science article to *Highlights for Children* magazine in 2008. She eventually approached an educational publisher and pitched her credentials, and a project soon came up that matched her expertise.

In 2011, Carmichael signed her first book contract. "The first time I held it [the book], it took me about an hour to catch my breath," Carmichael says. "I was looking at this thing and thinking: this is absolutely gorgeous, I can't believe I made this."

Four years later, that thrill has yet to wear off for Carmichael, who has to date authored 15 science books for children. Her topics range from deciphering communication between foxes to the development of forensic science. She says new ideas abound all the time. "I love the research. I love that sense of discovery that's involved in digging into a new topic. It's something new every day."

Carmichael also works part-time as a science specialist at Saint Mary's University's Writing Centre in Halifax, where she hosts in-class workshops and works one-on-one with students on their writing. She's discovered that many science students dread communicating research to readers.

"A lot of people seem to want to go into science because they don't like writing, and they think they won't have to do it," she says. "To me, communication is absolutely essential in every field, especially in science. Sharing our results and our research is arguably the most important stage of the scientific method.

We not only have to be able to do that work, but we have to be able to tell people what we found."

"Enjoying the experience of learning and being open to where that experience could take you is really important."



"Sharing our results and our research is arguably the most important stage of the scientific method. We not only have to be able to do that work, but we have to be able to tell people what we found."

In her role as the science specialist in the Writing Centre at Saint Mary's University in Halifax, Carmichael helps students improve their paper-writing skills.

Nowadays, Carmichael can't help but pinch herself, having finally managed to blend her two passions in a fulfilling career. Her ambition has only grown, with plans underway to write her first fantasy novel for teens.

It's children, though, who Carmichael seems to have especially charmed. Just ask the mom who recently messaged the author about her son reading Carmichael's book at bedtime. "She said that her son turned the light back on so that he could read just one more page," Carmichael says. "That is the best thing I have ever heard in my life."

Even in the early days, when she began to doubt her career path, Carmichael felt strongly about investing in her studies "If you are interested in the subject, it's worth studying, even if you're not sure what you're going to do with it," she says. "Enjoying the experience of learning and being open to where that experience could take you is really important." 🍀

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