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SPRING/SUMMER 2021

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RACE AGAINST THE VIRUS

CLIMATE CHANGE AND YOUR HEALTH



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Editor's Note



THE SIZE OF IT

In the 1960s American sci-fi movie *Fantastic Voyage*, scientists use top-secret miniaturization technology to shrink a US submarine and its occupants to the size of microbes. After they've been sterilized with UV light, the crew's task is to enter the body of a leading miniaturization scientist who has been injured during his defection from the USSR, and save his life by using a laser to remove a clot in his brain. During the mission, they get rerouted through a fistula, fend off attacks from the scientist's antibodies, and deal with depleted oxygen supplies by stealing some from his lungs.

Cheesiness aside, 60 years later there are some striking parallels between the scriptwriter's imagination and today's medical science. We may not be able to shrink people, but scientists are harnessing properties they've observed at the nanoscale to create new devices and materials for medical applications. The shrunken submarine is last century's imagining of this century's nanoparticles, which are being developed to efficiently deliver drugs to precisely the locations where they are needed.

Growing insight into the fundamental principles of biology and the underlying mechanisms of disease is allowing researchers to create groundbreaking therapies. The natural virus-defense system used by some bacteria has inspired a revolutionary new technique for gene editing. Key antibodies can now be identified, refined and cloned to boost our defenses against infection. And our understanding of the microbial world and its role in health and illness has multiplied in recent years, offering new pathways for the prevention and treatment of some of the world's most prevalent diseases.

Laser surgery is already old news for certain procedures. Thanks to Virtual Reality, students of anatomy can have an interactive 3D view of the human body, if not quite a submarine's-eye view. And there is even a safe form of UV light, these days, which entrepreneurs are employing in devices for the sanitation of hospital wards and nursing homes.

In fact, it's not the vision of future health science in *Fantastic Voyage* that jars with the present so much as the movie's social context, and its focus on East-West hostility. The Cold War is no longer the most likely candidate for our self-destruction. Today, that sad name badge can be slapped on the asthmatic chest of climate change.

As we celebrate some life-changing medical advances in the microbial realm, we must not lose sight of the big picture. It's staggering to think what medical miracles may be possible in another 60 years, but to realize them we need to stop treating the planet as an enemy and start regarding its health as synonymous with our own.

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TREK

TREK magazine is published two times a year in print by the UBC Alumni Association and distributed free of charge to UBC alumni and friends. Opinions expressed in the magazine do not necessarily reflect the views of the Alumni Association or the University.

We acknowledge that UBC's campuses are situated within the traditional territories of the Musqueam, Squamish and Tsleil-Waututh, and in the traditional, ancestral, unceded territory of the Syilx Okanagan Nation and their peoples.

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Volume 77, Number 1

Printed in Canada by Mitchell Press

Canadian Publications

Mail Agreement #40063528

Return undeliverable

Canadian addresses to:

Records Department

UBC Development Office

Suite 500 – 5950 University Boulevard

Vancouver, BC, Canada V6T 1Z3



The TREK Spotlight is made possible with contributions from HearingLife Canada

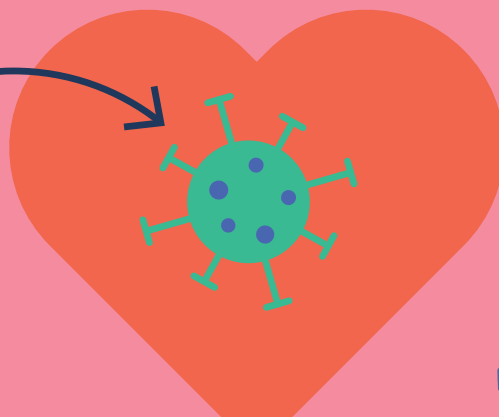
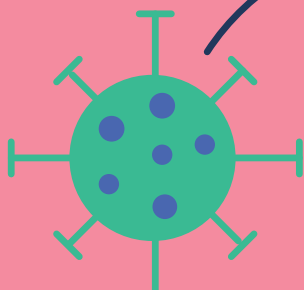
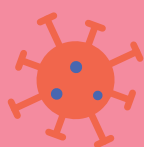


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A Picture



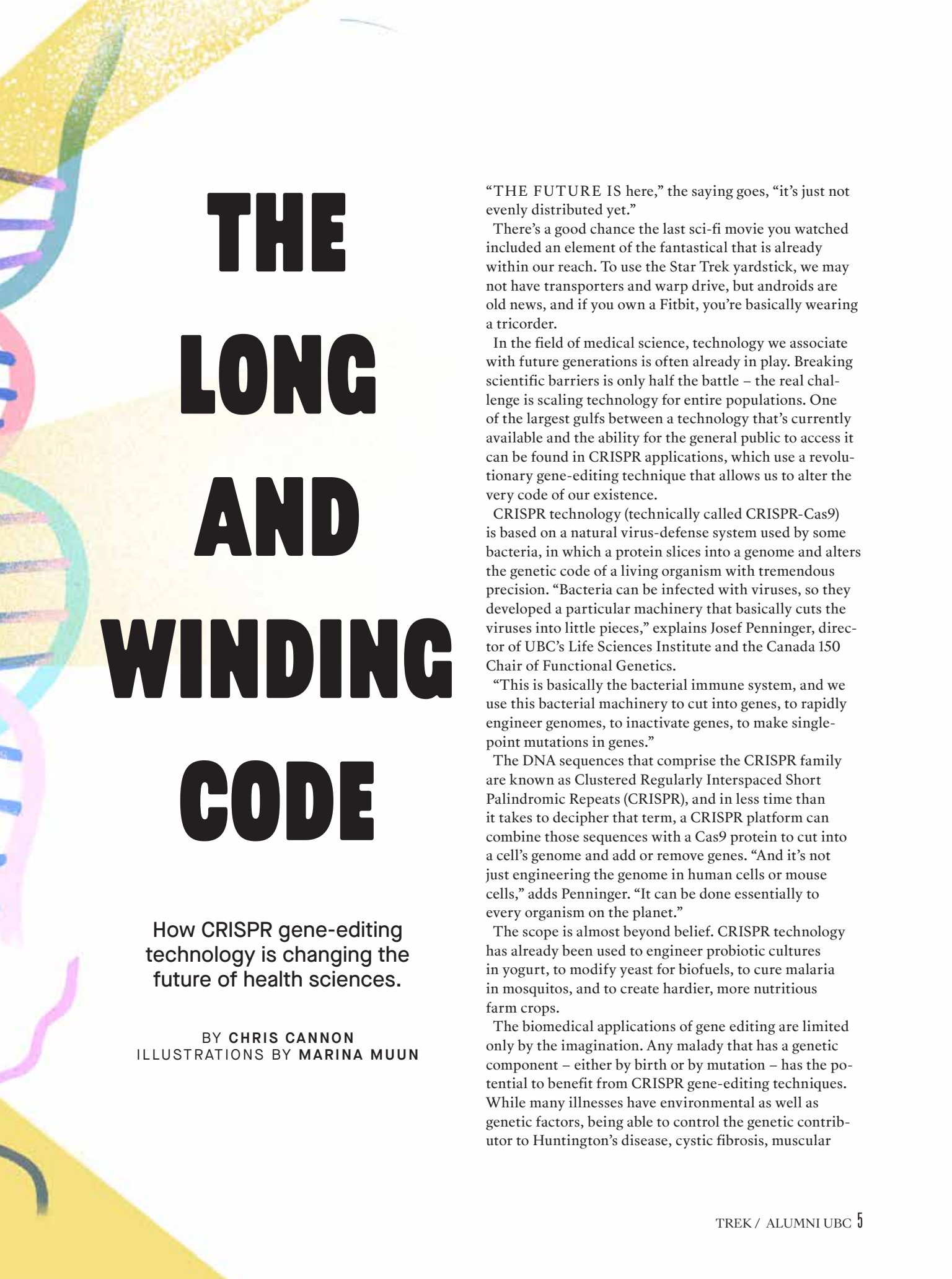


of Health

From revolutionary gene-editing techniques to heart valves for kids made from synthetic materials that can last a lifetime, rapidly evolving technologies are leading us into a new era of medical science.

ILLUSTRATION BY JOHN DEVOLLE





THE LONG AND WINDING CODE

How CRISPR gene-editing technology is changing the future of health sciences.

BY CHRIS CANNON
ILLUSTRATIONS BY MARINA MUUN

“THE FUTURE IS here,” the saying goes, “it’s just not evenly distributed yet.”

There’s a good chance the last sci-fi movie you watched included an element of the fantastical that is already within our reach. To use the Star Trek yardstick, we may not have transporters and warp drive, but androids are old news, and if you own a Fitbit, you’re basically wearing a tricorder.

In the field of medical science, technology we associate with future generations is often already in play. Breaking scientific barriers is only half the battle – the real challenge is scaling technology for entire populations. One of the largest gulfs between a technology that’s currently available and the ability for the general public to access it can be found in CRISPR applications, which use a revolutionary gene-editing technique that allows us to alter the very code of our existence.

CRISPR technology (technically called CRISPR-Cas9) is based on a natural virus-defense system used by some bacteria, in which a protein slices into a genome and alters the genetic code of a living organism with tremendous precision. “Bacteria can be infected with viruses, so they developed a particular machinery that basically cuts the viruses into little pieces,” explains Josef Penninger, director of UBC’s Life Sciences Institute and the Canada 150 Chair of Functional Genetics.

“This is basically the bacterial immune system, and we use this bacterial machinery to cut into genes, to rapidly engineer genomes, to inactivate genes, to make single-point mutations in genes.”

The DNA sequences that comprise the CRISPR family are known as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), and in less time than it takes to decipher that term, a CRISPR platform can combine those sequences with a Cas9 protein to cut into a cell’s genome and add or remove genes. “And it’s not just engineering the genome in human cells or mouse cells,” adds Penninger. “It can be done essentially to every organism on the planet.”

The scope is almost beyond belief. CRISPR technology has already been used to engineer probiotic cultures in yogurt, to modify yeast for biofuels, to cure malaria in mosquitos, and to create hardier, more nutritious farm crops.

The biomedical applications of gene editing are limited only by the imagination. Any malady that has a genetic component – either by birth or by mutation – has the potential to benefit from CRISPR gene-editing techniques. While many illnesses have environmental as well as genetic factors, being able to control the genetic contributor to Huntington’s disease, cystic fibrosis, muscular

dystrophy, cancer and heart disease, just to name a few, can change the face of public health.

Penninger wants to see that change happen at UBC, by building a CRISPR super-platform that will help medical researchers expedite the development of treatments for gene-related medical conditions, and work at the forefront of the rapidly evolving technology.

It would be a major advancement in a scientific field that can barely keep up with the string of major advances it's lately enjoyed. Genomic science is barely out of diapers compared to other scientific fields. It's only 150 years since Gregor Mendel founded the field of genetics, less than 70 since we identified the structure of DNA, and 25 since the first cloned mammal. If you remember Dolly the sheep, you are older than the modern age of genetics.

But these were passive applications – reading a book is one thing, writing a book is something else entirely. “It's really the first time in our history where we don't have to just sit by and observe nature, to set up the experiment to see what happens,” says Penninger. “We can actively change the genetic setup of organisms, from flies to worms to mosquitoes to, of course, humans – all with the promise of new human medicines.”

In terms of impact on healthcare, medicines are only the beginning. CRISPR tech has been able to turn adults' cells into stem cells, essentially turning back time. Researchers can then use those stem cells to create new tissues, which could eventually lead to the ability to grow entirely new organs genetically tailored for the individual. At the Institute of Molecular Biotechnology of the Austrian Academy of Sciences in Vienna, which Penninger led as the founding scientific director from 2002-2018, researchers are already growing blood vessels, heart components, and “mini-brains” that help researchers observe and understand how cancers develop.

But what matters is where the technology has its true impact – in patient care. The very concept of “precision

medicine” is rare in healthcare, with the greatest resources generally steered towards the broadest applications. Gene-editing technology opens the door to treatments for a host of rare diseases that might be cured in an afternoon.

“I think the first applications clearly will be in this rare, single-patient scenario,” says Penninger. “Because the common diseases – diabetes, Alzheimer's, Parkinson's – most of these diseases are multifactorial. It would be nearly impossible just to change one gene and we won't have Alzheimer's anymore or diabetes anymore. So the first people benefiting from these new technologies will be people with rare deadly diseases.”

Penninger tells the story of two siblings with a rare anemia that prevents them from making enough red blood cells, which the body needs to transport oxygen to the organs. Because this is caused by a genetic mutation, his team was able to use CRISPR techniques in stem cells to repair the underlying gene mutation and then create new red blood cells to model the disease process and test which genes are responsible.

The father of the children has the same mutation, but he is perfectly healthy. So they took cells from the father, brought them back into a stem-cell-like stage, and compared them side-by-side with his children's stem cells. Experiments like this help them to understand the disease on an entirely new level, potentially leading to a solution as simple as turning off a light switch.

But who pulls those switches? How do we know when we are crossing a line when that line is microscopic, and the options infinite?

Penninger quotes Dostoevsky's *The Brothers Karamazov*, where he called psychology “a stick with two ends... it all depends on whose hands it is in.” That's where we are with genetic science today, and since the genie is out of the bottle, that's a place we're going to have to get comfortable with.

“I think we all have to be aware we are tampering with technology, with nature, and there will be some accidents. But in the grand scale I think this is clearly technology that will advance biomedical research and medicine and advance our life on this planet.”



CRISPR TECHNOLOGY HAS ALREADY BEEN USED TO ENGINEER PROBIOTIC CULTURES IN YOGURT, TO MODIFY YEAST FOR BIOFUELS, TO CURE MALARIA IN MOSQUITOS, AND TO CREATE HARDIER, MORE NUTRITIOUS FARM CROPS. THE BIOMEDICAL APPLICATIONS OF GENE EDITING ARE LIMITED ONLY BY THE IMAGINATION.

It's a question we've struggled with since the dawn of technology – what risks are worth what rewards?

Until just a few hundred years ago, this was a local question, affecting only those within the grasp of the decision-maker's reach. Since the industrial revolution, into the nuclear age, and now with the ability to literally program our environment, it's become a global one, where the future of the human race – for better or worse – could hinge on a single strand of modified DNA.

How do we maximize the medical benefits of this biotech while preventing its misuse? How do we navigate the impossibly complicated regulations (and lack thereof) across 200-plus nations that can't even agree to stop making disposable plastic? How do we avoid starring roles in Jurassic Planet?

“Much of the challenge that we face in terms of policy, including CRISPR, is that whatever we find out about the magnitude and probability of risks and benefits, the choice about what counts as important and how they weigh against each other is not a scientific choice,” says Michael Burgess, a biomedical ethicist at UBC's School of Population and Public Health who has been studying genetics for more than 25 years.

“Ethical theory doesn't determine that either. These are effectively political choices, and we have to involve an informed public in the discussion.”

And just how far is an informed public willing to take it? Almost universally, Burgess says, people are more risk tolerant for technologies that address human health than they are for advances in environment and food systems. Splitting genes to solve diseases sounds a lot sexier to people than monkeying around with the food supply.

So when it comes to our health, not to mention our future genetic lines, how far down that slippery slope are we willing to go before digging in the spikes?

It's a tough question to answer if the slope keeps changing shape. “Science moves incrementally in terms of its accumulation of knowledge,” says Burgess, “but it also tends to move social policy incrementally.”

It wasn't long ago that in-vitro fertilization (IVF) procedures were banned or unavailable in some countries, and, even if available, weren't covered by insurance. But as society more fully embraced having children as a natural right, IVF became a common feature in healthcare coverage.

CRISPR applications are likely to be heading down the same slope, from a novelty few can access to a human right under the principle of equitable healthcare for all. Inevitably that means we will be deliberately changing the very nature of our descendants.

“Whenever we're assessing technology, there's the intended consequences, the thing we're designing something to do,” says Burgess. “And gene editing is an improvement over other forms of genetic modification, because it's much more precise in replacing a sequence in a certain place. What we don't know is what the effect of that is on the entire organism and over generations. So the question is, how far do we go? And then what do we do when we release that from a laboratory into a situation where the environment acts upon it?”

For the most part, we tend to accept that nature itself is unjust. It doesn't fairly distribute benefits and burdens, and over the course of history we have always intervened to figure out how we can better distribute our resources, the benefits of healthcare, and the risks of the technology we implement. But we are imperfect at assessing our own fallibilities, so often society has to make some guesses and take some chances. And usually the consequences of those guesses and chances are passed down to future generations.

Often – as we have been recently reminded – this is for the better.



▼
**Josef Penninger
(centre) with students.
He is the Canada 150
Chair in Functional
Genetics and director
of the Life Sciences
Institute at UBC.**



No other organization in Canada contributed to solving the COVID pandemic as much as UBC and the Life Sciences Institute, largely the benefit of work done years before. Pieter Cullis, who served as LSI's director before Penninger, developed the nanoparticles used in the Pfizer and Moderna vaccines more than a decade ago. UBC adjunct professor Carl Hansen and colleagues co-founded AbCellera – Canada's most valuable biotechnology company – and developed the first antibody treatment for the disease based on work done at the university's Michael Smith Laboratories in 2012. And Penninger's own work almost 20 years ago, before he arrived at UBC, established that the ACE2 enzyme found on the surface of most cell walls is the gateway through which viruses – including SARS-CoV – infect humans. Today, he is leading investigations into some promising anti-viral drug therapies targeting SARS-CoV-2, which causes COVID-19.

“Developing the vaccines we've got right now was a spectacular triumph

of science,” says Penninger. “It's quite remarkable. And there would have been no way without Pieter Cullis' work that vaccines would have been developed that fast. You never know what, in 10 or 20 years, might save our planet.”

This is why Penninger thinks the time is ripe to develop in North America the type of organization he grew at the Institute of Molecular Biotechnology in Vienna, considered one of the premier research facilities in the world. By transplanting the model to UBC, he envisions building a CRISPR hub available to researchers from any field of science, offering a skeleton key to crack any genetic puzzle on earth.

“A super-platform will help any researcher working on any organism to get help from a team of expert technicians who are permanently up to date with the latest technologies,” he says. “At the end of the day, CRISPR is CRISPR. You can adjust the basic technology to flies or humans to wheat. This really will allow everybody from every field to be faster and better.”





The Little Discovery Engine that Could

UBC spinoff AbCellera's rapid response to COVID-19 has multiplied its capacity for discovering more antibody therapies, targeting everything from autoimmune disease to cancer.

BY RICHARD LITTLEMORE
ILLUSTRATION BY FERNANDO VOLKEN TOGNI

THE ANTIBODY: IT'S a very small thing with a very big potential. The right antibody at the right time can save your life. Or it can turn your fledgling UBC startup into a multi-billion-dollar company, almost overnight – although the latter possibility applies to a pretty rarified cohort.

Either way, a good antibody can be hard to find. While the average person might produce a billion antibodies in a single day, they are typically versions that are designed to fend off familiar foes. If something new shows up – something like SARS-CoV-2, the virus that causes COVID-19 – your immune system is running blind. It prints out random antibody variants, working by trial and error to find one that is effective against the new threat and then hustling to make enough copies to have an impact. That can take weeks, during which you are dangerously exposed.

So, it's nice to have help. One option is to use a vaccine – containing a “dead” virus, or a harmless feature of the pathogen – to safely introduce your immune system to a new threat. That triggers production of effective antibodies, but it still takes time for your system to react.

In an emergency (as in, when you are already sick, haven't been vaccinated and are at heightened risk from the virus), it's better to have access to an external supply of the right kind of antibodies. These “monoclonal” antibodies are harvested from human (or, sometimes, zoonotic) sources, and cloned – brewed in large vats. The most famous example is the monoclonal antibody treatment from the US company Regeneron that was used to rescue then-President Donald Trump last year.

But even here, time is the enemy. It's incredibly difficult to find, refine and develop monoclonal antibodies. Véronique Lecault, the Chief Operating Officer of UBC spinoff AbCellera Biologics Inc., says that if

◀ Loading a sample onto a robotic arm to perform high-throughput screening. Photo: AbCellera.

you are using conventional technology, which dates to the 1970s, it typically takes 10 years or more to go through the discovery and development process. Yet, from a standing start last March, AbCellera took just over three weeks to find and deliver a monoclonal antibody candidate that they called bamlanivimab (named, one assumes, by scientists, not marketing people). The drug giant Eli Lilly optioned the “bam” and quickly brought it to market, winning regulatory approval and finding eager and deep-pocketed buyers all over the world. In December, when the already profitable AbCellera launched its Initial Public Offering (IPO) on NASDAQ, its \$20 opening share price more than tripled and the company raised upwards of \$555.5 million, ending its first day with a market capitalization of \$12.65 billion. It was the largest biotech IPO in Canadian history. Again: very small antibody, very big potential.

FOUNDATIONS

It’s tempting to restart this story in the laboratories named for UBC’s Nobel laureate Michael Smith. That’s where “Véro” Lecault did some of the groundbreaking work on which AbCellera was founded. But it’s worth stepping back even further, to introduce AbCellera’s CEO, Carl Hansen.

Edmonton born and raised, Hansen came to UBC in the 1990s to study engineering physics and honours math. He’s still proud to have attained “one of the most high-powered degrees in the country, maybe in North America.” But heading to the California Institute of Technology for a doctorate in applied physics, Hansen realized that he had a decision to make. The great challenges in physics and math are “100-plus-year-old problems” against which people have been making very little headway. “It was difficult for me to envision how I was going to contribute anything really fundamental,” he says – where-as the field of biotechnology was

breaking wide open. At Caltech, the brilliant young researcher Dr. Stephen Quake was knocking down barriers in microfluidics and genomics, leading Hansen to believe that he could make a case for joining Quake’s lab based on being an engineer – someone who could build devices for biomedical research. “And by doing that,” Hansen says, “I get to work at the interface between engineering and biology and computation.” And that, clearly, is a critical interface.

Hansen finished his PhD in 2005 and returned to UBC as faculty, claiming his own bench in the Michael Smith Laboratories and building a team that was the definition of multidisciplinary. In 2012, he broke out with former students Lecault, Kathleen Lisaingo (experimental medicine and biophysics), Kevin Heyries (biochemistry), Daniel Da Costa (engineering physics) and Oleh Petriv (cell biology), and formed AbCellera (think “Ab,” as the scientific signifier for “antibody,” and “Cell,” as in blood cell).

The excitement of starting a university spinoff can wear off quickly. There follow years of scrabbling for financing and learning to manage a complex enterprise, even while refining groundbreaking science. Some startups get bought out early, leaving founders to pocket a profit, but mourn as some American pharma swallows yet another homegrown biotech. Less often, stubborn overachievers start grinding out a small profit, but even the biggest successes usually go 10 or 15 years before being ready for launch on a public stock exchange.

The AbCellera team made the whole process look easy and quick. They doubled the size of their staff every year and attracted ever-larger grants and investments from foundations, governments and private investors, including Peter Thiel, the billionaire co-founder of PayPal and a member of AbCellera’s board of directors.

In 2018, AbCellera got US\$30.6 million from the US Defence Advanced

Research Projects Agency (DARPA) to research antibody treatments for pandemics. The company also signed deals with some of the world’s biggest drug makers to search for antibodies useful for treating other conditions.

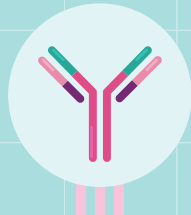
One of the key pieces of technology that made this all possible was “a credit card-sized antibody discovery engine” that earned Véro Lecault her PhD. Originally from Mirabel, north of Montreal, Lecault had gone to the University of Ottawa for a joint degree in engineering and biochemistry, because she loved both disciplines and couldn’t decide between them. Coming to UBC for a PhD in chemical and biological engineering, she soon found herself in Hansen’s lab – like him, bridging traditional barriers between engineering physics and biology.

If “engine” gives you an image of some tiny outboard full of complicated moving parts, it’s better to think of Lecault’s device as the world’s smallest test-tube tray – “a miniaturized fluid handling system,” as she describes it. It’s made of a clear, flexible silicone compound called polydimethylsiloxane (PDMS), which you might more commonly find in the form of contact lenses or as a shampoo ingredient (apparently PDMS makes hair shiny and slippery). In the AbCellera application, a thin layer of PDMS is dimpled with hundreds of thousands of very small chambers – nanolitre small (a nanolitre being a billionth of a litre).

In classical fashion for someone who studied advanced astrophysics, Hansen begins his description of this device by saying, “It’s not rocket science, really.” If you’re trying to make measurements on a single cell, or trying to detect an antibody that a blood cell is fabricating and sending out into the environment, you’ll be overwhelmed in a conventional volume of liquid, he says. “It would be like trying to detect a drop of orange juice in a swimming pool.” But if you take the same cell and put it into a volume 100,000 to 300,000

A race against the virus

Antibody treatments are essential during a pandemic, because they can be discovered and deployed much faster than vaccines and can potentially benefit people most at risk. Within 23 days of receiving a sample from one of the first US patients to recover from COVID-19, AbCellera and its partners identified 24 lead antibodies for drug development and clinical testing, which was initiated by Eli Lilly by day 90. This real-time response to COVID-19 shrunk the time it normally takes to develop a potential treatment from years to a few months.

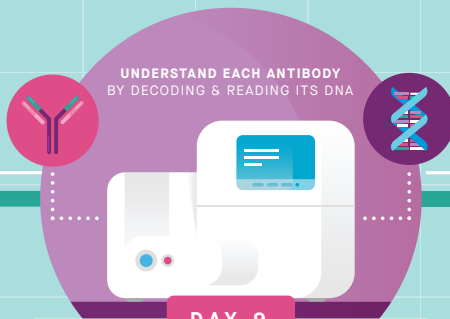


Antibodies are proteins made by the immune system to fight infection and disease. At any given moment, the human body has over a billion immune cells that make antibodies. AbCellera's technology was used to scan, decode and analyze antibodies from the patient sample to find rare antibodies that could potentially block the virus.



DAY 4

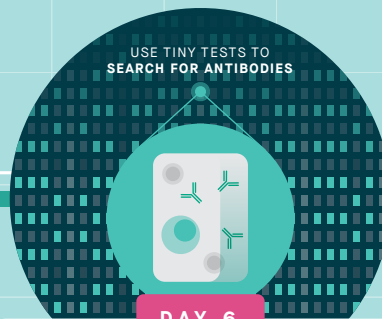
Within days of receiving the patient sample, AbCellera began screening 5,500,000+ immune cells individually to see which ones make antibodies against SARS-CoV-2, the virus that causes COVID-19.



UNDERSTAND EACH ANTIBODY
BY DECODING & READING ITS DNA

DAY 9

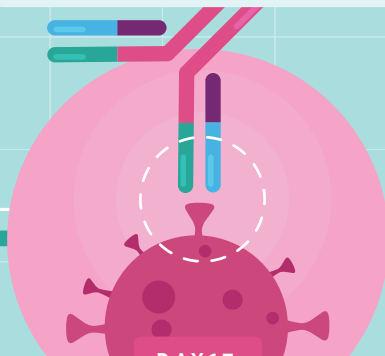
By sequencing their DNA, 500+ different antibodies that bind to the virus' spike protein were found and analyzed. The virus uses its spike protein to infect healthy cells; antibodies that block the spike protein can prevent the virus from entering cells.



USE TINY TESTS TO
SEARCH FOR ANTIBODIES

DAY 6

AbCellera used credit card-sized devices embedded with 200,000 tiny chambers to test millions of immune cells to find antibodies that stick to the surface of the virus. Positive hits glowed and machine vision was used to find and capture 2,000+ of these antibodies.



DAY 17

Using Celium™, and *in silico* tests, Eli Lilly and Company & AbCellera selected 190 of the most promising antibodies for potency testing with partners at the Vaccine Research Center (VRC).



CHOOSE THE BEST ANTIBODIES
USING CUSTOM SOFTWARE

DAY 23

Filtered down 24 antibody frontrunners for drug development with the VRC and Eli Lilly and Company.

times smaller, you get a detectable concentration. Even better, if you can crowd hundreds of thousands of these chambers onto a piece of PDMS the size of a credit card, you can then assay hundreds of thousands of samples simultaneously – or you can if the rest of Hansen’s team is there to manage microfluidic machine vision, hydrogen microscopy, and artificial intelligence adequate to generate and track enormous quantities of data.

FROM SCIENTIFIC INNOVATION TO BUSINESS APPLICATION

That, then, gets to the problem and the promise of the AbCellera business model. Conventionally, the simplest road to business success is to pick one thing and do it well, or to make one product and sell it many times. But Hansen and his colleagues don’t want to start a medical device company. They want to leverage their multidisciplinary capacity to discover new antibodies, which, Hansen says, means they have to “invest along the entire stack,” bringing together specialties

distribute and sell the ultimate drug or treatment.

This is both a nuisance and a good thing. It’s a nuisance, Hansen says, because “no one really believed that was a good way to build a business until it [AbCellera] really started to catch fire last year.” It’s a good thing, though, because of another business principle: it’s risky to have too many eggs in one basket.

ONE GIANT STEP FORWARD, ONE STEP BACK

In March last year, when AbCellera received its first COVID-infected blood sample, it took just 23 days to identify 24 candidates for development as monoclonal antibodies. Within 90 days, bamlanivimab was in clinical trials, and before the end of the year, 15 countries had authorized its use. The US offered US\$1.2 billion for 950,000 doses and promoted the treatment enthusiastically. Canada paid US\$21.3 million for more than 17,000 doses, but most of those continue to sit on the shelf.

Every individual on Earth has a capacity to fabricate “somewhere north of a trillion different antibodies, different DNA sequences – some small fraction of which may bind in a way that could make it a drug.”

including biochemistry, genomics, single-cell analysis, microfluidic machine vision, instrument design (“I probably forgot some”) to come up with a single antibody that can be replicated or formulated into a treatment or drug. With bamlanivimab, they proved that they can do so – and fast.

But the AbCellera team isn’t satisfied with that, either. They don’t want to find a single drug or treatment and build out a capacity to deliver it directly to market. They want to stay in the intellectually intense (and capital intensive) space where they are discovering all the time – identifying antibodies that they can licence to big pharma companies that manufacture,

In circumstances that Hansen describes as both infuriating and heartbreaking, provincial health authorities across the country balked. Despite the international uptake, Canadian officials weren’t convinced that the benefits of the treatment were worth committing the resources in an already overburdened system. (Each treatment requires a transfusion and must be administered early in the infection to be effective.) This rejection was a particular blow to AbCellera staff, some of whom had family members endure a shattering COVID infection, while being denied access to a treatment that might, at the very least, have

reduced the severity and longevity of their sickness.

It can’t be a coincidence that, as governments concentrated their investment in COVID vaccines, AbCellera’s share price slid from over \$70 to less than \$24, before climbing back (at time of writing) to just over \$30. That more than halved the value of Hansen’s own \$3 billion-plus in AbCellera stock, but if he is annoyed, he is not deterred. Indeed, Hansen, who sports a Jeff Bezos hairstyle, also harbours an Amazon-level of ambition. (Asked if he might forsake management to concentrate on science, Hansen name-checked his exemplars – entrepreneurial founders who have made the jump from science nerd to CEO: “Zuckerberg, Gates, Elon Musk, Jeff Bezos – it’s hard to think of a counter example.”)

In AbCellera’s widening world, Hansen is forever talking in billions and trillions. For example, he says, every individual on Earth has a capacity to fabricate “somewhere north of a trillion different antibodies, different DNA sequences – some small fraction of which may bind in a way that could make it a drug.”

As a class of drugs, antibody-based treatments currently constitute a \$240-billion industry. And AbCellera, which Hansen says has “somewhere between 50 and 70 antibody drug discovery deals with some of the best companies in the world,” is looking to find therapies for “cancer, inflammation, autoimmune disease, obesity, diabetes, cardiovascular disease, neurodegenerative disease, infectious disease, just about everything.” And while drug-company partners narrow their focus – and their potential – by concentrating on proven moneymakers, AbCellera will continue upgrading its investigative stack. It will leverage its COVID windfall and an incredible talent pool (UBC grads comprise more than half of AbCellera’s staff) to bolster its discovery engine.

So, no longer a very small thing, and the potential is bigger than ever.

HUMAN ON A CHIP

UBC's Hedtrich Lab takes on
Canada's other drug crisis.

BY DIANE HAYNES
PHOTOGRAPHY BY RAEFF MILES

IT TAKES AT least 15 years and millions of dollars to bring a new drug to market, and most fail in Phase II or III of development. A key reason is that the differences between humans and non-human animals – still the standard subjects of preclinical studies – is too great.

“We can do better,” states Dr. Sarah Hedtrich simply.

Hedtrich leads research in the eponymous Hedtrich Lab within UBC’s Faculty of Pharmaceutical Sciences. Combining expertise in pharmacology, biomedical engineering and drug delivery, her team of 11 aims to establish next-generation therapies, nanomedicine, and tissue engineering and regeneration with a particular focus on diseases of the human skin and lung. Their highly interdisciplinary work involves close collaboration with experts in chemistry, medicine and genetics. Perhaps most novel of all is the fact that Hedtrich does not use any animals in her research.

“Mice simply don’t develop eczema,” Hedtrich explains. “[Researchers] trigger eczema artificially and then use this as the model to test the drugs. But they have no idea if what they see in those animals represents what happens in humans. In my field, animal models are not predictive enough. I am trying to develop human-centred methods to reduce, and maybe at some point replace, animal models.”

Hedtrich specializes in 3D tissue models, specifically of skin and lung tissues, that feature all of the important layers, structures and reactivity of human skin. She connects them with other 3D organ models to form a network that begins to resemble and behave with the complexity of a living human organ system. Organs on a chip.

Hedtrich holds up a plastic chip approximately 4 centimetres long by 8 centimetres wide by 1 centimetre thick – readily available online, apparently – out of which rise three circular, dished cylinders of different heights and diameters, each meant to hold a different organ tissue model. Each cylinder is connected to the others by a microfluidic channel etched into the plastic, to which a pump is attached that moves the culture medium through the channels to simulate blood flow. The whole thing resembles a cool-looking toy – Lego for lab nerds.

“In our bodies, no tissue is isolated,” Hedtrich says. “Everything is connected. When I apply something to the skin, it ends up in the bloodstream and then the liver. In order to predict what a drug will do in the human body, you need complex systems where different tissues are connected.”

US\$2.6b

Current average cost to develop one new drug

6,013

Number of active clinical trials in Canada in 2020

15 years

Average time to market for a successful drug

4,562,522

Number of animals used for scientific purposes in 2019 (self-reported)

up to 90

Percentage of drugs that fail in development

In a recent *Nature* article on how COVID-19 has highlighted the urgent need for alternatives to animal models by which to study human viruses, Hedtrich *et al* state that once scientists are able to engineer a 10-organ system – with circulatory, endocrine, gastrointestinal, immune, integumentary, musculoskeletal, nervous, reproductive, respiratory and urinary tissue models – they will have achieved the complexity researchers require: human on a chip.

Currently, setups are not modular (most chips aren’t made to connect with one another), are expensive, require significant and highly specialized expertise to engineer and operate, and can take one to two years to build. Many researchers who need or would prefer to use these setups do not have the financial resources or the expertise of a Hedtrich Lab to create the tissue models. “If we want more people in biomedical engineering to use these, then we need cheaper systems and we need modular systems,” Hedtrich says.

While Hedtrich cautions that no large studies have yet proven these models’ superiority to animal models in predicting drug efficacy, she cites cosmetics and toxicity testing as immediate use cases. In fact, approximately 40 countries worldwide have already banned animal testing of cosmetics. Canada, however, is not one of them. At a policy level, Canada lags well behind the EU, Asian countries, South America and the US.

A relatively recent arrival from Germany, Hedtrich expresses surprise over Canada’s failure to play a leading role in the global movement toward animal alternatives. However, she is unstinting in her praise of Canadian scientists in this field, saying they are at the forefront of this research. And, together with organizations such as the Canadian Centre for Alternatives to Animal Methods (led by UWindsor’s Dr. Charu Chandrasekera) and the Canadian Society for Humane Science (led by UBC’s Elisabeth Ormandy), she intends to build a national network to foster awareness, education and training, and collaboration.

Hedtrich and Ormandy offer an undergraduate course at UBC – New Approach Methods in Biomedical Science. Hedtrich’s lab-based graduate course will resume once in-person work is possible again, and she is committed to training young researchers in these alternative methods. She knows that unless something changes at the policy level, they’ll face the same barriers to accessing funding and even to publishing their research findings that she faces now. “The field is still in its infancy,” Hedtrich concedes, “but I’m convinced this is the future.”



The Language of the Eyes

A novel method for assessing dementia risk could help populate critical drug trials.

BY DIANE HAYNES
ILLUSTRATION BY FERNANDO VOLKEN TOGNI

BICYCLE, VELVET, CHURCH. I watch over her shoulder as she tries to draw 10 minutes before 11 o'clock on a blank circle. *What is today's date? Who is the Prime Minister of Canada? What did you eat for lunch yesterday? Count backwards from 100 by intervals of seven. Now, what were those three words?*

The test is known as the Mini Mental State Examination (MMSE), and the 30-question exam is standard in both clinical and research settings for non-invasive diagnosis of mild cognitive impairment (MCI) and dementias. My 80-year-old mother, a primary school teacher from 1962 to 2002, attempts to answer questions her students might have aced. She fails. Perhaps worst of all, she knows it.

In 2016, her score is 26 out of 30. She is given a diagnosis of MCI, and we leave the clinic shaken but determined to beat this thing. By 2017, it is 17. In 2018, it's 9. According to the geriatrician, at 9 she should not be mobile, or able to feed or toilet herself. But she is. She is also gardening, exercising, lunching with friends. Right now, though, she is crying. Despite having provided no functionally useful information and no change to the course of treatment, this latest test feels like a TKO.

According to the Alzheimer's Society of Canada, 44 million people worldwide – including over 747,000 Canadians – are living with Alzheimer's or another dementia. The incidence of dementia increases five-fold every year from age 65 onward; one in four seniors aged 85-plus has a dementia diagnosis. Most insidiously, new research shows changes in the brain and body up to 20 years before symptoms appear.

Therapies with the potential to slow or alter dementia's progression have failed to date in part because by the time a diagnosis is made, neurological changes are too far advanced for the interventions to be effective. Because of disease stealth and persistent social stigma, drug trials are struggling to find enough appropriate candidates, and screening costs can reach \$100,000 per person. Already, up to 90 per cent of all potential therapeutics fail in the

development stage. But right now, potentially efficacious dementia drugs are failing for lack of trial participants. In 2018, these numbers drove Pfizer out of the Alzheimer's race altogether.

Enter: CANARY. Ever the emblem of the sensitive early warning system, in this case, CANARY is acronymic for Clinical Data, Natural Language Processing and Eye Tracking for Dementia Risk Stratification. Neurodegeneration in Alzheimer's disrupts gaze and language pathways, and signs are detectable before any cognitive symptoms appear. A UBC team was first in the world to determine that by tracking the two behaviours in concert and over time, they can identify and assess risk for MCI and Alzheimer's disease with greater success than by assessing either in isolation.

Dr. Thalia Field leads the CANARY team, a group of multidisciplinary researchers working in natural language processing, machine learning, AI, computer science and neurology. A stroke neurologist and clinician-researcher with UBC Medicine, Field champions the use of technology to improve experiences and outcomes for both clinicians and patients.

Her colleague Dr. Hyeju Jang is a CIHR postdoctoral fellow in Computer Science and the Data Science Institute at UBC and the BC Centre for Disease Control. With a doctorate from the Language Technologies Institute at Carnegie Mellon University, Jang explores humans' use of language through the lens of computation.

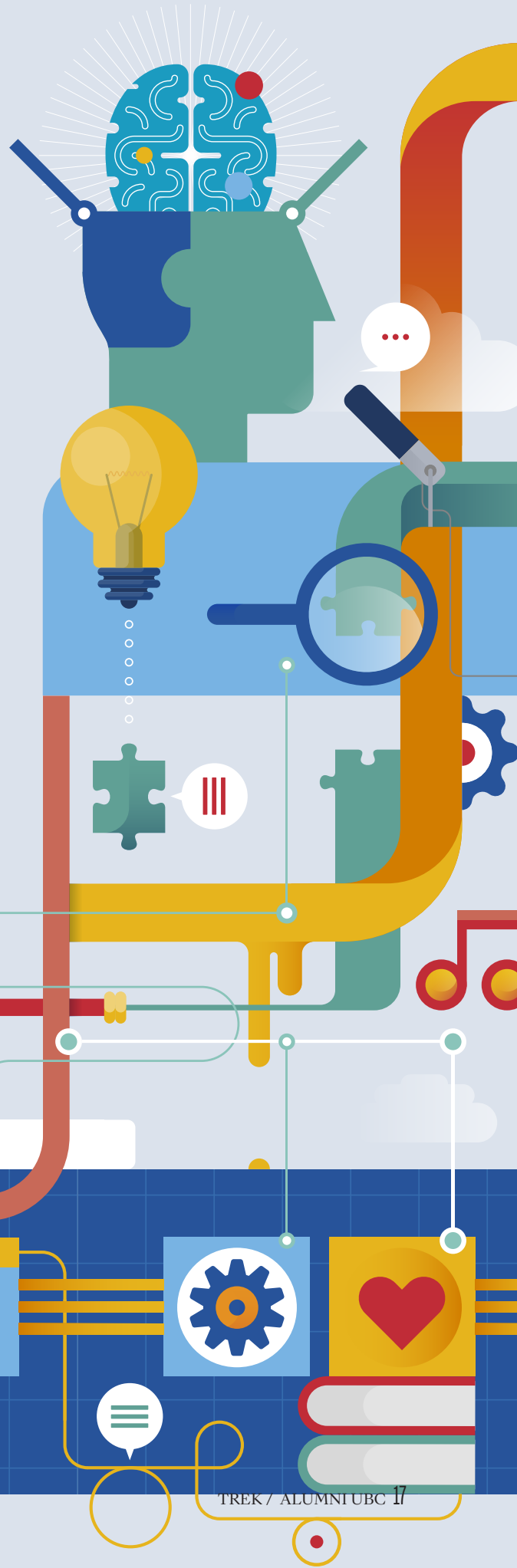
They built a machine learning model from a 1980s dataset comprising audio recordings and transcriptions of 257 dementia patients and 242 healthy elderly controls. Using a neural network, a relatively new form of machine learning algorithm, and including age as a factor, the model changes as new volunteers enter the study and the dataset grows. By tracking speech patterns and eye movements in concert, the model's predictions as to whether someone is clinically at risk for dementia or a healthy control has improved from 73 to 80 per cent.

Remarkably, English is not Jang’s first language, and as Field says of the team’s multidisciplinary collaboration, “We are *all* learning each other’s languages.” This humble exploration across disciplines speaks to the sensibility required for reenvisioning the way the medical field approaches predementia and dementia patients. Because after over a century, there is still so much we don’t know.

With my eyes, I follow a dime-sized red circle around the perimeter of my screen, then I focus on a cross in the screen’s centre. Next, I describe a drawing, then read the paragraph that appears. Finally, I choose a topic from a list and tell a story based on a personal memory. These five exercises form the core of the CANARY test. Although I’m nervous, Field’s research assistants, Caitlin Lewis and Tom Soroski, put me at ease. Now in my mid-50s, I’m apprehensive about what the test might reveal, but since there’s no apparent right or wrong, I find myself enjoying it. Then, after a short survey about the experience, Tom and Caitlin administer the MoCA – the Montreal Cognitive Assessment. I quickly recognize most of its content from the MMSE. I repeat sequences of words and numbers after Caitlin. I draw a clock that says 10 minutes after 11, but my 3D cube is all wonky. I get flustered, feel my face flush and my heart race, wonder if I’m messing up my countdown by sevens. *Face, velvet, church, daisy, red*, I blurt out at the end, before I can forget.

We say goodbye, the screen goes dark, and all I can see now is my own reflection – a face so much like hers – staring back at me. This one’s for you, Mom, and for everyone looking toward a better outcome.

CANARY is seeking volunteers to advance its research. See page 54 for details.



CAN YOU CATCH OBESITY?

Dr. Brett Finlay and colleagues think that many “non-communicable” diseases – including obesity, heart disease and diabetes – may actually be transmitted through the trillions of microbes in and on the human body.

WHAT LINKS HAVE BEEN FOUND BETWEEN MICROBES AND NON-COMMUNICABLE DISEASES (NCDS)?

For over a century, since microbiologists Robert Koch and Louis Pasteur showed that microbes caused infectious diseases, our approach to prevention and treatment has been to kill pathogens through sanitation and the use of antibiotics, as well as the use of vaccines.

As a result, diseases like scarlet fever and polio are no longer the killers they once were, but this decline in infectious disease has coincided with an increase in what are classified as non-communicable diseases, such as diabetes and asthma.

It was only 10 to 15 years ago – after research into increased rates of child asthma – that we started to realize that in getting rid of all the bad microbes we had also been destroying some of the beneficial ones that we need to have in us and on us. The research proved that if children don’t get early exposure to beneficial microbes, they won’t develop normally and are at greater risk of developing asthma later on. Since then, most other prevalent Western diseases – including allergies, obesity, Alzheimer’s disease and cardiovascular disease – have also been linked to a lack of beneficial microbes (or increase in detrimental ones).

The best example of a causal role for microbes, mechanistically, is cardiovascular disease. We know people can get atherosclerosis because the microbes that break down red meat use an enzyme to do so that leads to a secondary product, which causes hardening of the arteries, leading to heart disease and stroke.

The exciting part is that in animal models, if you inhibit those microbial enzymes, you can prevent cardiovascular disease – no matter how much red meat is consumed. So the determining factor is not so much cholesterol levels as the presence of certain microbes.

We have demonstrated that people with a wide range of conditions, from obesity and inflammatory bowel disease to type 2 diabetes and cardiovascular disease, have altered microbiota. Of course, there are probably genetic components to some of these diseases, but for those you can’t explain based on genetics, it always comes down to the microbes.

WHAT EVIDENCE IS THERE THAT MICROBES TRANSMIT THESE DISEASES BETWEEN PEOPLE?

Animal experiments involving fecal transfer from diseased humans into healthy mice have shown that the disease phenotype is also transferred. That is pretty stunning. It's like putting a human pathogen into an animal model and seeing it cause disease. It's even been shown to be the case with Parkinson's, which is a brain disease.

Of course, you can't try the same experiment with humans to see if they get sick, but the risk of inflammatory bowel disease is much higher in spouses of people with the condition than it should be, for example, because they are sharing the microbes that are involved in this disease. And if you have an obese friend, you have a much higher chance of being obese yourself. There was also an interesting study on an island in the South Pacific, where the researchers figured out who was married to whom just by looking at the microbes in the feces.

The Achilles' heel of these experiments is that you can't definitively prove the microbes are transmitted rather than independently picked up from a shared environment and lifestyle. But data shows people do exchange microbes with one another – for example, tens of millions of them with a kiss – and microbes from dogs are picked up in their owners, which can't be accounted for by a shared diet. There are lots of smoking guns.

DOES YOUR HYPOTHESIS APPLY TO ALL NCDS?

I think different diseases involve different microbial contributions. I looked closely at cancer. If microbes are involved, spouses of people with cancer should show increased incidence, but that really didn't show up, so I think cancer is a genetic change – usually a particular mutation that causes cells to proliferate. Unless the microbes are generating those mutations, they probably don't have a lot to do with it.

IN LIGHT OF WHAT WE'RE LEARNING, WHAT NEW TREATMENTS AND PREVENTION ARE BEING DEVELOPED?

I'm working with companies to develop live bio-therapeutic products, or LBPs, which are like a probiotic but targeted at specific



BRETT FINLAY, OC, OBC, FRSC

Leading microbiologist who holds the Peter Wall Distinguished Professorship at UBC, specializing in the role microbes play in health and disease

BOOKS

As well as publishing hundreds of academic papers, he has co-authored two books aimed at the public: *Let Them Eat Dirt: Saving Your Child from an Oversanitized World* and *The Whole-Body Microbiome: How to Harness Microbes - Inside and Out - For Lifelong Health*

CURRENT PROJECT

Tracking children born during the pandemic to investigate the long-term effects of hygiene and isolation on their health and microbial balance

diseases or their prevention. Most of us in the field believe that, eventually, we should be able to take mixtures of microbes and correct issues that the harmful microbes, or lack of beneficial microbes, are causing.

Most of the treatments available today involve fecal transfers. Life-threatening *Clostridium difficile* infections, for example – which can set in after microbes are killed off by the antibiotics used during surgery – has a 95 per cent cure rate using this method. A form of inflammatory bowel disease, ulcerative colitis, has a 40-45 per cent success rate, which is much better than any drug treatment we have. Even in autism, there are some interesting fecal transfer studies coming out.

WHAT CAN WE DO NOW TO LESSEN OUR CHANCES OF DISEASE?

When COVID hit, the only way we had to deal with it was the same way we had in the past, and that's through hygiene measures. The last year has drastically changed our world from a microbial point of view, and we need to pay attention to this, because I think we will see an effect.

I can't give you a microbe pill today. But I can tell you to take the kids outside and let them play in the dirt, get a dog in the house, change to a healthier diet – all these things push microbes in a healthier direction to decrease the damage that's been done.

Each generation we get cleaner and cleaner, and living in cities means our microbes are getting less and less diverse. I'm really concerned that two or three generations from now, we'll realize that we've killed off microbes that we actually need to survive as a species. There are even researchers who are bio-banking microbes from various isolated communities around the world, such as Papua New Guinea, because they have very different microbes than the rest of society.

Just realizing that microbes are intrinsically involved in the evolution of our species, and that they themselves evolve, changes how you think about diseases and what you can do to prevent them. It used to be that you eat a healthy diet because it gives you the right vitamins and nutrients. And now that book has been rewritten: you eat a healthy diet, because it makes your microbes healthier – and they then have a beneficial effect on you. It always comes down to the microbes.

OPINION

Climate change is a public health emergency.

DR. COURTNEY HOWARD

ILLUSTRATION BY MARINA MUUN



▼
**DR. COURTNEY
HOWARD**
MD'05

▼
Emergency
physician in
Yellowknife

▼
Head of advocacy
for WHO's Civil
Society Working
Group on Climate
Change and Health

▼
Past president
of the Canadian
Association of
Physicians for the
Environment

Illustration: Margie and the Moon

COVID-19 HAS EXPOSED major gaps in our ability to prevent and respond to infectious disease outbreaks. As many epidemics including SARS, HIV/AIDS and Ebola have shown, we must include animal and environmental health factors in our discussions. In fact, there is increasing awareness that managing the overlapping health threats we currently face means shifting the overall frame within which we consider wellbeing to what is called “Planetary Health,” defined by the *Lancet* as “the health of human civilization and the state of the natural systems upon which it depends.”

One of the most urgent imperatives for this shift is the need to generate a healthy response to climate change, which is recognized by the World Health Organization (WHO) as the biggest threat to global health in the 21st century. And that threat is increasing. The Vancouver I grew up in is now bathed in smoke most summers. People with allergies on the Prairies are sneezing through longer and more severe pollen seasons. And Lyme disease is impacting an ever-larger part of Canada. As an emergency physician in Yellowknives Dene Territory, I serve a patient population extending up to the high Arctic, where Inuvialuit, Dene, and Gwitch'in peoples are already coping with the unstable ice, food insecurity, and mental health challenges that come with living in a place that is 3 °C warmer than when their octogenarian Elders were born.

My UBC training prepared me for many health emergencies, but not this one. How should we respond?

The *Lancet* tells us that tackling climate change is our biggest health opportunity. Many of the measures needed to stabilize our ecological foundations would have corresponding health benefits. A recent Harvard study showed that in 2012, 34,000 Canadians died as a result of fossil fuel-related air pollution. Dirty air contributes not only to new asthma cases in children, but also to the top five chronic diseases that kill Canadians: cancer, heart disease, stroke, chronic lower respiratory disease, and diabetes. The potential to save lives by decreasing air pollution, along with greenhouse gas emissions, is tremendous. Climate policy is health policy.

Progress in low-carbon technology provides us with new options. As with tobacco, we need to stop facilitating unhealthy choices and make healthy ones cheaper and easier to access. It is a step in the right direction that the federal carbon pricing backstop was recently upheld by the Supreme Court of Canada. It is a shameful step backwards that, as of May 26, \$31.68 billion in public money (\$842.72 per capita) has been spent since the start of the pandemic to support fossil fuel energy in Canada (according to the Energy Policy Tracker out of the International Institute for Sustainable Development and Columbia University). Would you like your public dollars to go towards buying kids



cigarettes? If not, you should be appalled to see fossil fuels supported in your name. Far better to spend that money on retraining and early pensions for fossil fuel workers to help them transition to work in a clean economy.

We can save lives with health-conscious decisions on energy, transportation and the built environment. The entire world now has increased access to low-pollution energy; we need to stop telling ourselves that fracking for gas in Northern BC and exporting it as LNG to other countries is a net benefit to the globe. It's not. It also risks marring Beautiful British Columbia for generations to come. We need zero-emissions vehicle mandates, support for energy-efficient home retrofits, and continuing upgrades to active transport infrastructure. Walking and cycling both have tremendous health benefits.

The National Health System in the UK recently committed to achieving Net Zero by 2040,

telling suppliers that within the decade they will purchase only from companies with equal or greater sustainability commitments. VGH-based surgeon Andrea MacNeill has founded a Planetary Healthcare Lab, and connections and energy are building across the country.

In a Yellowknife study done in partnership with UBC's Dr. Caren Rose, we found that two and a half months of wildfire smoke in 2014 was associated with double the normal number of asthma exacerbations in the emergency department. The qualitative part of our study demonstrated that this prolonged smoky period made people feel isolated, anxious, disconnected from the land and physical activity, and worried about what the future may bring for their children.

In almost every media interview I've done since then, the reporter has asked, "Doctor, is this a new normal?" And every time I've had to say, "No. It is going to get worse. We need to prepare."

Due to greenhouse gas emissions already built up in the atmosphere, by the time a child born today in Canada is in their early twenties, the country will be 1.8 °C warmer than it was at a new baseline drawn by Environment and Climate Change Canada between 1986 and 2005. If we continue along our current high-emissions pathway, that same child will be living in a country 6.3 °C warmer by their early sixties.

Encouragingly, the final theme we picked up on in our qualitative study on wildfires was the pride and feeling of empowerment expressed by people who had taken an active role in responding to the threat – fire-smarting their homes, organizing indoor activities for children in clean air shelters, or readying boats in case of highway blockage by fire. Preparation not only does good, it feels good. Action feels better than anxiety.

Awareness of the need to co-manage climate change and the recovery from COVID-19 is increasing. As the head of advocacy for the WHO Civil Society Working Group on Climate Change and Health, I helped to launch a healthy recovery initiative asking G20 leaders to prioritize low-carbon investments. That letter was signed by organizations representing two thirds of healthcare workers worldwide. To our knowledge, this is the greatest ever show of consensus amongst healthcare professionals. As we emerge from this pandemic, we must begin by thanking the children who have stayed at home, mostly to protect their adults, by building a world coming out of it that will protect them.



Mind Games

Virtual Reality has the power to transport a user's mind to an infinite number of places and scenarios, but is it powerful enough to block out external pain? Nursing prof Bernie Garrett discusses the technology's potential.

ILLUSTRATION BY **GRACIA LAM**

WHAT IS THE THEORY BEHIND VR'S ABILITY TO RELIEVE PAIN?

We know the brain can suppress pain by modifying sensory input. A good illustration of this is that if you have more than one type of pain – both knee and hip pain, for example – you tend to only focus on one of them at a time, as neural pain attenuation tends to work in a prioritizing manner. Virtual Reality is a deeply immersive experience and essentially works as a very powerful form of distraction. It transports you to a computer-generated beach or forest – anywhere we want – and the immersion is so complete you can hear a bird tweeting, look in its direction, and see it as you move around. Although the graphics may not be as high fidelity as in real life, they are convincing enough to make you perceive you are actually there. Having the patient perform therapeutically designed activities in a VR environment forces their brain to focus on something other than the pain and allows them to get some relief from it.

HOW HAS IT PROVEN EFFECTIVE?

There is far more research on acute pain than on chronic pain. It's been shown to work well for burn patients having dressings changed, for example, immersing them in cold or snowy virtual environments that psychologically reduce the heat and pain. It's also been shown to help when giving kids injections, and I imagine in five years' time most pediatric clinics will have a VR headset they can use to distract kids during those sorts of procedures. For chronic pain, the results are still mixed, but it does seem to work well for some things, such as phantom limb pain. In fact, VR is becoming a standard therapy for this, providing experiences where the patient sees both limbs working. This seems to have a profound effect on the brain and a person's experience of pain.



DESCRIBE YOUR CURRENT RESEARCH

Chronic pain is a huge issue in Canada affecting millions of people, and it's not well managed in the health system. As nurses, we're very interested in practical applications of technologies in healthcare, so we are using VR in the homes of cancer patients with chronic pain who have been on opioids long term to see if we can help alleviate their pain in other ways. We're giving them VR headsets to use for a month and measuring their pain scores, sleep index and functional ability. A control group is viewing the same applications, but on a computer screen instead of in VR. Most pain-related VR research tends to occur in clinics and address acute pain. We're the first to conduct trials in people's homes and explore VR's use as a daily pain reduction tool.

WHAT ARE THE CANCER PATIENTS EXPERIENCING IN VR TO HELP ALLEVIATE THEIR PAIN?

We have four VR applications. Two are cognitive, requiring patients to problem-solve. For example, one involves navigating a three-dimensional light maze by manoeuvring mirrors to move light beams. Such spatial problem-solving involves a lot of high-level cognitive activity. The other two applications offer more introspective experiences – for example, a guided meditation experience while walking through a forest.

WHAT HAVE YOU DISCOVERED SO FAR?

COVID-19 restrictions mean the trials are on hold, but, as soon as we are able to recruit enough participants, we will have a good sense of whether the VR is making a difference in terms of their pain. So far, electroencephalogram (EEG) studies have shown some distinct patterns. These include changes in the brain's alpha-theta bandwidths, areas usually associated with more inward-attentive and reflective activity.

COULD VR THERAPY REPLACE PHARMACEUTICAL PAIN RELIEF?

At the moment, we're exploring it as an adjunctive therapy. Many patients with chronic pain are taking opioids, which are powerful narcotics with side effects, so anything we can do to reduce the amount they need is helpful. Also, patients can only tolerate VR for about 30 minutes, after which they can get eye strain and neck ache. So, people get a pain holiday for half an hour, but in terms of continual use we're not at the stage where we can use VR to supplant drugs. New technologies being developed that use projected VR environments instead of a headset could eliminate these limits. They would also permit more detailed neurological studies, such as MRI scans of the brain during a VR experience – currently impossible because of the metal in headsets.

RESEARCH PARTICIPANTS NEEDED

The researchers are recruiting cancer outpatients who are over 16 and experiencing moderate to severe daily pain. For more information, contact Crystal Sun, UBC School of Nursing, 604-822-7679 / crystal.sun@ubc.ca

THE FUTURE IS NOW

UBC-grown medical
marvels.

ILLUSTRATIONS BY
NAOMI ANDERSON-SUBRYAN



A HEART VALVE FOR KIDS

**ARTIFICIAL HEART VALVES USUALLY COME
IN ONE STANDARD SIZE, BUT THE REAL HEARTS
THAT NEED THEM DON'T.**

A team at UBC Okanagan is evolving valve replacement technology to address the needs of patients with smaller than average hearts, such as children. They are prototyping a prosthetic aortic valve made from an elastic synthetic mixture they say can last over a patient's entire lifespan – flexible enough to work in immature hearts and adapt as they grow larger. Unlike existing technologies, the device uses the principles of soft robotics, working in tandem with the cardiovascular system to adjust its diameter and control blood flow.

Researchers:

Hadi Mohammadi, associate professor of mechanical engineering (UBC Okanagan); adjunct professor in the Department of Surgery; Luke Ohlmann, MSc student

BLOOD FOR EVERY EMERGENCY

WHEN DISASTERS STRIKE, TYPE O – THE UNIVERSAL BLOOD TYPE – IS IN HIGH DEMAND.

Transfusion patients must receive either their own blood type or type O to avoid an immune response. The ability to convert any type of donated blood into type O, then, would be a game changer, and UBC researchers are inching closer to that lifesaving alchemy. By removing the antigens that distinguish A and B blood types from O, scientists have demonstrated that conversion is possible, but it has never been achieved at sufficient scale. The antigens are removed using enzymes that feed on sugars with a similar structure, and in 2018 the UBC researchers achieved a breakthrough when they identified a group of enzymes found in the human gut that are 30 times more efficient at the process. The following year, they succeeded in turning a unit of type A blood into type O using enzymes they had isolated and cloned. They are now testing the process for safety before moving on to clinical trials and, with help from the entrepreneurship@UBC program, have formed a company called ABOzymes Biomedical to facilitate this process.

Researchers:

Chemistry professor Stephen Withers, protein biochemist Peter Rahfeld; microbiologist Steven Hallam; pathologist Jay Kizhakkedathu





AN INJECTABLE BONE IMPLANT MADE FROM CELLULOSE

**RESEARCHERS FROM UBC AND MCMASTER ARE, QUITE LITERALLY,
PUTTING THE “PLANT” IN IMPLANT.**

They have developed what could be the bone implant material of the future, and it's derived from plant cellulose. The airy, foam-like substance can be injected into the body to provide scaffolding for new bone growth. It's made by treating nanocrystals derived from plant cellulose so that they link up and form a strong but lightweight sponge – technically speaking, an aerogel – that can compress or expand as needed to completely fill out a bone cavity. When there are gaps, implant failure can occur, as is sometimes the case with current (mostly ceramic) implants. The aerogel implants are expected to break down into non-toxic components in the body as the bone starts to heal. More testing is required before clinical trials can begin, but the material's future applications include dental implants, and spinal and joint replacement surgery.

Researchers:

Emily Cranston, professor of wood science and chemical and biological engineering; Kathryn Grandfield, professor of materials science and engineering, and biomedical engineering (McMaster)

SURGERY WITHOUT CUTTING THE SKIN

SURGERY HAS SEEN THE LIGHT, AND IT COMES IN THE FORM OF A LASER BEAM.

UBC researchers have developed a specialized microscope that uses an ultrafast infrared laser to scan living tissue up to a depth of one millimetre and help diagnose diseases such as skin cancer. And by intensifying the heat of the laser, they discovered it could also be used to precision-treat any abnormalities discovered without breaking the surface of the skin. The revolutionary instrument, which is a type of multiphoton excitation microscope, can alter the pathway of blood vessels without impacting any of the surrounding vessels or tissues, and is being developed to treat any accessible structure of the body requiring extreme surgical precision, including nerves or blood vessels in the skin, eye, and brain.

Researchers:

*Haishan Zeng and Harvey Lui, professors of dermatology and skin science;
former postdoctoral fellow Yimei Huang; PhD student Zhenguo Wu*



PREVENTING BLINDNESS WHILE YOU SLEEP

**UBC RESEARCHERS HOPE THEIR NEW MEDICATED DROP
WILL BE ONE IN THE EYE FOR GLAUCOMA.**

Although effective drugs already exist for treating glaucoma – which is the number one cause of irreversible blindness in the world – the challenge lies in delivering them to where they're needed. Medicated drops have a tendency to roll off the eye instead of being absorbed, and don't always reach the back of the eye where the drug is needed to repair neurons and relieve pressure on the optic nerve, which can progress to glaucoma. And although cannabinoids like CBGA (cannabigerolic acid) are effective at relieving symptoms, they don't easily dissolve in water – a barrier to their medicinal application. The team's solution was to develop a hydrogel and fill it with thousands of nanoparticles containing CBGA. Applied at bedtime, the substance responds to blinking and conditions within the eye to mould itself into a lens-like coating. The nanoparticles slowly dissolve overnight and penetrate the cornea. The drops are now undergoing clinical testing by industry partner, InMed Pharmaceuticals, and the researchers are exploring if the hydrogel can be used to deliver drugs for other eye disorders, such as macular degeneration.

Researchers:

*Vikram Yadav, associate professor of chemical and biological engineering,
and biomedical engineering; Syed Haider Kamal, research associate*





FIRST AID FOR ASTRONAUTS

A UBC DISCOVERY MAY PROVE USEFUL IN LUNAR EMERGENCIES.

The researchers have shown that soil silicates play a key role in blood clotting, and that this mechanism is unique to terrestrial vertebrates. They discovered that the presence of soil in wounds activates a blood protein known as coagulation Factor XII, which helps speed up the wound-sealing process. In remote situations with no access to healthcare, sterilized soil could potentially be used to stem bleeding and save lives. And it doesn't get much more remote than the Moon. The researchers are now testing silicates from the lunar surface to see if they can trigger a similar clotting reaction. If so, they might have hit on a useful first aid strategy for future colonizers of the Moon.

Researchers:

*Christian Kastrup, associate professor of biochemistry and molecular biology;
Lih Jiin Juang, PhD student*

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INSIDE

**Jaelem Bhate,
BMus'17, MMus'19**

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Conductor
and composer,
founder of
Symphony 21

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process to
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Read his story
on the next page. >>

CHANGE/ MAKERS

LIBERATING MOZART

Could non-traditional venues give classical music a boost?

BY ERIC DAVENPORT

Mozart, Brahms and Stravinsky spend a lot of time shut in at the Orpheum, but Jaelem Bhate, a rising star in Vancouver's classical scene, is literally and metaphorically taking classical music to new places. With his own symphony orchestra, Symphony 21, he's liberating the music from its concert hall confines and releasing it into the vibrant cityscape.

Symphony 21 played their first concert in September 2019 against a backdrop of exposed brick in a heritage building between Gastown and Railtown. There were cocktail bars and craft beer taps at the back of the room. And although COVID-19 has made in-person performance impossible for the last year, it hasn't prevented the orchestra from exploring other novel venues. For their 2020 digital season, they performed and filmed one of their pieces – Kirsten Ewart's "Warmth" – from the deck of the *St. Roch*, a schooner that travelled the Northwest Passage, circumnavigated North America, and now rests at the Vancouver Maritime Museum on English Bay.

This does not mean Bhate is averse to a traditional setting. He's conducted in some of Canada's grandest concert halls, including the Orpheum, where he conducted the Vancouver Symphony Orchestra in 2019. A few months earlier, he'd gained national recognition for his work when he was named one of CBC's "30 Hot Classical Musicians Under 30."

Bhate composes music with an understanding that all genres are intimately connected to one another. In high school, he was a drummer for a rock band called Negative Attraction – classical and jazz initially paling in comparison to rock and roll. But Bhate came to love music in all its forms. Soon after he entered



UBC as a science student, his old high school concert band performed at the Chan Centre. Bhate was asked to fill in as a conductor because of the BC teachers' strike. He describes it as a "lightning-bolt" moment that convinced him to drop science and join the UBC School of Music.

Today, Bhate writes exhilarating pieces for jazz orchestra as well as classical. His inspirations stretch from Leonard Bernstein to the Beatles, and he created Symphony 21 in part so that people who don't think of themselves as classical listeners would give the music a fair shot. "It's a way to introduce a new idea, so that people don't think they hate it before they even try it," he says.

Part of the allure is the atmosphere Bhate creates. Ultimately, though, the music is the centre of his project. "Everything else can sometimes get in the way of the art, and it should always be the other way around," he says. In the end, a composer's devotion is to the music. Everything else in the business is secondary.



◀ Engineering grad Kunal Sethi in UBC's HATCH makerspace. Photo: Ajay Randhawa Photography

LIFE-SAVING LIGHT

Kunal Sethi's tech startup UVX aims to mass-cleanse hospitals and care homes with a safe form of ultraviolet light.

BY JARED DOWNING

Engineer Kunal Sethi is secretive about what, exactly, his revolutionary germ-zapper will look like. But it will be small, he says: a programmable, ceiling-mounted device roughly the size of a Wi-Fi router that quietly bathes entire rooms in ultraviolet light – potentially saving tens of thousands of lives each year.

But wait – isn't UV light dangerous? Normally, yes, when the body is exposed to it in large amounts. So why is Sethi's Vancouver-based startup UVX trying to put ultraviolet emitters in operating rooms and hospital corridors?

The secret lies in "far-UVC," a type of UV light with a specific, tiny wavelength window (200-230 nanometers) that is harmless to humans but deadly to most germs. "It's kind of a sweet spot," Sethi explains. "Our outer layer of dead skin cells absorbs it, but it penetrates the cell nuclei of pathogens to inactivate them."

UVX, which is part of the entrepreneurship@UBC program, plans to release its first device, the Zener, this fall. Sethi and UVX co-founder Saimir Sulaj – a native Albanian whom he met at a Vancouver hackathon – believe far-UVC technology could be the next major step in disease prevention.

"At first, we'll focus on hospitals, long-term care homes, and COVID-19 testing clinics," Sethi explains. Now 26, he studied engineering but has had an interest in healthcare development since a botched surgery in his native Tanzania left him with chronic knee issues. When he came to UBC (with an International Leader of Tomorrow award), he co-founded the

Tanzania Heart Babies Project to raise funds and awareness for children with congenital heart disease.

His career shifted to health technologies after a pandemic-era call with a friend, a hospital nurse, who casually mentioned having to scrub down surfaces two or three times. "We ended that conversation joking about an automatic robot disinfectant," Sethi says.

But the more Sethi researched, the less of a joke it seemed. He learned that even before the pandemic, around 100,000 people died in the United States each year of infections contracted at hospitals, which are breeding grounds for drug-resistant superbugs. When Sethi learned about far-UVC technology, it had already been well-researched and was even undergoing clinical trials. Yet other than a few early experiments (including a self-cleaning plane lavatory by Boeing), it had not really hit the market.

"I guess there wasn't enough traction, enough interest before COVID-19," Sethi says. "People often ask us, 'Is this only applicable to COVID-19?' And no, it's not, because you'll always have *C. diff.*, H1N1, Salmonella, other infectious pathogens beyond SARS-CoV-2."

Sethi believes the pandemic will leave us, if nothing else, with a new appreciation for health and hygiene – and a new awareness of the microscopic killers that prey on the sick and elderly.

He can see a future in which germ-killing lights shine in every bathroom, subway car and restaurant kitchen, quietly zapping our germs into oblivion.

Kunal Sethi,
BASc'17



Co-founder of
a health tech
startup



Next challenge:
Data-driven
cleaning intelligence for custodian crews

CHANGE/ MAKERS



▶ Cicely Belle Blain and their book of poetry.

Cicely Belle Blain, BA'16, (them, they)

◀◀

Co-founder of BLM Vancouver

CEO of Bakau Consulting

◀◀

Next challenge: Finding the time to write a fantasy novel

radical.” After the months of protests in response to the murders of George Floyd, Breonna Taylor, and too many other people of colour, Blain’s workshops have been in particularly high demand. But Bakau’s website reminds clients that, like protests, anti-racism work is not a single event but a continuous process that is “always timely.”

Blain may be young, but they have been an activist long enough to witness several moments of cultural reckoning and massive media attention on anti-blackness and police brutality. Yet the violence continues. Today, is Blain hopeful? “I’m exhausted,” they say. “Just because we are talking more about injustice doesn’t mean automatic change.”

But their weariness is only rivalled by their optimism. Blain says they find hope in millennials’ and Gen Z’s fearlessness in discussing uncomfortable truths, and remain committed to doing the daily work – whether in business, poetry or protest – that transforms communities.

POETIC JUSTICE

The co-founder of the Black Lives Matter Vancouver chapter uses poetry and education to resist oppression.

BY RACHEL GLASSMAN

How many people can say that they’ve founded a business, led a major protest movement, delivered a keynote address at UBC graduation and published a book – all before the age of 30? Well, Cicely Belle Blain can, for one.

Blain is an activist and educator who found their passion for social justice early, securing an \$8-million grant to build a youth community centre when they were just a teenager. Blain credits the “fearless” women in their family for teaching them that “activism is essential.” Their grandmother, who protested against nuclear weapons in the 1970s and founded her hometown’s antiracism task force, “has always been a feminist, even before it was cool.”

After graduating from UBC, where they received the prestigious International Leader of Tomorrow Award, Blain co-founded the Black Lives Matter (BLM) Vancouver chapter. The intersectionality at the heart of the movement was

life-changing for them. As a Black, queer non-binary femme, Blain remembers their experience with BLM as “the first time in my life I didn’t have to hide or sacrifice any part of myself.”

That freedom to celebrate and share all aspects of their identity has shaped Blain’s art as much as their activism. Last year, they published an intimate book of poems, *Burning Sugar*, described by the publisher as “a poetic exploration of Black identity, history, and lived experience.” *Burning Sugar* is for Blain a natural – though more personal – extension of their activism, using poetry to educate and to resist oppression.

Blain also leverages their business chops to create change: they are the founder and CEO of Bakau Consulting, an equity, inclusion and anti-racism consulting company. Blain has trained over 1,000 clients, transforming corporate spaces where their affiliation with BLM was once “seen as too



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THE DELINQUENT

When an overzealous 1930s student administration treated him unfairly, Louis Chodat claimed the moral victory, and then some.

BY SHELDON GOLDFARB

Poor Louis Chodat. The son of an admired UBC French professor, he might have been expected to excel at university. And he did, though not in the classroom, where one might expect, but on the playing fields. He became a star athlete when he arrived on campus in 1930, playing both basketball and “Canadian rugby,” which was not rugby at all, but the newer game of North American football. He was good at throwing forward passes and kicking converts and field goals. His offhand remarks were treated as witticisms, and he was soon to display a strong streak of loyalty, though not in a way that endeared him to Student Council.

It was in his second year that he ran into difficulties. He hadn’t completed his first year’s studies, and so began to be declared ineligible for certain games. This was treated in a light-hearted way at first in a basketball game between “Eligibles” and “Ineligibles,” but things got more serious in the spring of 1932 when Council discovered that young Louis was playing for non-UBC teams. It seems his heart was much more in athletics than academics, and if he wasn’t going to be allowed to compete as a UBC player, well then he would sign up for teams at the YMCA or the Vancouver Athletic Club or Ryerson United Church.

No, no, no, said Council. It’s against Alma Mater Society policy for UBC students to play for outside teams. Long before this *The Ubyyssey* had railed against UBC athletes who played for outside teams, especially if they played against UBC. It is “childish and petty,” the paper said in 1924, “and, further, it is disloyal.” Council in 1932 took the

same approach, warning Chodat to stop playing for the Y. Chodat said he would have to consult his teammates at the Y: a sign of loyalty, one might think, but the wrong sort of loyalty. Council fined him \$5 (about \$95 in today’s money).

Chodat refused to pay. Council took the case to the university administration, which agreed to issue a one-day suspension. *The Ubyyssey* declared this a glorious moment. True, the bulk of the student body were on the side of the “delinquent” – and who wouldn’t be? He was not being allowed to play for UBC, and then was fined for playing

It is “childish and petty.”

The Ubyyssey’s take on student athletes who played for non-UBC teams (1924).

for others. But *The Ubyyssey* thought there was an important principle to uphold: the power of Student Council, the right of the Alma Mater Society to enforce its own rules, even if it created a little hardship for an individual student.

The case made the papers outside UBC. The *Vancouver Sun* made him out to be a hero and said he came out the winner because he paid the fine and then was allowed to play for the Y. Not sure that really made him the winner. In any case, in the next few years Chodat continued to appear in the sports pages of *The Ubyyssey* as a star player, but for outside teams playing against UBC. This raised no new issues because by that time he had left the university.

He went on to join the air force and in 1940 married Stella Brinham. He died in 1978. He never finished his degree, the academic side of the Chodat inheritance being left to his sister Isabelle, who did complete a degree (in nursing) and even won a \$15 prize on graduating in 1936. She went on to marry William Petrie, a physicist who also wrote a book on orchids.

As to the rule against playing for outside teams, that was finally abolished in 1949 by a general meeting of the student body after Student Council once again tried to fine a “delinquent” athlete for playing for an outside team. Louis Chodat would have been pleased, one likes to think.

Sheldon Goldfarb, PhD’92, MAS’96, is the archivist for the Alma Mater Society. For more tales of UBC student life, see his book, The Hundred-Year Trek.



▲ The men’s senior basketball team, pictured in UBC’s 1933 yearbook, likely suffered defeat at the hands of former UBC star player Louis Chodat, who played for an opposing team after being banned.

THE BIG PICTURE



CANADA'S FIRST 5G DRONE FLIGHT

In April, UBC Vancouver was host to Canada's first 5G drone flight. The 5G network recently installed on campus has a much higher bandwidth than the normal radio frequencies usually used for unmanned flight, allowing for smooth and accurate manoeuvring and the ability to share video and data with multiple remote users. Among many other potential uses, 5G drones may soon be employed for monitoring forest fires or transporting medical supplies to remote locations. The new 5G network is one of the most exciting technological developments on campus, and will allow researchers to explore many more innovative applications of the technology.

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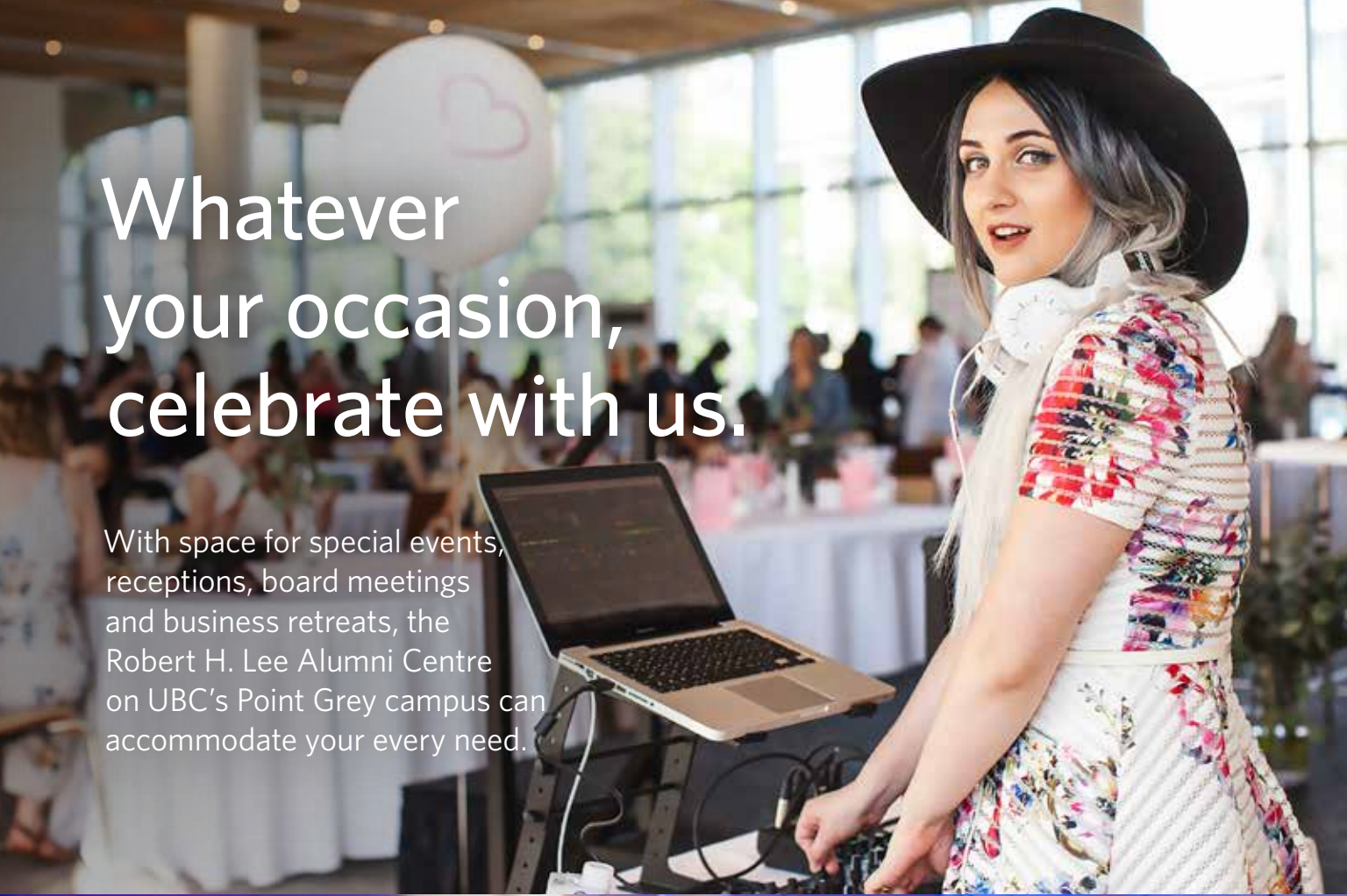
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PRESIDENT'S MESSAGE

BC's response to COVID-19 reveals the potency of its life sciences sector.

UBC President and Vice-Chancellor
Santa J. Ono

It's appropriate that the theme of this issue of TREK is Frontiers of Medicine.

As we all know, those frontiers have been pushed back at an unprecedented speed in recent months, as researchers around the world – including at UBC – have responded to the COVID-19 pandemic. This response has been complex and wide-ranging, addressing acute medical concerns and public health delivery, as well as broader social and mental health impacts.

In collaboration with my colleague, Dr. Gail Murphy, UBC's Vice-President of Research and Innovation, I recently wrote an article for *The Hill Times* on this topic. It noted that UBC researchers have been working in collaboration with others around the world to develop treatments and vaccines for COVID.

In fact, I'm proud to say that UBC labs – along with BC-based life sciences companies – have played an outsized role in the global efforts to address COVID-19. As a hub for nanomedicine and precision medicine, BC's life sciences sector was well prepared to contribute, with three Vancouver-based companies in particular leading the way – all with UBC connections.

One notable success, Acuitas Therapeutics, has developed critical drug delivery systems and contributes the lipid formulations needed for the Pfizer/BioNTech vaccine to enter human cells.

AbCellera – which has pioneered an artificial intelligence- and microfluidics-powered antibody discovery platform – partnered with pharmaceutical company Eli Lilly and Co. to develop an antibody treatment for COVID-19 authorized by Health Canada and the US Food and Drug Administration. AbCellera went on to post the largest-ever IPO for a Canadian biotechnology company, becoming the country's most valuable biotechnology company with a market capitalization of more than \$8 billion at the time of writing. (See page 10.)

Vancouver's Precision NanoSystems has multiple clients working on COVID-19 vaccines and recently announced that, with federal support, they will leverage their cutting-edge biomanufacturing



platform to build one of Canada's first large-scale manufacturing facilities capable of producing mRNA vaccines and other genetic medicines.

Each of these companies has been celebrated as a success story of Canadian science and innovation, not only in response to COVID-19, but in an increasingly competitive and global biotechnology industry.

They exemplify what it means to operate on the frontiers of science and medicine. Each is a spinoff from UBC, formed initially around research at university laboratories and fostered on campus. This ongoing connection to the university's scientific enterprise remains vital to their success today.

Their success has been enabled by fundamental research, with UBC scientists advancing our understanding of natural processes over many years – in some cases, decades – to a point where it was possible to develop breakthrough platform technologies. In the case of Acuitas, the foundation was laid in the 1980s by a team of UBC researchers who started with a desire to understand the roles of lipids in biological membranes and realized the applications for precision drug delivery technologies.

I'm proud of the role that UBC – its faculty, its students, its staff and its facilities – has played in these COVID-19 success stories. And it gives me confidence that we can face future challenges in the same way.



This fall my 18-year-old daughter enrolled in my alma mater. Where did the time go?

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FINDINGS



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Ugly potatoes

Millions of tons of edible produce is being discarded because of the way it looks. Could food labelling stop the rot?

THE RESEARCH:

"Misshapen" fruit and veg are often discarded by farmers and retailers in the US, or avoided by consumers, leading to the wastage of more than 65 millions of tons of edible food a year, along with the land and water used to grow it. In 2014, a French supermarket chain started selling imperfect-looking produce by marketing it as "ugly," and others soon followed suit using a variety of marketing strategies. Some of these worked, others didn't – so profs from the Sauder School of Business dug into the factors that make consumers embrace or turn up their noses at misshapen vegetables.

THE BOTTOM LINE:

More consumers buy misshapen produce when it is described as "ugly."

The researchers examined people's preconceptions about misshapen food and found that consumers expected imperfect produce to be less tasty and even less nutritious than standard, even though there was no rational basis for this.

"People attach a beauty premium to attractive objects, and believe they have all kinds of positive attributes," explains UBC Sauder PhD student Sid-dhanth Mookerjee, who co-authored the study

with Sauder profs Yann Cornil and JoAndrea Hoegg. "Likewise, there's often an ugliness penalty effect, which negatively impacts perceptions of objects."

But when the researchers tested the efficacy of "ugly" labeling through multiple field studies – including one at a local farmers market where they sold both attractive and unattractive tomatoes, carrots and potatoes – they found customers spent more on the misshapen produce when it was labeled "ugly," even spending more on it than on the standard produce. And click-through data from online food ads showed the term "ugly" to be more effective than terms like "imperfect."

"Ugly" signals to consumers that the only difference between items is aesthetic, says Mookerjee, which makes them aware of their bias and significantly increases their willingness to buy the less attractive produce.

Although the "ugly" produce was sold at a 25 per cent discount, it turned out to be more profitable for sellers, as the cost of acquiring it was lower. But if the discount is too high, caution the researchers, consumers begin to suspect the quality of the produce.

IMPAIRED DRIVING

THE RESEARCH:

UBC researchers studied prescription records and vehicle collision reports to find out if the use of common prescription drugs, such as opioids and medication for treating anxiety and depression, increased the risk of road accidents.

THE BOTTOM LINE:

British Columbia drivers prescribed sedating anti-psychotics have a 35 per cent increased risk of causing a road collision, while people on commonly prescribed benzodiazepines (like Valium or Xanax) increase their risk by 25 to 30 per cent. In the case of high-potency opioids such as morphine, the study showed a 24 per cent increased risk of collisions.

Researchers including Dr. Jeff Brubacher, an associate professor at UBC's faculty of medicine, studied prescription records and motor vehicle collisions from a 20-year period in BC. This included almost five million drivers, over 131 million prescriptions, and over 600,000 collisions from January 1, 1997, to December 31, 2016.

The team analyzed police reports to determine which drivers were responsible for crashes, and then compared the risk between drivers with active prescriptions and those without any prescriptions.

They also assessed whether tolerance might play a factor. People with a new prescription (less than 30 days) and people with an established prescription (more than 30 days) turned out to have similar risk.

Brubacher stresses that even if people don't feel any symptoms, such as drowsiness, they are still at greater risk of causing an accident, especially if taking several medications at the same time. He says the results indicate a need for more caution on the part of drivers and specific advice from prescribing physicians. They could also help inform warnings on medication labels and public education campaigns.

POLLUTION AND THE PANDEMIC

THE RESEARCH:

Lockdown measures have slowed economies. Researchers assessed the effect this has had on levels of air pollution, and whether the effect has been comparable around the globe.

THE BOTTOM LINE:

On average, air pollution has dropped 45 per cent domestically and 35 per cent internationally during the first wave of lockdowns. But some world regions experienced an increase, based on their economic activity.

The study linked detailed data on lockdown timelines with satellite pollution data from 162 countries, factoring in times where lockdown restrictions eased. Although it focused on global urban centres, the researchers found significant differences in air pollution trends from country to country.

Most of North and South America, Europe, southern Africa, eastern Asia and the Pacific saw improved air quality during lockdown,

but some parts of South America and Asia saw air quality worsen.

"It's really about the source of the pollution here," says Dr. Frederik Noack of UBC's Faculty of Land and Food Systems. "Lockdowns don't automatically mean air quality improves, because in less industrialized countries you might see

"[It] shows us how complicated the economic activity and the environment relationship is," says Noack. "There needs to be more nuance when it comes to addressing environmental issues.

"If we were to save the environment by only focusing on one sector [like limiting manufacturing, industry

Industrialized countries like Canada could learn from the pandemic by maintaining flexible work-from-home policies beyond the crisis, in order to reduce the impacts of industry and transportation on air quality.

more biomass burnings, [and] increased agricultural activities and residential energy use."

Indeed, some countries saw air pollution increase by as much as 25 per cent.

and transportation], it might give advantage to pollution in a different sector like agriculture."

Noack suggests that more industrialized countries like Canada could learn from the pandemic by maintaining flexible work-from-home policies beyond the crisis, in order to reduce the impacts of industry and transportation on air quality.

The study also encourages the use of a mix of targeted policies that include all economic activities, and underlines the importance of market-based environmental instruments like pollution taxes or cap-and-trade systems.



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REWIND

The Bus Stop Café:

A home away from home

BY RACHEL GLASSMAN



▲
Last day of service at the Bus Stop Café. Photos: Bob Jemison. UBC Library UBC 44.1/595-1 (top) UBC 44.1/590-1 (bottom).

“When your mother is 1,000 kilometres away and long distance bills [are] too high, you can still go to the Bus Stop,” wrote alum Cheryl Fieguth in 1987.

She was referring not to the transit hub, but to the campus café (situated beside UBC’s original bus stop, now occupied by a Triple O’s). The café was noteworthy both for the cozy solace it gave homesick students like Fieguth, and for its quirky layout. Servers bustled about with coffee and cinnamon buns in several sunken pits, placing them at face-level with the customers perching at the surrounding counters. The impression from a distance, according to one former patron, was that the staff all appeared to be incredibly short.

Those seemingly tiny waitresses, many of whom had worked there for

decades, made up a large part of the café’s charm. Alumni remember the servers as motherly figures whose sound advice and good humour buoyed up many a floundering student. The servers’ legendary kindness made them campus “celebrities in their own right,” recalls Andy Shaw, BCom’84. When Shaw ran into a former Bus Stop waitress in Kits thirty years after he’d graduated, he recognized her instantly.

Alas, there is an end to everything. In 1990, despite students’ petitions and mournful letters to *The Ubyyssey*, the café served its last cup of coffee and the David Lam Management Research Library sprouted up in its stead. Announcing the library’s opening, *The Ubyyssey* grumbled, “Those of us who remember the Bus Stop Café are thinking this building better have a damn good snack bar.”



THE SCOOP

Hip hop, horticulture and high achievers

1. UBC SOIL IS HOST TO WHICH GROUP OF PLANTS WITH A FAMOUS LINEAGE?

- a) Elm trees descended from the “Liberty Tree” of the American Revolution
- b) Sunflowers descended from those depicted in Van Gogh’s Vase with Twelve Sunflowers
- c) Apple trees descended from the tree Isaac Newton sat beneath while contemplating gravity
- d) Tulips descended from the flowers that inspired Sylvia Plath’s poem “Tulips”



2. UBC HAS HAD THREE RHODES SCHOLARS IN THE LAST FIVE YEARS. RHODES SCHOLARS ATTEND WHICH PRESTIGIOUS EUROPEAN UNIVERSITY FOR GRADUATE SCHOOL?

- a) Cambridge University
- b) Oxford University
- c) The Sorbonne (Paris)
- d) King’s College London



3. WHICH 80S/90S MOVIE ICON HAS AN HONORARY DEGREE FROM UBC?

- a) Alicia Silverstone (Cher Horowitz, *Clueless*)
- b) Michael J. Fox (Marty McFly, *Back to the Future*)
- c) Carrie Fisher (Princess Leia, *Star Wars*)
- d) Matthew Broderick (Ferris Bueller, *Ferris Bueller’s Day Off*)



4. THE UBC LIBRARY HOUSES A COLLECTION FROM WHICH FAMOUS VANCOUVER LOCATION?

- a) Vinyls from Red Cat Records
- b) Movies from Videomatica
- c) Illustrated books from MacLeod’s Books
- d) Film from the Ridge Theatre

5. UBC’S 1994-95 SCHOOL YEAR WAS STRANGE BECAUSE...

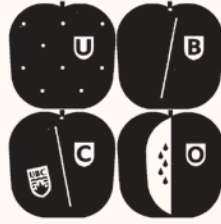
- a) *The Ulysses* wasn’t published
- b) The football season was cancelled
- c) A bus strike shut down public transportation into campus
- d) The old physics building burned down

6. WHICH FAMOUS NEW YORK-BASED HIP HOP GROUP PERFORMED AT UBC’S ARTS COUNTY FAIR IN 2004?

- a) Public Enemy
- b) A Tribe Called Quest
- c) The Beastie Boys
- d) De La Soul

- 1: c) Newton’s apple trees: Grafts of the tree that is said to have inspired Isaac Newton’s law of universal gravitation arrived at the UBC campus in 1971 and were planted outside the TRIUMF physics laboratory.
- 2: b) Oxford: Oxford’s coveted Rhodes Scholarships are given to exceptional students around the world. Engineering student Brendon Tankwa is the most recent recipient from UBC.
- 3: b) Michael J. Fox: Fox received an honorary degree from UBC in 2008 for his role as an actor and entertainer, and for his philanthropic work in support of Parkinson’s disease research.
- 4: b) Videomatica: Three years after the beloved Kitsilano movie-rental store closed in 2011, the UBC Library acquired its extensive collection of films, valued at \$1.7 million. The collection is open to all library users.
- 5: a) *The Ulysses*: After disputes with the AMS meant that the paper was not published for the 1994-95 year, *The Ulysses* won a referendum and became independent and autonomous from 1995 onwards.
- 6: d) De La Soul: The trio played at Thunderbird Stadium in 2004, when Arts County Fair was one of the foremost music festivals in Canada.

NEWS FLASH



VANCOUVER

OKANAGAN

DR. BONNIE HENRY AND GRETA THUNBERG AMONG UBC'S 2021 HONORARY DEGREE RECIPIENTS

Bonnie Henry (UBC Vancouver)

Provincial Health Officer Dr. Bonnie Henry is the calm and assured face of the COVID-19 pandemic response in BC. She has led the government initiative from a rational, scientific perspective, garnering accolades from across Canada and internationally. Her specialized work in public health and preventive medicine has also included critical international initiatives such as the WHO/UNICEF polio eradication program in Pakistan and the World Health Organization's response to the Ebola outbreak in Uganda. She was awarded an honorary Doctor of Science degree at UBC's virtual spring graduation.

Greta Thunberg (UBC Okanagan)

Teenager Greta Thunberg has gained international recognition for challenging world leaders to take immediate, science-based action against climate change, and for sparking climate-change activism in many parts of the world. A three-time Nobel Peace Prize nominee, she has given speeches in venues ranging from the World Economic Forum in Davos, Switzerland, to the 2019 UN Youth Climate Summit in New York, to which she famously travelled on an emissions-free yacht. Thunberg was awarded an honorary Doctor of Laws degree by UBC Okanagan.

TREASURES FROM THE KLONDIKE

UBC's Vancouver library is now home to an unparalleled collection of rare books, maps, letters and photos dating from the Klondike Gold Rush (1894–1904), which will support research and learning and be made available to the public. It was a gift from UBC alum and supporter Philip B. Lind, CM, whose grandfather, Johnny Lind, carved out success as a prospector, arriving in the Yukon two years before the big Klondike strike in 1896 that ignited the gold rush. The Department of Canadian Heritage's Canadian Cultural Property Export Review Board recently designated the collection as a cultural property of outstanding significance.

LEARNING IN AN INDIGENOUS LANGUAGE

UBC Okanagan has become the first university in Canada to offer a bachelor's degree in Indigenous language fluency. The program will start by offering a comprehensive and high-quality education in Nsyilxcn – the language spoken by members of the Syilx Okanagan Nation – with the aim of producing new and fluent speakers with a deep understanding of the language, culture and customs.

\$13.7 mil

Amount UBC invested to create an enriched online learning experience in response to the pandemic over the 2020-21 school year.

73%

Percentage of students who were not impacted by or were able to manage the emotional impacts of the pandemic, according to Dr. Daniel Vigo, lead author of the study published in the *British Journal of Psychiatry*. "That speaks to a very resilient student body," he says.

101,000 sq. ft.

Area of a proposed new student recreational centre on the Vancouver campus.



DR. SHERYL LIGHTFOOT

Dr. Sheryl Lightfoot, a UBC professor of First Nations and Indigenous Studies and Political Science, has been named the North American member on the United Nations Expert Mechanism on the Rights of Indigenous Peoples. It is the first time an Indigenous woman from Canada has been appointed to the prestigious position. Dr. Lightfoot specializes in complex questions about Indigenous people's rights and how those rights are being claimed and negotiated in various political spaces.



DR. ISMAËL TRAORÉ

In March, Dr. Ismaël Traoré was appointed director of Faculty Equity for the Provost's Office (UBCV). He is responsible for leading initiatives to broadly diversify the UBC Vancouver campus, with an emphasis on increasing faculty equity, diversity and inclusion. Dr. Traoré currently serves in the Multicultural Advisory Council reporting to the Attorney General of British Columbia, and is an anti-racism public educator and consultant, with subject expertise in critical race theory and whiteness studies.

BEYOND DIVERSITY

A welcoming and inclusive workplace requires a willingness to change the status quo

BY **ASMIN CHEN,**
GREG LOCKWOOD,
RACHAEL E. SULLIVAN,
HANAE TSUKADA,
AND MAI YASUE
(facilitators and strategists,
Equity and Inclusion Office,
UBC)

Improving employee diversity has often been pushed as the cure-all for creating equitable and inclusive workplaces. And yet when people are hired into a new workplace, they are often expected to assimilate to its cultural norms. The challenge is that while the creation of a diverse workforce is a positive step, it takes more to create a workplace culture in which all employees can thrive.

Going beyond representational diversity to promote authentic inclusion requires intentional practices that include shifting the culture to make room for new perspectives and experiences; creating intentional processes for working through conflict; and being clear and transparent about decision-making, as well as thoughtful about how colleagues are recognized and valued.

When an organization is not prepared to support a diverse workforce beyond the hiring of one, harmful consequences for both individuals and businesses can result. Low retention rates and the need to rehire for the same position can reduce an organization's stability and contribute to reputational damage that may reduce the number of highly qualified applicants keen to join it. This in turn can generate doubt about the value or legitimacy of hiring from diverse candidate pools. Without a plan to interrupt it, the cycle continues.

The following guidelines offer a helpful starting point for establishing a welcoming culture that values all employees.

Assess your current status

Before developing new hiring strategies, begin with a critical reflection on the motivations and outcomes of your practices so far. Are they reflective of an organization that really wants to change, and is ready to support and benefit from new ways of thinking about its operations? Assessing your current status can help you find and address any barriers to building a diverse and thriving workforce.

One way is to identify any patterns in terms of who has left the organization over the last three years. This can uncover areas of tension, which can then be addressed to ensure a more supportive environment for new members. It can also reveal areas of improvement, where practices have paid off.

Another way is to consider how diversity is extended throughout the organization's hierarchy. Are all of the women being promoted to leadership positions white, or are BIPOC women and gender-diverse employees also represented? While a workforce might collectively represent different genders, races, and abilities, diversity is much more than the percentage of an organization's employees who are not able-bodied white males.

Examine your hiring strategies

Are your organization's recruitment and hiring strategies a way of "performing" diversity, or is there a genuine aspiration to benefit from diverse perspectives and experiences?

Establishing thoughtful hiring policies, and being transparent about the motivations behind them, will help organizations demonstrate their commitment to recognizing and retaining a diversity of talent. This approach is underpinned by equitable hiring practices – such as removing biased language from job descriptions, creating a rubric for assessing all the candidates according to the same criteria, and being mindful of power dynamics to ensure that the application and interview process is sensitive to the inclusion of marginalized groups.

Clarity and transparency not only help to increase the candidate pool, but also to counter the perception that diversity is being prioritized over merit.

Provide learning opportunities

Another aspect to consider is how informed your workforce is on the issues and opportunities around equity, diversity and inclusion. Creating an inclusive culture depends on building awareness and genuine buy-in for related practices. Providing all staff members with professional development opportunities in these areas encourages collective involvement and personal investment in building an inclusive work environment. And the more aware and inclusive a workforce is, the higher its expectation of leadership to support, lead, and be representative of this diversity as well.

Walk the talk

How open is leadership to shifting the ways things are currently done? A truly inclusive workplace

**THE MORE
AWARE AND
INCLUSIVE A
WORKFORCE IS,
THE HIGHER ITS
EXPECTATION OF
LEADERSHIP TO
SUPPORT, LEAD,
AND BE REPRESENTATIVE OF
THIS DIVERSITY
AS WELL.**

will be open to accommodating the differing needs of employees, including those with disabilities, cultural and religious practices they wish to observe, or family needs they are responsible for attending to. Full inclusion means that all employees can bring their whole selves to work, without having to take on the burden of pushing for the right to do so.

The disruption to life caused by COVID-19 means many people have adjusted their personal working arrangements. In fact, we are presented with a prime opportunity for a fresh look at the context of work, and how it might be improved to enhance inclusion for everyone.

Turn conflict into a positive

Even when an organization has worked to put in place inclusive practices, conflict will still happen and needs to be addressed. Does your organization have a process in place to engage with conflict in ways that are respectful to all concerned? Are there resources to help employees resolve differences and seek support? Establishing clear, fair, and accessible methods for engaging in conflict can turn it into an opportunity for learning and growth.

Treating a diverse set of insights and experiences as an asset is a foundation for organizational cohesiveness and success. More organizations are starting to reap the benefits of inclusivity, but it requires thought and effort to establish. Before hiring for diversity, think about your current workplace culture; are there systems and structures in place to support all employees? If yes, your organization has the ingredients to set up new employees for success. If not, go back to the drawing board, reassess what changes need to be made, and map a new path forward together.

A blue line-art illustration of hands sewing, with a needle and thread forming a large, looping shape that frames the text. The background is a mix of orange and yellow tones with a textured, cross-hatched pattern.

A STITCH IN TIME

**The pandemic has spawned
a sewing surge and
a chance to rediscover
the practical arts.**

BY **MARY GALE SMITH**
Sessional lecturer,
UBC Faculty of Education

ILLUSTRATION BY
MARGIE AND THE MOON

United Kingdom Prime Minister Boris Johnson sent Britons Googling this past fall when he said “a stitch in time saves nine” to describe actions to prevent the spread of COVID-19. The phrase means it’s better to spend a little time solving a little problem now to prevent spending more time on a bigger problem later. As the BBC reported, it’s a sewing reference that can be traced back to 1723.

The COVID-19 pandemic has brought sewing and craft and their practical uses into the news. Some sewing machine manufacturers saw a shortage as both big-box retailers and small shops experienced a pandemic sewing rush.

Many sewists and crafters dusted off their sewing machines or purchased new ones to begin sewing masks, whether for personal use, for front-line workers or for sale. Some fashion designers and large brands also ramped up mask production.

As a curriculum researcher and a retired home economics teacher, pandemic sewing is a chance for me to revisit the value of education in the practical arts.

Sustainability closer to home

“A stitch in time saves nine” was a favourite proverb of my grandmother, along with “waste not, want not.” She “turned coats,” painstakingly taking apart threadbare coats, so that she could turn the fabric inside out and re-stitch the coat to make it look new. As her standard of living improved, she continued to mend, repair, conserve and remake textiles.

Before the mass rise of garment industries, wealthier people hired seamstresses or tailors for custom-made clothing. Households relied on making and recycling clothes, as well as buying them either new or secondhand, while relying on skills in the household or local domestic self-employment.

“Repair, reuse, make do and don’t throw anything away” was a motto in the Great Depression. The notions of “use it up, wear it out, make do or do without” were responses to First and Second World War textile restrictions.

By the turn of the 20th century, with industrialization and globalization “ready to wear” garments became available. Home sewing continued, but mass-produced and industrially manufactured garments, promoted by advertising and easily available in stores and via catalogues, gradually reduced home-sewn wear. By the end of the century, fast fashion dominated.

Ten million tons of clothing waste go to landfills every year in North America, and 95 per cent of it could be re-used or recycled. We only need to consider this or see the unfair and dangerous working conditions for garment industry

labourers to realize our current clothing consumption is not sustainable.

Education theorist Madhu Suri Prakash, who writes about critical conversations related to environmental education, notes that addressing the ecological crisis is connected to our many daily decisions and the basic items we use.

Demise of learning hands-on skills

Sometimes buried in the stories of pandemic sewing is a comment to the effect that at one time such handicraft was typically taught in schools in home economics classes.

But in some places, home economics (albeit with a variety of labels) is still taught in many schools, although it is somewhat diminished due to the general devaluation of practical education. Sometimes it's called family studies, family and consumer science, or human ecology.

In the past half-century, home economics in higher education has been downsized, dismantled, and in some cases met its demise. UBC's School of Family and Consumer Science was discontinued at UBC, along with the home economics degree, in 1999. There are a variety of reasons behind this trend. New arenas of work opportunity and concern were available following the second wave of feminism, and in the post-war years marketers capitalized on consumerism as a new patriotic duty. Home economics had long connected local consumption and production and global ecology, but as education scholar Maresi Nerad argues, post-secondary university departments traditionally dominated by women, including home economics, "were gradually eliminated when administrators no

longer found them useful."

The mantra "bring back home economics education" is sometimes seen in the popular press, following nutrition researchers Alice H. Lichtenstein and David S. Ludwig's 2010 article of the same name.

Where home economics still exists, it is often at the margins. Some have argued this is because the knowledge gained is not considered valid. But that premise of epistemological superiority needs to be questioned.

Ten million tons of clothing waste go to landfills every year in North America, and 95 per cent of it could be re-used or recycled. We only need to consider this or see the unfair and dangerous working conditions for garment industry labourers to realize our current clothing consumption is not sustainable.

It is in the practical arts where students learn to meet the ordinary and material demands of everyday life and to become, as the American Family and Consumer Science curriculum notes, empowered to "solve the perennial and emerging practical problems of their families, workplaces and community..."

When one has the necessary resources, time and support, there can also be emotional wellness benefits to making and doing with one's hands.

Intelligent consumerism

The values of earlier adages like "a stitch in time" were the foundation of home economics. Home economist Abby Marlatt, one of the presenters at the Lake Placid Conferences that were the genesis of home economics, argued

that sewing, millinery and dress-making contributed to intelligent consumerism and social justice.

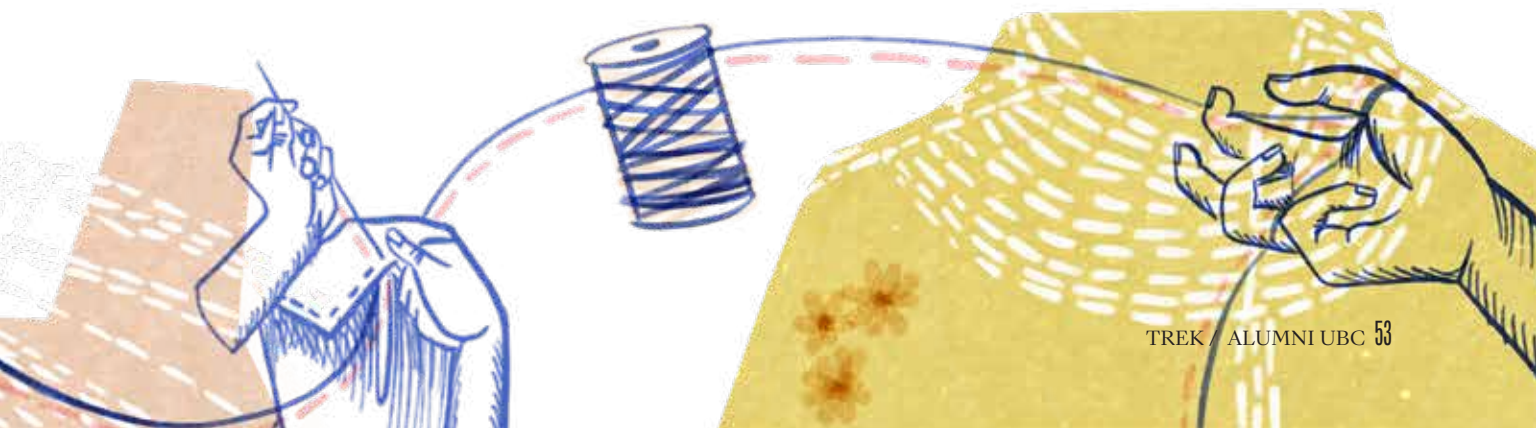
Early founders of the field chose "home economics" from the Greek *oikos* meaning home or family (a word also at the root of "ecology"), and *oikonomikos* meaning management of a household, frugality and thrift. Lately, home economic scholars such as Eleanore Vaines (an associate professor emeritus from UBC's now defunct School of Family and Consumer Science)

have highlighted ecology as an enduring theme, explaining that the "home" is our Earth and "economics" is the judicious use of resources. The International Federation of Home Economics identifies its ultimate goal as achieving sustainable living for all.

Once out of the closet, sewing and all the other practical home-based activities of pandemic times have the potential for utilitarian, psychological and environmental benefits. That is why some designers, makers and consumers are imploring us not to stop sewing after the pandemic and why home economics still matters.

This article was originally published in *The Conversation*: theconversation.com/pandemic-sewing-surge-is-a-chance-to-rediscover-the-practical-arts-148246

THE CONVERSATION



Things to Do



ALUMNI UBC SUMMER SERIES

June-September, 2021

Virtual Race

Get active this summer on a customized virtual course between UBC's Vancouver and Okanagan campuses.

Virtual Wine Tastings

Sit back, relax, and sip along with a panel of experts who will guide attendees through a virtual wine tasting journey.

Geocaching Adventure

Geocaches are everywhere, so get outside and start hunting!

Summer Music Experience

We're partnering with students, alumni, and local arts organizations to celebrate the talented members of our local arts community.

 [LEARN MORE AND REGISTER AT:
alumni.ubc.ca/summer-series](https://alumni.ubc.ca/summer-series)



UBC READS

Magdalena
Wade Davis

Professor, Anthropology

The story of the Magdalena River is the story of Colombia. That story tells of a people who have overcome years of conflict because of their character, which is informed by an enduring spirit of place, a deep love of a land that is home to the greatest ecological and geographical diversity on the planet.

Consent
Annabel Lyon

Assistant Professor, Creative Writing

Consent is a novel about two sets of sisters who are brought together by their roles as caregivers, the unexpectedness of tragedy, and their need to reckon with the man they blame for it all. Along the way, issues of consent – sexual consent, consent to caregiving, consent in the context of death and dying – are presented in challenging and even shocking ways.




CALL FOR VOLUNTEERS

UBC's CANARY research is described in detail on page 16. It compares the speech and eye movements of people with Alzheimer's disease and mild cognitive impairment (MCI) to those of healthy volunteers to see if there are patterns that can be used to detect the disease early, and to monitor its progression over time.

You may be eligible to participate in this study if:

- you have a diagnosis of mild to moderate Alzheimer's disease, mild cognitive impairment, or if you are a healthy volunteer age 70 or over.
- you are 19 years of age or older
- you are able to speak and understand English
- you are able to consent to the study

You may not be eligible to participate if you have had a recent brain injury, or if you have a neurological or psychiatric condition.

 [CALL 604-822-0768](tel:604-822-0768) OR EMAIL
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Explore an exhibit

MUSEUM OF ANTHROPOLOGY

Shadows, Strings and Other Things: The Enchanting Theatre of Puppets
Until Friday, December 31, 2021

This award-winning immersive online exhibit is presented by MOA. Discover more than 230 unique, hand-crafted puppets from Asia, Europe and the Americas, organized over five theatrical staged areas. The exhibit focuses on the art of puppetry and storytelling, and includes added features and activities such as teaching kits, podcasts and videos. The original exhibition earned the 2020 Canadian Museums Award of Outstanding Achievement in the Exhibition – Cultural Heritage.

BEATY MUSEUM OF BIODIVERSITY

The Curious World of Seaweed
Late 2021

An exhibit by Josie Iselin, *The Curious World of Seaweed* presents contemporary scans of seaweed collected from our Pacific Coast. The scans are layered onto historical lithographs of particular algal species, creating a taxonomic vector from past to present and into an uncertain future. The exhibit aims to broaden the ideas of seaweed as both taxonomer's and artist's muse. The exhibit will show luminous scans of seaweeds in combination with lithographs that are directly tied to the taxonomic history (the naming) of the algae.

DID YOU MISS?

The Phil Lind Initiative 2021 speaker series

The Anti-Democratic Turn

The unprecedented assault on the rules and norms of democracy in the US over the past four years has exposed its vulnerability. Despite the eventual outcome of the 2020 presidential election, democracy in the US may not be as resilient as we once thought. If we accept that the previous administration is a symptom of more deeply rooted problems in American society, how do we begin to address these emerging fault lines in the democratic process? How can we protect the integrity of our democracies in an era marked by authoritarian resurgence and nativist backlash?

Speakers included:

Danielle Allen (James Bryant Conant University Professor, Harvard University)

Timothy Snyder (Professor of History, Yale University)

Anne Applebaum (Writer and Pulitzer Prize-winning historian)

➔ **THEIR TALKS OR INTERVIEWS ARE AVAILABLE AT:**
lindinitiative.ubc.ca/video

Monthly Contests on the alumni UBC App!

JUNE

A 5-night Trip Merchant vacation to Cartagena, Colombia – only suitable for those who like white sands, palm trees and centuries of history.

JULY

A Vancouver Whitecaps FC jersey and prize pack (for when your T-Birds jersey is in the wash).

AUGUST

\$100-worth of drive-time from Evo Car Share. Grocery store runs or future road trip?

SEPTEMBER

A \$100 gift card for an adidas Canada shopping spree is a great way to beat pandemic-induced inertia.

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IN MEMORIAM



PROFESSOR ROBERT MUNDELL, CC, BA'53, LLD'00

Professor Robert Mundell, who died on April 4 at the age of 88, was one of the preeminent economists of his era, receiving the 1999 Nobel Prize in Economics. His ideas – often controversial – helped to establish a European currency and to promulgate the “supply-side” economic theories that the US implemented under Ronald Reagan in the 1980s. He remains an important figure for modern macroeconomics, and his influence underlies the very language of our political discourse.

Mundell was born in Kingston, ON, on October 24, 1932, to William Mundell, OBE, and Lila Teresa Hamilton. After World War II, his family moved to BC, and Mundell began his studies at UBC a few years later.

At the time, UBC was unusual among economics departments for teaching older economic theories that predated John Maynard Keynes. Mundell attributed his unorthodox ideas in part to the classical, pre-Keynesian grounding in economic theory that he received as an undergraduate student. After UBC, Mundell studied at the University of Washington, earned his PhD at the Massachusetts Institute of Technology, and became a postdoctoral fellow at the University of Chicago, where he had fiery debates with Milton Friedman, another iconoclastic Nobel laureate. Mundell returned to UBC to teach before he moved permanently to Columbia University in 1974.

When they awarded him the Nobel Prize in 1999, the Swedish Academy wrote that Mundell’s predictions about the international economy were chosen with “uncommon – almost prophetic – accuracy.” He is remembered as a luminous, challenging, and foundational thinker.



DUNCAN L. PITMAN, BASC'47

Duncan Pitman grew up in Prince George. Following his release from army duty in 1945, he returned to UBC and completed his bachelor’s degree in engineering physics. After graduating, he was awarded a fellowship to Purdue University, where he completed his master’s degree in mathematics.

In 1949, he accepted a job in Southern California in the blossoming aerospace industry, where his Control Theory led to advancements in missile systems’ guidance and control. In 1957, Duncan was selected by Douglas Aircraft to represent the company on the National Advisory Committee on Aeronautics, which was responsible for advising President Eisenhower on advances in aircraft and space-related technologies. He was selected to give seminars on Deep Space Navigation at Cal Tech University.

In 2016, at the age of 96, he passed away. He often reflected on how his contributions to cold war missile systems ultimately found purpose in launching weather and communication satellites that today save lives and advance our understanding of our universe.

JAMES P. PATTISON, BA'49, MA'52

James Parker Pattison, proud graduate of UBC, quietly passed away on April 29, 2019, at the age of 91.

Born August 25, 1927, in Richmond, BC, Jim moved to Toronto not long after his graduation to take on a position as chemist at CIL paint. This is where he met his wife of over 65 years, Marion Ruth Lindsey.

Later in life, he joined the Ontario Public Service, where he moved up the ranks to become a director. The job had little to do with chemistry, but his work was always technical. For example, he redesigned the



Ontario Provincial Police uniforms and assigned government buildings based on analyzing asset usage.

Jim was a lifelong learner with an ever-expanding list of hobbies, including piloting planes and gliders, travelling, playing the piano, being part of a math society, and day trading. He was a classic: he had a warm personality, and he was good-natured and always polite.

Jim was predeceased by his daughter, Marianne. He left behind his wife, Marion (who passed away soon after on September 25, 2019), his sons, Bruce (Chantale), Robert and Glenn (Gita), and his granddaughter, Taryn Pattison.

ARTHUR M. PATTERSON, BASC'49

Art Patterson of Calgary passed away on December 26, 2018, at the age of 94 years. Art was devoted to his family and dearly loved his children, grandchildren and great-grandchildren. He loved his wife of 60 years, Margaret, more than anyone or anything and missed her immensely over the 10 years since her passing.

Art was born in Calgary and grew up in what became known as the “Hart House” above Sarcee Trail. He trained as a navigator during WWII. Following the war, he graduated as a geological engineer from UBC. This led to a long and successful career as an exploration geologist in the oil business in Calgary.

Art travelled thousands of miles with Margie, either on skis, on foot, in a kayak or in their motorhome. Art was a skilled woodworker and in his later years built seven beautiful grandfather clocks for Margie, their children and their grandchildren. Despite several major medical problems over his 94 years, he kept his humour and optimistic attitude.

Art was predeceased by his firstborn son, James Arthur, and his wife, Margaret Helen. He was also predeceased by his dear friend and companion Donna Riback. He is survived by his children: Harry (Sarah), Mary (Paj), Susan and Joan; grandchildren Luke (Chelsea), Nigel (Lynnea), Amelie (Brayden), Angela, Krista (Kam), Tessa (Ben), Ben (Tara), and

Jennifer (Alex); and six great-grandchildren Isla, Quinn, Keagan, Ella, Marla and Toriana.



TIMOTHY HUGH HOLLICK-KENYON, BA'51, BSW'53, MSW'69

Dr. Tim Hollick-Kenyon Sr. died peacefully on November 8, 2019.



Tim's wife, Ina (Ritchie) Hollick-Kenyon (MSW), predeceased him in 2014. He is survived by three children and four grandchildren.

Tim combined work and volunteer experiences to create a career in social work and educational organizations spanning four decades. He held executive and senior posts with non-profit organizations, including the UBC Alumni Association, the Children's Aid Society of Vancouver, and Capilano College (now University). Tim lived out his belief in lifelong learning by completing a PhD in higher education at the University of Oregon in 1979.

Tim was many things to many people. With his wife and kids in tow, he built a log cabin in the Chilcotin and loved spending time there. Just last year, Tim voyaged to the Antarctic to add to his bird-sighting list and to visit the area where his father flew and navigated for explorer Lincoln Ellsworth. He was active in scouting, volunteered with many organizations, and offered one-on-one support to many individuals throughout his life.

WILLIAM "BILL" MURDOCH, BCOM'55

Bill Murdoch passed away peacefully in Salmon Arm, BC, at the age of 91, after "90 great years" and one in declining health. Bill's love of the ocean and commerce degree in 1955 led to a career in the



fishing industry in BC, Nova Scotia, Newfoundland, the Philippines and India. Captain Bill built a 38-foot sailboat, the *Leisure Lee*, and sailed to Alaska for his 80th birthday. "Mr. Fix It" enjoyed the challenge of repairing things over buying brand new. He loved competing in golf, bridge and ping pong. He was a master woodworker, salmon smoker, creative inventor, investor and music lover. He expressed his love generously through acts of service to his friends, his church and his wife, Ev, daughters Joan, Kathy and Barb, nine grandchildren and 11 great-grandchildren. Bill remained a positive, loving, caring and interesting man to the end, and is deeply missed.

CYNTHIA SINNOTT, BSC'59

On January 14, 2020, Cynthia Anne Sinnott of Campbell River, BC, passed from this life into the arms of Jesus.



She arrived at the world, to her parents Gladys and Charles Ball, on January 7, 1934, in Paget, Bermuda. Cynthia chose a career path that would lead her in spiritual growth. She graduated as a RN in 1954 from King Edward VII Memorial Hospital in Bermuda. Then she arrived in Victoria, BC, and started a BSc in nursing at Victoria College. It was during this time that she met Gerald Patrick Sinnott, and they continued their studies at UBC and married on December 20, 1958. In 1960, they settled in Victoria, and Cynthia became a nursing instructor at St. Joseph's Hospital. From 1977 to '89, Cynthia was a nurse at the Campbell River Hospital and became Head Nurse at the ECU. She became an associate to the Sisterhood St. John the Divine and expressed a prayer relationship with the Sisterhood.

Cynthia is survived by her loving husband, Gerald Sinnott, with whom she was married for 61 years. She was the cherished mother of Susan, Patricia and Katherine (Dale), with six loving grandchildren: Kyla, Rachel, Liam, James, Owen and Anna.



DR. DAVID F. HARDWICK, MD'57, LLD'01

Dr. David F. Hardwick died on May 15. He was an internationally recognized pediatric pathologist who was involved with the UBC Faculty of Medicine for more than 60 years as a student, professor, special advisor and mentor to many.

The inimitable bow-tied professor emeritus was a graduate of UBC's fourth medical class. He was appointed to the Department of Pathology in 1965 and was department head from 1976 to 1990. His research contributions were in the fields of pediatric pathology, pathophysiology, clinical pathology and the economic effects of clinical laboratory testing.

Fondly regarded by his students, Dr. Hardwick received teaching awards throughout his career. As faculty advisor to the Medical Undergraduate Society for more than 40 years, he championed the distributed medical program and touched the lives of countless students, not only with his humour and handshake, but as a deeply respected mentor, human being and friend.

He was also an important advocate for the creation of Medical Student and Alumni Centres across BC.

Dr. Hardwick was elected to the UBC Senate and appointed as faculty advisor to UBC presidents for many years. In 2001, UBC awarded him a Doctor of Laws, *honoris causa*, in recognition of his commitment to the principles of academic freedom, and in 2007 he received a Lifetime Achievement Award from *alumni UBC*.

A man with an impeccable sense of humour, Dr. Hardwick's career was driven by curiosity and a compassion to serve others. He will be dearly missed.



DONALD "SILVER DONALD" CAMERON, CM, ONS, BA'60

Silver Donald Cameron was a leading Atlantic Canadian writer, educator and advocate for social and environmental justice. He died in Halifax in June 2020, aged 82.

Donald's ties to UBC were deep. After graduating, he lectured in the English Department. His father, Dr. Maxwell A Cameron, BA'27, MA'33, was head of the Department of Education until his untimely death in 1951. His oldest son by his marriage to Catherine Ann Cameron, BA'60, MA'64, is Dr. Maxwell Cameron, BA'84, professor of political science. At the time of his death, Donald was married to author Marjorie Simmins, BA'84.

Donald earned an MA from the University of California and a PhD from the University of London. He was associate professor of English at the University of New Brunswick, where, with other activists, he founded the alternative newspaper *The Mysterious East*.

In 1971, Donald changed direction, becoming a writer, film producer and advocate based in the tiny Cape Breton community of D'Escousse. For nearly 50 years, he was the only full-time freelance writer in Cape Breton, producing 20 books, along with articles, films and radio dramas, nearly all with the themes of social and environmental justice, and harmony between human communities and nature. His last book was *Blood in the Water: A True Story of Revenge in the Maritimes*.

Silver Donald Cameron spent the last 10 years disseminating the wisdom of those guiding us towards a sustainable future through *The Green Interview*, a collection of 100-plus conversations with leading thinkers. He was also the first Farley Mowat Chair in Environment at Cape Breton University.



GEORGE MITCHELL HENRY, BED'64

George was born in Gladstone, MB, to Mary and John Henry. He passed away in Lions Gate Hospital after a lengthy and courageous battle with cancer. He is survived by his sister June (Arnie), wife Shirley, son Michael, daughter Michele, grandchildren George (Rachel), Grant, Alex, step great-granddaughter Bella, and many nieces, nephews and friends.

George's love of the ocean originated in Prince Rupert, where he grew up and spent summers fishing off the coast. After high school graduation he moved to New Westminster to attend BCIT and UBC.

"Mr. Henry" taught in 100 Mile House for four years, then at Pemberton Secondary School for 30 years as a teacher and vice-principal. He is remembered for his musical talents in the many musical productions that he wrote and produced, and for performing in the band "The Generation Gap," which included some of his students and a teacher.

George was a charter Pemberton Lions Club member, president of the Pemberton Museum and president of PACA (Pemberton Agricultural & Community Association). He was a great historian and spent countless hours on construction, supervision, and fundraising events for the Pemberton Museum. He also built and operated Pemberton's first drive-in restaurant – the "M & M Drive Inn." George will be missed for his sincerity and sense of humour, which he maintained even during his final days.

MARIAN NELSON, BA'65

Marian Nelson (née Patterson) passed away peacefully at the age of 76 in December 2019. She is survived by her daughters, Krista Nelson (BSc'94) and Meryl Nelson (BSc'98), brother John Patterson (BSc'64, Med'81)



and their families. Marian was pre-deceased by her husband, Vern, and parents J. Lionel and Bertie Patterson.

Marian was born and raised in Vancouver. She attended Lord Byng Secondary School, followed by UBC. After a short time in Palo Alto, California, she lived for many years in Kirkland, QC, White Rock, BC, and, most recently, Thunder Bay, ON.

The UBC campus and community were always special to Marian. After completing her BA, Marian worked in the UBC chemistry department, where she met her future husband, Vern Nelson (BSc'65, PhD'69). She returned to the campus again years later to work in the Distance Education Office (later OCPE) in the Faculty of Education.

Marian will always be remembered for the love and kindness she shared with her family and friends.



ANTONIN PROCHAZKA, PHD'72

Antonin (Tony) Prochazka was born in Prague, Czechoslovakia, in January 1945. He received his engineering degree from the Faculty of Nuclear Physics of the Technical University of Prague in 1967. After the Soviet Union invaded Czechoslovakia in August 1968, he came to Vancouver and continued his studies for a PhD at UBC's Department of Physics and at the TRIUMF project. Upon completion of his PhD he chose to work in industry. Over the years he worked for CBC Engineering in Montreal and Northern Telecom in Hull, and later set up his own firm in Ottawa, consulting for various companies and specializing in RF design. He was a member of the Association of Professional Engineers of Ontario



and a senior IEEE member.

Tony was a loving husband of 50 years to Jitka (BASc'73, Civil). He was happy to have seen his three daughters succeed in their careers and find their life partners, and he was overjoyed at the arrival of each of his six grandchildren. He passed away peacefully at home, his family present, on July 21, 2019, after a long-term illness.

RUTH BURSTHALER, MSC'73

April 6, 1936 – July 26, 2019.

Ruth passed away peacefully on July 26. She had no children but will be sadly missed by her nine nieces and nephews and many friends.

Ruth was a nurse by profession, and obtained her master's degree in 1973 at UBC. She spent most of her career involved in nursing education, both in Canada and also abroad with the World Health Organization. She worked in Egypt, Libya and Iran to

improve nursing practice and help establish a Bachelor of Nursing program. After her work abroad, she began a PhD at UBC, but did not finish, instead taking a job consulting in Continuing Education for the Registered Nurses Association of BC. She completed her career with the Canadian Cancer Society, then retired to Salt Spring Island in 1994. She led an adventurous life, full of passion for the education of women and the welfare of animals.



JANET L. PORTER MIKLAS, BSC'82

Janet Miklas (née Porter) passed away suddenly of a heart attack in August 2019. She was born in England and trained as an occupational therapist. Upon moving to Vancouver,

she completed the bachelor's degree completion program in rehab (OT) in 1982 and worked at CARS and GF Strong in Vancouver. She retired to travel and sail with husband Walter, before moving to Gabriola Island in 2010. They enjoyed the island life and were involved in gardening, wildlife preservation and preventing freighter anchorage off Gabriola (GAFA). She was predeceased by her husband in 2019. Janet is survived by her sister Ann Porter Hoke (UBC grad '82) and the family in the US. Janet left her many friends and family too early; she still had preservation causes and travel plans to complete.



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THE LAST WORD



Eden Robinson

MFA'95, DLitt'18

Avid reader,
would-be weaver.

WHO WAS YOUR CHILDHOOD HERO?

My dad.

DESCRIBE THE PLACE YOU MOST LIKE TO SPEND TIME.

In the tub reading.

WHAT WAS THE LAST THING YOU READ?

An edited copy of the forthcoming novel *Probably Ruby* by Lisa Bird-Wilson.

WHAT'S THE MOST IMPORTANT LESSON YOU EVER LEARNED?

Stubborn, patient persistence trumps everything. Be as soft and relentless as water and you can carve the Grand Canyon.

WHAT WAS YOUR NICKNAME AT SCHOOL?

Bubbles.

WHAT IS YOUR MOST PRIZED POSSESSION?

I commissioned a cedar hat by Colleen Nelson, and it is so intricate and perfect. It gives me joy every time I look at it.



CLAIM TO FAME

Award-winning author whose latest novel, *Return of the Trickster*, concludes a lauded coming-of-age trilogy



HOBBIES

They include “shopping for the apocalypse” and “perfecting gluten-free bannock”



LATEST PROJECT

Haisla language classes

More Q&As with Edén Robinson at trekmagazine.alumni.ubc.ca

WHAT WOULD BE THE TITLE OF YOUR BIOGRAPHY?

I Would Rule the World if I Could Get Off the Couch.

IF A GENIE GRANTED YOU ONE WISH, WHAT WOULD IT BE?

A zero-emissions house near the ocean with an air pump, emergency wood stove and solar panels.

WHOM DO YOU MOST ADMIRE (LIVING OR DEAD) AND WHY?

My grandmother. She had a knack for loving people who didn't know how to love themselves. She didn't put up with BS, but she still wrapped her love around you like a warm blanket.

WHAT WOULD YOU LIKE YOUR EPITAPH TO SAY?

Eden Robinson has moved on to her next chapter.

WHAT IS YOUR PET PEEVE?

People who cut the line.

IF YOU COULD INVENT SOMETHING, WHAT WOULD IT BE?

A way to cheaply and easily remediate mercury spills.

IN WHICH ERA WOULD YOU MOST LIKE TO HAVE LIVED, AND WHY?

Whatever era they discover how to shut off Rheumatoid Arthritis. I have PMR and AS, two rare types of RA, and the impact on my life has been profound. I miss my strength and energy.

NAME THE SKILL OR TALENT YOU WOULD MOST LIKE TO HAVE.

Anything with my hands! My mother is a seamstress, my aunties weave and crochet, my uncles carve, and they all create wonderful things. All my cedar weavings turn into coasters.

WHICH FAMOUS PERSON (LIVING OR DEAD) DO YOU THINK (OR HAVE YOU BEEN TOLD) YOU MOST RESEMBLE?

Elaine Miles, who played Marilyn Whirlwind on *Northern Exposure*.

DO YOU HAVE A PERSONAL MOTTO?

Do it now before you forget to do it.

WHAT IS THE SECRET TO A GOOD LIFE?

Prioritize love.



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the difference.”**

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Ogechi Anumba

First-year student, UBC Science



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