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Editor's Note



THE MYSTERIOUS BRAIN

The human brain contains billions of neurons connected by trillions of synapses. To put that in perspective, the number of busy little neurons in our heads has been compared to the number of stars in the Milky Way, and the number of connections between them to the number of galaxies in the universe (give or take). Although not strictly accurate, the comparison helps to convey the unmatched complexity of the brain. Is it any wonder that we know relatively little about it? While modern imaging techniques have revealed a significant amount about the brain's structure – and which parts of it are associated with certain functions, experiences, or disorders – knowledge remains limited about the underlying processes. The brain is a hard nut to crack, which makes it irresistible to researchers from a wide span of disciplines – from the computer scientists who want to simulate it, to the neurologists who want to heal it, to the philosophers who have long-pondered the abstract concept of the mind.

Its enigmatic and controlling nature places the brain high in the anatomical pecking order. While it's good to have guts or a big heart, "brainy" is arguably the more covetable attribute. And while people sometimes say they feel things in their gut or in their heart, it's really the brain that is most closely associated with our sense of self. It's the motherboard for our memories, moods, perceptions, decisions, and speech. It's the mysterious generator of dreams and ideas. This is why conditions that affect the normal functioning of the brain, such as dementia, stroke, and psychosis, represent some of our biggest health fears. They can rob us of our humanity – our ability to remember, to reason, to be in control, to be ourselves.

With populations aging and mental health disorders on the rise, the human brain is receiving more attention than ever, with several nations committing many millions of dollars to research programs. These initiatives, together with advancing technologies such as machine learning, are driving new methods for modelling and studying the brain. And this in turn is leading to greater insights into how the brain develops and functions, to better understanding about how diseases of the brain progress, and to the development of more treatments and strategies for keeping our brains healthy into old age.

We may never fully unravel the mysteries locked inside the brain's slippery maze, but mystery is what propels our thirst to know and the discoveries that improve our lives.

"The most beautiful experience we can have is the mysterious," wrote Albert Einstein, a man whose brain was much admired. "It is the fundamental emotion that stands at the cradle of true art and true science." *

VANESSA CLARKE Editor

*translated quote from Mein Weltbild (My World View)

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CBC VANCOUVER

HEALTHY BRAINS

- 4 The Case for Daydreaming Far from a waste of time, it's a good habit to have.
- 10 Our Second Brain: More than a Gut Feeling The human digestive tract contains millions of neurons.
- 16 Brainwaves Novel UBC research targets devastating neurological disorders.
- 20 Getting Under the Skin with Epigenetics How does everyday experience affect brain development?
- 26 When Stress Gets in Your Head The links between stress and depression are strong and mysterious.
- 30 The Science of Forest Therapy How forests can improve emotional and cognitive health.

Healthy Brains

Cover: Photography by Kyrani Kanavaros, illustration by Katie Lukes This page: Image by Andriy Onufriyenko/Moment via Getty Images With populations aging and mental health disorders on the rise, the human brain is the focus of more research attention than ever. Advancing technologies such as machine learning are driving new methods for modelling and studying this highly complex organ, and strategies for keeping us healthy, long into old age.

The case for daydreaming

It's time to put down your phone and let your mind wander.

BY **RICHARD LITTLEMORE** PHOTOGRAPHY BY **KYRANI KANAVAROS** ILLUSTRATIONS BY **KATIE LUKES**



IT'S GETTING EASIER and easier to hate the phone – and according to UBC psychology professor Dr. Kalina Christoff, that animosity might be well placed.

The phone in question should not be understood as a telephone; hardly anybody still uses those things to actually speak – out loud – to another person. No, a phone in today's context is the computer in your pocket, your crutch and addiction, the thing that steals your attention and monopolizes your time – but spares you from ever looking lonely or unproductive. According to Christoff's theory, these instruments that entertain and inform – that sometimes hold us trancelike – might also be obstructing the part of our brain that we rely upon for self-reflection and creativity. In a cumulative and worrying way, our smartphones might be making us stupid.

This is no mere speculation. Christoff's opinion is informed by much more than the gut-level concern felt by every parent who has watched their adolescent children disappear into violent videogaming or Insta-gratification. Christoff has stared, at least metaphorically, into the brains of thousands of test subjects, looking especially at what's happening when they are not hyperfocused – and what she has seen is remarkably positive. On the increasingly rare occasion when we let our minds wander, the blood in our brains rushes to what is called the default network. Christoff's assistant, UBC master's student Andre Zamani, describes this network as a vital support centre for spontaneous thought – a creative space that helps us sort through our thoughts and experiences. Christoff says, "Our experiences form our lives - past, present, and future - and left to wander, our mind will process them into stories and meaning." But a cultural emphasis on goal-driven thinking, which happens in another part of the brain, "disconnects us from the fullness of our experience." The long-term effect of this disconnection is unclear, but Christoff points out that if we disrupt animals when they are dreaming (another function that occurs in the default network), they fail to learn. That hardly feels promising at this point in human history. Christoff has what could be characterized as an antiauthoritarian view of human cognition. An early fan of the political philosopher Friedrich August Hayek, whose fundamental thesis is that people should be free from coercion, Christoff has always resisted attempts to force the functioning of her brain into any kind of a box. This concern emerged early. Born in Sofia, Bulgaria, before the fall of the Berlin Wall, she grew up in an era of "Soviet socialist doctrine-based control." Bulgaria, she says, was a place where the government was there "to tell people how to begin their autobiography." They told a clearly talented seven-year-old Christoff that she was going to be a concert pianist. They placed her in an exclusive music school and said - great news! - she wouldn't have to study history or math; she could just play the piano all the time. Christoff didn't last. Aside from getting into trouble for improvising when playing the classics, she says, "I wanted to study math." By the time the Iron Curtain fell in 1989, the then-14-year-old was beginning to take an interest in social processes. Soon after the New Bulgarian University opened in 1991, she began studying economics and political science, discovering Hayek before switching to a Bachelor of Science in psychology and a master's in cognitive science. All the while, on the long bus rides to and from school, she was marvelling at the other passengers - all trapped in that pre-cellphone space, staring slack-jawed into the middle distance. Christoff couldn't help wondering what was happening in those apparently idle brains. When she got accepted to a PhD program at Stanford University in 1997, Christoff says she was excited to get away from the still-oppressive Bulgaria, but she was soon bridling under a different kind of coercion – the cultural compulsion in the West to produce, to always be doing

something. Against that background, she became increasingly interested in understanding the thoughts of humans who were clearly productive and those who didn't seem to be doing very much at all – soon emerging as an expert in using functional Magnetic Resonance Imaging (fMRI) to illuminate brain performance.

Developed in the 1990s, fMRI is an open, non-invasive window into the mind – a mechanism not just for mapping the brain, but for watching it work. Using radio waves and an electromagnet that generates a field 50,000 times the strength of the Earth's background magnetism, an fMRI scanner can generate real-time images that enable scientists to track blood and oxygen as it moves to and from different parts of the brain.

Zamani says this has offered a huge advance over the early days of brain mapping, when the American-Canadian neurosurgeon Wilder Penfield revolutionized the field by inserting electrical probes into the brains of patients who were awake on the operating table, stimulating tissue to try to identify the function of various parts. Some of Penfield's brain maps, published in the 1950s, are still in use today, but – thanks in part to fMRI scanners – scientists now understand that most functions don't rest in a single place in the brain: they are performed by elaborately interconnected and dynamically adaptive networks.

Depending on whom you ask, there are seven main networks, such as the sensorimotor network (feeling, hearing, and motor response) and the visual system (sight and visual processing). And while the various parts of the brain all function more or less at once, some networks necessarily consume more blood-borne resources while they are working. For example, if there is a loud bang in the room, the dorsal attention network will jump into action, and perhaps recruit other parts of the brain to respond to a threat or an opportunity. Of the seven, however, the two most prominent are the executive network which is responsible for task-oriented, deliberate thinking - and the default network, the part of our brain that is active when we mentally turn inward, during introspection and imagination.

If you look at this from the perspective of micromanaging employers, they want to see their offices full of alert-looking people animated by their executive networks – doing their work and focusing their attention on tasks that will advance the corporate purpose. On the surface, at least, that's where



KALINA CHRISTOFF

Professor of psychology. Expert in using functional Magnetic Resonance Imaging (fMRI) to study brain functions.

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CURRENT PROJECT

Writing a book about how the self arises through spontaneous

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She enjoys jazz, windsurfing, and anything that makes waves.

the money gets made. A room full of people whose brains are engaging their default networks might look instead like they are all daydreaming, which is micromanagingemployer code for "doing nothing." But Christoff's fMRI research shows that a wandering mind is, in fact, an incredibly active mind, busy making connections in a way that could be highly beneficial, even if it might not always contribute to an immediate task or the day's productive bottom line. "We measure and value everything that is enabled by the executive network, but we put that function on a pedestal to the detriment of other functions in the brain," she says. "If one network is on all the time, it takes away from the others – it takes away our opportunity to reflect, to understand who we are, or to make sense of our experiences. There is a dynamic imbalance." And another way to understand "dynamic imbalance," she

says, is "burnout." When Christoff shares her research, showing fMRI images of people in silent reverie, their default networks highly active, many ask what we should be doing to restore balance. To which she says it's not as simple as turning off your phone: "Devices are just a tool – good or bad. But we use tools to entrench our existing problems." At least other people do. Christoff, who in addition to her academic and research duties also served recently as the interim director of the Peter Wall Institute for Advanced Studies, keeps the notifications on her own phone turned off 24/7 – she responds in her own time.

Hearing that the default network also dominates when we are dreaming, some people ask if we should simply sleep more, to which Christoff says: Yes, but... It's good to get enough sleep, and when you dream you have spontaneous thoughts; it's a critical function. But even "lucid dreaming" (when you're aware that you're dreaming) doesn't involve deliberate processing, says Christoff. Whereas, if you are mind-wandering during the day, you get the benefits of the spontaneous and creative thought, but also the possibility of an attentive response - "not just the wild elaboration, but the deliberate evaluation." Which means that if you stumble upon a good idea, you can alert the executive network to register and act upon it. Of course, being over-tired means that if you finally get a moment to daydream, you're likely to just fall asleep. Christoff says you have to get enough sleep so you can be awake to mind-wander.





CHRISTOFF'S RESEARCH SHOWS THAT A WANDER-ING MIND IS AN INCRED-IBLY ACTIVE MIND, BUSY MAKING CONNECTIONS IN A WAY THAT COULD BE HIGHLY BENEFICIAL.

Another common question, which Christoff reports with a tiny hint of frustration, is "What should I do if I have half an hour?" Her somewhat contradictory answer is that you can't schedule spontaneity, but you have to make time for it. You can't just sit down with an inspired sense of purpose and daydream. But if you make a habit of turning off the phone and building into your routine a daily bus ride or a walk to work, your brain will begin to anticipate that opportunity and take advantage of it.

Of course, you also have to overcome any traditional and cultural biases against sitting in quiet contemplation. There is, first of all, the Freudian suspicion of the "dark mind," ever lurking to lead us off the righteous path. As Christoff says, "Who knows what I might think next if I leave my mind to wander?" There is also research from Harvard psychologists Matthew Killingsworth and Daniel Gilbert, who authored a 2010 paper published in *Science* entitled, "A wandering mind is an unhappy mind." They argued that we are happier when we remain on task, not allowing obsessive thought to crowd its way into our consciousness. Christoff disagrees. "Obsessive thought can seem spontaneous, but it's usually driven by strong incentives." We might be ruminating about money problems or some task left undone, or simply "negatively self-evaluating." Christoff says, "True spontaneous mind wandering actually gets us away from the thing we can't stop thinking about." So, she says, in this world where we can't imagine a solution that is based on spontaneity, not on control, we should set aside some time to do something that makes us happy – itself a challenge. "We don't notice what makes us happy; we are too busy doing what we are told." Still, she adds, it's worth the effort; play jazz, work in the garden, go for a walk. "Make sure all the systems of the brain have their time of day."

8 UBC MAGAZINE / ALUMNI UBC

OUR SECOND **BRAIN: MORE THAN A GUT** FEELING

The human gut contains more nerve cells than the spinal cord and exerts significant influence on the brain.

BY HEATHER GERRIE, MSC'21 | ILLUSTRATIONS BY NAÍMA ALMEIDA

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UBC MAGAZINE / ALUMNI UBC 11

YOU DON'T NEED a degree in neuroscience to suspect that the brain and gut are somehow connected. The feeling of "butterflies" in our stomach when we prepare to give a presentation, stress-induced stomach ulcers, emotional eating, and even our intuition showing up in the form of a "gut feeling," all provide clues that the brain and gut are talking to each other.

But the brain and gut are far more connected than most of us realize. In fact, emerging evidence is showing that the gut-brain axis is one of the most powerful relationships in our body.

OUR ENTERIC NERVOUS SYSTEM

Comprised of 100 million neurons, the network of nerve cells lining the digestive tract is so extensive that it is sometimes called the "second brain." Technically known as the enteric nervous system, this network of neurons is often overlooked – yet it contains more nerve cells than the spinal cord or peripheral nervous system.

This resemblance to the brain in our heads doesn't end with neurons. The mass of neural tissue in our gut produces over 30 different neurotransmitters, which are signal ling molecules typically associated with the brain. This includes a staggering 95 per cent of the production and storage of serotonin, the neurotransmitter famously known as the "happy chemical" due to its role in regulating mood and wellbeing.

GUT-BRAIN CROSSTALK

So how do the brain and gut actually talk to each other? A thick cable of neurons runs between the base of the brain and our gut forming the vagus nerve, the longest cranial nerve in our body. The vagus nerve serves as a bidirectional information highway, with the brain and gut sending messages to each other within the order of milliseconds.

The vagus nerve isn't the only way the brain and gut communicate. Our guts are home to trillions of bacteria and microbes that inhabit the intestines and form the gut microbiota. The gut microbiome is so enormous that there are 100,000 times more

12 UBC MAGAZINE / ALUMNI UBC

microbes in your gut than there are people on Earth.

Many of these microbes live in the mucus layer that lines the intestines, placing them in direct contact with nerve and immune cells, which are the major information gathering systems of our bodies. This location also primes microbes to listen in as the brain signals stress, anxiety, or even happiness along the vagus nerve. But the microbes in our gut microbiome don't just listen. These cells produce modulating signals that send information back up to the brain. In fact, 90 per cent of the neurons in the vagus nerve are actually carrying information from the gut to the brain, not the other way around. This means the signals generated in the gut can massively influence the brain.

THE INFLUENCE OF GUT HEALTH **ON BRAIN HEALTH**

The crosstalk along the gut-brain axis helps make sense of the accumulating evidence that the gut is involved in

of inflammation, which is a chronic symptom in many neurological conditions. Disruption in the health of the gut microbiome can trigger an immune response and lead to inflammation. Over 70 per cent of the body's immune cells are targeted to the digestive tract – which is helpful in the case of ingesting toxic bacteria but also means a gut-immune response can launch a powerful inflammatory response in the body.

THE ROLE OF THE SECOND BRAIN IN MOOD DISORDERS

Inflammation is also a hallmark of mental illness and may explain the link between gut and mental health. For example, a recent study reported that a significant number of patients with inflammatory bowel disease also suffered from depression and anxiety. Both the vagus nerve and gut microbiota are likely involved in this. Stimulation of the vagus nerve has been shown to reduce inflammation and stress, and some researchers are

The vagus nerve serves as a bidirectional information highway, with the brain and gut sending messages to each other within the order of milliseconds.

brain health and disease. Many neurological conditions, such as Parkinson's disease, Alzheimer's disease, schizophrenia, and autism spectrum disorder are correlated with gastrointestinal issues or altered gut microbiomes. Recent research on Parkinson's disease found that the enteric nervous system begins to degenerate before the classical symptoms of Parkinson's appear, and a dysfunctional gut microbiome is typical of this disease. Further, there is a significant decrease in the quantity of microbes in the gut microbiome of individuals with Alzheimer's disease, and an unhealthy diet is a commonly cited risk factor for Alzheimer's. One explanation for this is the role

even suggesting that vagus stimulation could be a new drug-free antidepressant. Certain healthy gut bugs like the probiotic Lactobacillus rhamnosus, can even send signals to neurons to release GABA, a neurotransmitter that promotes calmness. Gut microbes also promote neuroplasticity, a process implicated in mood.

While it is now apparent that the gut is more than just a machine for digesting food, there is still much to be discovered in terms of how the gut can influence overall health. As our understanding of the gut-brain axis increases, there is the exciting possibility that improving gut health may lead to breakthroughs for treating brain disorders.

ORTH NORT WITH MARGARET GALLAGHER

WEEKENDS 6AM



HEALTHY BRAINS / THE GUT-BRAIN AXIS

The Gut-Brain Axis

UBC researchers are uncovering the links between gut health and brain health

BY HEATHER GERRIE, MSC'21 | ILLUSTRATIONS BY NAÍMA ALMEIDA



Modern life and missing microbes

CAROLINA TROPINI'S FAVOURITE BRAIN FOOD: BERRIES (WHICH ARE HIGH IN ANTIOXIDANTS)

Dr. Carolina Tropini (BSc'08) is an assistant professor in the School of Biomedical Engineering and Department of Microbiology and Immunology. Her research examines how industrialization and modern lifestyles have led to the loss of key bacteria from our gut microbiota and the impact of this on human health and disease. But how do you go about establishing which microbes have been lost? Tropini's team compared the microbiomes of people from traditional and industrialized societies and noted which microbes were missing from the industrialized gut. Modern lifestyle factors such as antibiotic usage, diets high in processed food, increased sanitization, and less time outdoors have reduced exposure to bacteria and changed the landscape of the gut microbiome. "In turn, an altered microbiota increases risk for modern diseases such as chronic inflammation, diabetes, and inflammatory bowel disease [IBD]," says Tropini, "all of which were unknown to our ancestors."

Tropini's lab has a growing interest in how early-life gut inflammation influences the developing brain. In a collaborative project with Dr. Annie Ciernia, co-winner of the UBC Faculty of Medicine 2021/2022 Precision Health Catalyst Grant, Tropini's team induced gut inflammation in young mice to mimic pediatric IBD. These

young IBD mice demonstrated abnormal immune signalling in the brain, alongside deficits in social and cognitive development. Untangling the implications of a depleted microbiome on brain health beyond development is a work in progress. "There is a lot of correlation between altered gut microbiota with inflammation, which leads to an increased risk of depression and dementia," says Tropini. But she notes, "Eating poorly for one meal likely won't lead to permanent negative impact; it's lifestyle changes and loss of these microbes that can cause long-term effects." What can we do to regain healthy microbes in our gut once they've been lost? The answer may not be quite as simple as a probiotic supplement. "Not all probiotics are created equal," explains Tropini. Fermented foods such as yogurt, kimchi, and sauerkraut are more helpful for building resilient immune systems because they create a natural exposure to microbes. "If you want to reintroduce bacteria there need to be things in place that will support natural growth and integration." Tips for creating a supportive gut environment include a diet with plenty of variety and fibre to help different members of the microbiota flourish.



Could a parasitic worm help **MS patients?**

LISA OSBORNE'S FAVOURITE BRAIN FOOD: COFFEE (WHICH CAN BE PROTECTIVE AGAINST ALZHEIMER'S)

The thought of a parasitic worm living in your gut is generally not a positive one. But Dr. Lisa Osborne (PhD'11), an associate professor in the Department of Microbiology and Immunology, is on a mission to show us just how beneficial certain worms are for our brain and gut health.

The aut microbiome is home to a rich and complex ecosystem containing bacteria, viruses, fungi, and mammalian parasites. Much like the earth's ecosystems, industrialization, and modern lifestyles have led to a significant decline in biodiversity. Disappearing from the modern gut are helminths, parasitic worms which have been eradicated in two thirds of the global population.

While a heavy burden of worms has negative health outcomes, the surprising twist is that too few worms can also be bad for us. "Epidemiologists noticed that areas where helminths are still endemic have really low rates of autoimmune and inflammatory disorders," Osborne explains. "Where helminths have been eradicated, those diseases are on the rise." A possible explanation for this trend is the "Old Friends hypothesis," which suggests that exposure to specific viruses, bacteria, and even worms during development helps build resilient immune systems.

The theory that helminth infection could be protective against certain diseases is supported by the immunomodulatory mechanisms of helminths. "Worms are powerful immunomodulators," says Osborne. "They guide wound healing and limit inflammation, which is directly antagonistic to the damage caused by autoimmune disorders." This is beneficial for helminths, as limiting

inflammation prevents them from being expelled by the body. Osborne's research team investigates helminth infection in cases of multiple sclerosis (MS), an incurable autoimmune disease. In a mouse model of MS. Osborne's lab showed that helminth infection can delay onset and promote disease remission. A recent preliminary clinical trial in England treated MS patients with hookworms, a type of helminth. It showed promising results and no adverse side effects.

Are worms the future of treating diseases like MS? "I really do believe that worms are an incredible tool for learning about the gut-brain axis," says Osborne. But she cautions that worms are still parasites and harnessing the power of helminths may be better approached indirectly. "Perhaps there are specific compounds we can isolate from these worms that then guide immune based treatments."

residue limits.

Common herbicide affects mouse behaviour

JACQUELINE BARNETT'S FAVOURITE BRAIN FOODS: CHOCOLATE AND COFFEE (FOR THEIR IMPACT ON MOOD)

The food we eat impacts our brain and gut health. But how we grow what we eat matters just as much. Jacqueline Barnett (BSc'17) is a PhD candidate in Dr. Deanna Gibson's lab in the Department of Biochemistry and Molecular Biology at UBC Okanagan. Her research investigates the impact of the herbicide glyphosate on our gut microbiome.

Glyphosate is the active ingredient in Roundup™, an agrochemical that first came on the market in the 1970s and revolutionized farming by controlling weed growth. Almost 19 billion pounds of Roundup[™] has been sprayed globally since 1974, with notably high amounts used on Canadian dietary staples such as wheat, soy, oats, and corn.

Humans do not possess the pathway that glyphosate acts on, so it was believed that the herbicide did not pose a risk to human health. However, glyphosate does alter the bacteria in our gut. "Glyphosate actually inhibits a really important bacterial pathway," says Barnett. This is the shikimate pathway, a metabolic pathway used by bacteria and plants.

Opportunistic pathogens are more resistant than healthy microbes to the effects of glyphosate, which can result in the overgrowth of harmful bacteria. An imbalance in the ratio of healthy to harmful bacteria in the gut can induce an inflammatory state called dysbiosis, which has the potential to impact behaviour via the gut-brain axis.

Barnett investigated the impact of glyphosate on microbiome dysfunction and behaviour by exposing mice to glyphosate in doses approved by the Environmental Protection Agency. Her findings suggest that even the approved dose has an impact and that the effects persist through multiple generations. "We're seeing behavioural differences - mice whose grandparents were exposed travel less and move more slowly," she says. Glyphosate exposure also shows effects on anxiety and working memory. Research efforts to understand the impact of glyphosate on human health are growing. "It's possible that the impact of glyphosate [has] been going on for years, but the chronic effects are compounding with subsequent generations," says Barnett.

Barnett emphasizes that glyphosate has legitimate benefits. "We live in a world where food insecurity is a real threat," she says, pointing to the fact that agrochemicals increase yield and reduce cost to farmers. But she hopes for better surveillance. "The Canadian Food Inspection Agency does not test for glyphosate," says Barnett, proposing better quantification of maximum



BRAINWAVES

Serious disorders affecting the brain and nervous system can be complex to treat. UBC researchers are exploring some promising new avenues.

SPINAL CORD INJURY

A MULTIDISCIPLINARY RESEARCH TEAM HOPES TO MEND THE GAP

A car crash, a sporting collision, a fall from a ladder — incidents like these can change lives in an instant. If the spinal cord snaps, the resulting gap means nerve impulses from the brain can't reach the body. That disruption can cause significant health problems including chronic pain, sexual dysfunction, loss of bladder or bowel control, and paralysis.

Spinal cord injury (SCI) also poses serious challenges for healthcare treatment. Invasive surgery and the use of solid materials for repairing the gap carry the risk of damaging any remaining nerve fibres and bodily functions.

An innovative approach to treatment offers hope. UBC's multidisciplinary Mend the Gap team is developing a soft gel biomaterial that a machine-vision-equipped surgical robot can inject precisely into the point of injury to help nerve fibres regrow. In contrast to previous treatments, the biomaterials are compatible with bodily systems and structures, says research lead Dr. John Madden, a UBC electrical and computer engineering professor. The gels can also contain medication to modify scar tissue (which can complicate repair) as well as revive nerve fibres.

"The soft gel that our team plans to use contains tiny magnetic rods that are aligned using an external magnet, creating guide rails that support the nerve fibres to grow in the right direction, eventually crossing the gap," Madden says.

UBC surgery and zoology professor Dr. Wolfram Tetzlaff points out that because invasive surgery is minimized, recovery times could be faster and the potential for damage is reduced. Beyond SCI, the researchers hope to find ways of applying this treatment to other chronic injuries. "A soft gel can be moulded into the shapes of the many different lesions seen in the body, and thus provide personalized treatment," says Tetzlaff. Due to the complexity of the nervous system, a cure for SCI is not currently the goal. But the team hopes the project will lead to increased motor function, a longer life span, and a better quality of life.

Tanya Bennet, a PhD student in Biomedical Engineering, is pipetting hydrogels that serve as scaffolds for neural cells, in the development of an in vitro model of the injured spinal cord. *Photo: Martin Dee/UBC*

BRAIN CANCER

TINY RECEPTORS COULD BE A KEY NEW TARGET FOR TREATMENTS

Brain cancer. It's the diagnosis no one wants to hear. Patients with high-grade gliomas, or tumours in the brain and spinal cord, have an average life expectancy of 12 to 16 months. Not only do tumours in the brain spread more aggressively than in other tissues, but they are also resistant to chemotherapy and have a high probability of recurring after surgical removal.

Two UBC Okanagan researchers are working to better understand the development and rapid growth of cancerous cells in the brain. Sessional lecturer Dr. Mitra Tabatabaee and Dr. Fred Menard, a professor of chemistry, biochemistry and molecular biology, examined astrocytoma, a highly fatal cancer with no effective treatment that begins in astrocytes – cells that support nerve cells.

They analyzed the potential role of an imbalance of glutamate – a neurotransmitter that stimulates nerve cells – in astrocytoma progression. Their findings suggest that several receptors not previously considered in brain cancer research might be crucial to cancer's growth.

Star-shaped astrocytes extend tentacle-like cellular projections to communicate with neighbouring cells. When astrocytes become cancerous, these projections become longer, and their networks more complex, invading different areas of the brain. How far they extend is implicated in the cancer's resistance to treatment, as any extra-long cell projections left behind during surgery can grow back.

A suspected cause of this uncontrolled growth is elevated levels of glutamate. When astrocytes sense glutamate, the concentration of calcium rises inside the cell. Since calcium is also necessary for growing cellular projections, the glutamate receptors that affect the calcium inside astrocytes are prime suspects for the abnormal growth of astrocytoma cells.

Tabatabaee and Menard identified a glutamate receptor and two other molecular contributors crucial in extending the projections of cancerous cells. With further study, researchers believe that these overlooked receptors can serve as targets for designing more effective chemotherapies and open up new avenues to halt the progression of this aggressive and often fatal cancer.

MULTIPLE SCLEROSIS NEW RESEARCH NETWORK IS DEVELOPING NEXT-GENERATION

CELL-BASED THERAPIES

Multiple sclerosis (MS) is an unpredictable and incurable disease where the immune system mistakenly attacks and destroys nerve cells in the brain and spine. Symptoms can vary greatly, from dizziness and muscle spasms to loss of vision, speech, or movement.

Thanks to an unprecedented \$33.8 million donation from an anonymous donor, UBC and partners are forming the MS Research Network headquartered at the Djavad Mowafaghian Centre for Brain Health, which will use the latest in cell and gene engineering to develop, manufacture, and test next-generation cell-based therapies. Researchers spanning multiple disciplines are collaborating to tackle different aspects of the disease, with the aim of slowing the progression of MS by controlling symptoms and even reversing the damage it causes to the nervous system.

Surgery and biomedical engineering professor Dr. Megan Levings is leading research that could make immunosuppressant treatments more effective for more patients. These treatments can leave patients vulnerable to infection, but her research team has proven that T cells, which control the body's response to healthy tissue, can be trained to recognize and accept specific tissues that a faulty immune system would attack. The goal is to control inflammatory responses that contribute to damage of the nervous system. Meanwhile, medical genetics professor and neurobiologist Dr. Freda Miller is leading an exploration of how stem cells could be used to repair damage caused by MS, which destroys myelin, the fatty protective sheath covering nerve cells in the brain and spine. "The beauty is that the brain contains reserves of neural stem cells. With the right chemical prompts, they can be converted into cells that produce myelin, replacing the ones destroyed by MS," says Miller. The combination of the research by Dr. Miller's team with Dr. Leaving's immuno-

Dr. Miller's team with Dr. Leaving's immunotherapy could offer patients the possibility of recovering. "In a perfect world, we figure out a way

"In a perfect world, we figure out a way to regenerate the damaged areas, while our colleagues in immunology train the immune system to leave the new myelin alone," Dr. Miller says. "It's a one-two punch."

ALZHEIMER'S

LAB-GROWN MINI-BRAINS REVEAL PROCESSES OF BRAIN DEGENERATION

Two UBC researchers are using stem cell technology, 3D bioprinting, and next-generation neuroimaging to grow and analyze tissue models of patient's brains. Their aim is to better understand the mechanisms of Alzheimer's disease and inform new options for treatment. Dr. Haakon Nygaard (Fipke Professor in Alzheimer's Research and director of the UBC Hospital Clinic for Alzheimer Disease and Related Disorders) and Dr. Brian MacVicar (UBC psychiatry professor and Canada Research Chair in Neuroscience) are collaborating on a pioneering project to determine the role that oxidative stress plays in the death of brain nerve cells. "Understanding the specific processes that trigger oxidative stress is key to developing successful targeted therapies for people with Alzheimer's," explains MacVicar. Using stem cells taken from the blood of Alzheimer's patients and a 3D bioprinter, the researchers are growing tissue models of the patients' brains in petri dishes. Each model, Nygaard clarifies, is "a 3D ball of tissue that incorporates the major cell types of the brain" but, unlike the brain, is "not a complex, multi-layered structure." These 100 "neurospheres" enable researchers to closely follow and gain insights into the basic cellular mechanisms that cause the brain to degenerate into Alzheimer's. MacVicar has developed techniques using state-of-the-art neuroimaging to help them visualize these processes.

Dr. Haakon Nygaard, Fipke Professor in Alzheimer's Resea

They have nearly completed a three-dimensional model that incorporates the main cell types of the brain. This model, says Nygaard, will help them find answers to long unanswered questions, such as how different cell types interact. "Once we have modelled the progression of Alzheimer's in many different patients, the data should yield valuable new insights into how, ultimately, we can reduce oxidative stress and protect brain nerve cells." Both Nygaard and MacVicar are optimistic that their work could lead to the development of more effective diagnosis and intervention, and maybe even prevention.

18 UBC MAGAZINE / ALUMNI UBC

PARKINSON'S

MACHINE LEARNING FOR BETTER DISEASE MONITORING AND TREATMENT

A person with Parkinson's disease will typically be monitored just once or twice annually by their physician, but a clinic visit is often a poor reflection of how people are doing in the comfort of their own homes. Dr. Martin McKeown, John Nichol Chair in Parkinson's Research, says that's because symptoms can fluctuate due to multiple factors. Researchers at the Djavad Mowafaghian Centre for Brain Health are working on new ways to unobtrusively monitor patients between visits.

One approach is the deployment of privacy-compliant smart cameras to empower people to monitor their disease at home. The new cameras, coupled with analyses being developed by McKeown and colleagues, are powerful enough to analyze the data (without requiring images to be stored or transferred) to help inform treatment decisions. Another initiative involves an app that can remotely measure and score 12 movements involving fingers, arms or feet – an assessment that previously required a clinic visit.

When Parkinson's medication wears off, it can be very uncomfortable, but taking too much medication to prevent this results in other problems. Predicting wearing-off symptoms an hour before they happen would allow enough time to take new medication and have it take effect. Researchers are thus trying to ascertain if a wearable sensor can provide this information, which could eventually be used to guide dosage and timing.

McKeown and colleagues are also using various brain imaging techniques to determine the best ways to non-invasively modulate the brain (via an electrical current or ultrasound) to improve motor function.

Tying all these projects together is the requirement of analyzing huge amounts of data, all while ensuring that the privacy of individual patients is integral to the design. Data scientist and research associate Dr. Maryam Mirian oversees the analysis of these data using various AI and machine learning approaches.

Ultimately, machine learning techniques applied to "big data" will provide a more complete understanding of what is happening in the daily lives of patients, contributing to much-needed advances in treating this degenerative disorder. · · · <mark>· · ·</mark> · · · · · · · · · · · · ·

Getting Under the Skin with Epigenetics

Unravelling the mysteries of gene expression in early brain development.

BY CHRIS CANNON | ILLUSTRATIONS BY FERNANDO VOLKEN TOGNI

20 UBC MAGAZINE / ALUMNI UBC

IT'S BEEN 20 YEARS since the completion of the Human Genome Project, one of the most ambitious and fruitful scientific endeavours in all of human history. The mapping of the human genome in 2003 engendered a new approach to biomedical research, laying out the complex musical score of our DNA that would allow us to discover, analyze, and even change the individual notes that make up the symphony of the human body.

If the genome is the score, then epigenetics is the orchestra – the combination of biological players in the body that determine how those notes are expressed. Just as an individual musician might play a measure more legato than is written on the sheet, an individual environmental factor might cause a gene to express itself differently in the human body, without any change to the underlying DNA. As an orchestra can play a score in a variety of different ways, epigenetic modifications - both natural and human-engineered - can alter the expression of genes in response to environmental cues, causing lasting effects on an individual's health and well-being over the course of their life. "There is an innate part of shaping the epigenome that happens from conception onwards in all of us," says Dr. Michael Kobor, UBC professor of medical genetics. "There's pretty good evidence that there are certain sensitive periods during human development where given environments or experiences might exert a more profound effect on the epigenome. The best-studied sensitive periods are during early life, where a lot of the research has shown that if something happens to a growing child, it can get under the skin, as we like to say, and in part, be associated with different changes in the epigenome."

THE PLASTICITY OF NEWBORN BRAINS

Kobor and his team have been working with Dr. Steven Miller - a neurologist who focuses on newborns, studying brain injury and brain development in babies who are critically ill, or born prematurely, or with

THE IDEA THAT **WE CAN REWIND EPIGENETIC CHANGES AND CREATE POSITIVE EPIGENETIC PAT-TERNS SPEAKS TO** THE POTENTIAL TO **NOT ONLY SLOW** DOWN, BUT EVEN **REVERSE SOME OF THE NEGATIVE EFFECTS OF ONE'S ENVIRONMENT, AND POSSIBLY EVEN** AGING ITSELF.

congenital disease. They are seeking to understand the factors involved in gene expression during the early stages of life, particularly the epigenetics of brain development and how this affects brain health across the human lifespan.

"We've turned to epigenetics to understand potential ways in which a baby's everyday experience might influence the trajectory of their brain development," says Miller, who heads the Department of Pediatrics at UBC. "The newborn brain is plastic, and there has been lots of outstanding work in neuroplasticity that shows how the immature or developing brain responds to changes in their environment."

The notion of guiding plasticity in a newborn brain is an even more recent development than human genome mapping. The newborn brain has specific vulnerabilities to injury from things like perinatal asphyxia - a lack of blood flow or oxygen at birth. Where once it was believed such injuries had fixed outcomes, research has shown that these injuries can be prevented or even reversed by changing environmental factors. For instance, full-term babies with perinatal asphyxia can now be treated in a newborn intensive care unit, where they are cooled to 33.5 degrees for 72 hours. This process, known as therapeutic hypothermia, slows down the metabolism, decreases excitatory neurotransmission, and has other positive effects that aren't completely understood, ultimately decreasing mortality and reducing significant neurodevelopmental disability.

"If you had told me at the start of my career that there would be a treatment for perinatal asphyxia," says Miller, "I would have thought that that was just science fiction."

GENES EXPRESSING THEMSELVES

The current frontier of epigenetic studies is how gene expression influences the transformation of the brain across childhood, and the trajectory of childhood brain maturation that sets up brain health for the life course. At the centre of this work is an understanding of DNA

methylation - how the addition of a methyl chemical group to a DNA molecule affects gene expression - which can have significant impacts on the body's overall functioning and health.

DNA methylation can be thought of as the orchestra's conductor, guiding the individual musicians in how they express the score. In the early stages of brain development, billions of neurons form trillions of connections, largely guided by the methyl chemical groups that attach to DNA and histone proteins.

The initial years of life represent a remarkable period of growth and transformation for the human brain. As the foundation for lifelong cognitive, emotional, and social abilities takes shape, early brain development holds the key to unlocking our full potential. By exploring some of the most captivating aspects of this vital developmental stage, we can better understand the intricate processes that shape who we become.



A DYNAMIC START:

Even before birth, the brain is already hard at work. The neural tube, which eventually develops into the brain and spinal cord, begins forming just three weeks after conception.

SENSORY PRIORITIES: During infancy, the brain prioritizes the development of sensory and motor regions. This allows babies to rapidly learn about their environment through touch, taste, smell, sight, and sound, and helps them acquire essential motor skills.



SOCIAL CONNECTIONS: The brain's social and emotional areas develop rapidly in the first few years of life. Through interaction and bonding with caregivers, infants learn to recognize faces, interpret emotions, and form attachments.



POWER OF PLAY:

Playtime is more than just fun for young children; it's essential for brain development. Engaging in play activities helps strengthen neural connections and promotes cognitive, social, and emotional growth.

When a methyl group is added to a DNA molecule, it can modify the gene's expression by either turning it on or off - a process known as epigenetic regulation which plays a critical role in controlling the body's gene expression patterns.

Methylation is also involved in many other physiological processes in the body, including DNA repair and the regulation of cell growth and division. Certain lifestyle factors can affect methylation patterns, and some of these changes have been associated with health



LANGUAGE WINDOW:

Early exposure to language is crucial for children. By age five, their brains have established strong neural pathways for understanding and speaking their native language, making this period vital for language development.



SLEEP'S ROLE:

Adequate sleep is vital during early childhood. Sleep helps consolidate memories, promotes learning, and supports the brain's ongoing development.



BRAIN PLASTICITY:

The young brain is highly adaptable, thanks to a phenomenon called neuroplasticity. This enables children to learn and adjust quickly to new experiences and challenges, setting the stage for a lifetime of growth and discovery.

conditions, including cancer, autoimmune disorders, and neurological disorders.

Gene expression across a lifetime can be influenced by a broad variety of factors, ranging from diet and exercise to socioeconomic status. Researchers can actually see an epigenetic pattern related to growing up in poverty for the first three or four years of life, even if that given person no longer lives in poverty as an adult.

The collaboration between Miller and Kobor zeroes in on these early epigenetic patterns by focusing on the effects a critical-care environment has on a preterm newborn with medical issues. "How does the everyday experience of babies born prematurely and requiring critical care influence the trajectory of brain development?" asks Miller. "Whether it's the pain that they're exposed to, the injuries that they acquire, infections, being on a ventilator, or medications - each of these things contributes to this trajectory of brain health, either negatively or positively."

To understand the lasting impact of these early-life exposures – or how they might be mitigated through epigenetic alterations - Miller and his colleagues also study the children's environments as they grow. "What's happening in these homes that is promoting brain repair and supporting this trajectory of brain development?" adds Miller. "Our hypothesis is that pathways that may be involved are things like exposure to reading, nutrition, and maybe even exercise. We're starting to ask, what are the pathways by which we're seeing these really improved outcomes beyond what you would have expected from the neuroscience? Is that mediated by epigenetics?"

ALTERING GENE EXPRESSION

As important as early brain development is to overall health, epigenetic markers can be changed across the entire lifespan. Smokers, for instance, have less DNA methylation than non-smokers at certain parts of the AHRR gene (a gene that plays a critical role in the body's response to environmental pollutants and the regulation of immune system functions). But if you give up smoking for a year, you can increase your DNA methylation, even bringing it back to the regular level of non-smokers.

"These methylation marks on the genes kind of act like a dimmer switch," says Kobor, who holds the Canada Research Chair in Social Epigenetics, and has recently become the inaugural Edwin S.H. Leong UBC Chair in Healthy Aging. "If you can play with that dimmer by changing your environment or by changing your behaviour, you change the level of gene expression." In some cases, changes in methylation patterns may be chemically reversible. Using modified versions of the technology behind CRISPR – a gene-editing tool that allows precise editing of DNA sequences - scientists are already able to add methyls to DNA in a test tube, altering the expression of the AHRR gene to "raise the dimmer switch" and restore proper gene expression that was suppressed by smoking. The idea that we can rewind epigenetic changes and create positive epigenetic patterns speaks to the potential to not only slow down, but even reverse some of the negative effects of one's environment, and possibly even aging itself.

The future of medicine is likely some combination of these two scientific frontiers, with both CRISPR technology and epigenetic research offering vast possibilities in preventive and corrective healthcare. Using precise interventions tailored to an individual's unique DNA and epigenetic profile, doctors will be able to control both the musicians and the orchestra, keeping everyone's body and brain in tune.

ONLY AS OLD AS YOU FEEL

The field of epigenetics may even challenge the concept of age itself. Just as previous decades have recognized the complexity of race and fluidity of gender, the cutting edge of Kobor's research focuses on "epigenetic clocks" two dozen or so methylation patterns in the human body that allow us to measure biological age not chronologically, but chemically. As each epigenetic clock is based on hundreds of methylation sites (out of approximately 28 million options), the potential combinations – and the information each combination could reveal – is practically infinite.

"I have become so fascinated by the epigenetic clock," says Kobor. "I think it will be an amazing tool to create a deeply interdisciplinary research framework that will ultimately have a place in healthcare." So far, epigenetic clocks have proven to be reliable predictors of health outcomes, with older epigenetic age showing a higher risk for age-related diseases such as Alzheimer's and cardiovascular disease. The technique can also be used to quantify the individual effects of environmental factors on a person's biological age, such as exposure to pollution, stress, and poor nutrition accelerating epigenetic aging, and healthy lifestyle habits such as exercise, a balanced diet, and stress reduction slowing it down.

Although fully stopping or reversing one's epigenetic age is a dream of the distant future, the promise of epigenetic research bringing about an era of "healthy aging" is already being realized in Kobor's lab, where targeted lifestyle interventions that reduce one's epigenetic age can delay or prevent otherwise inevitable age-related diseases.

"We are still in the very early days of this research," says Kobor. "I think why people get so excited about epigenetics is that it provides a fairly advanced picture of how experiences can get under the skin, and fits very neatly in the nature and nurture debate. What we need now is recurring genetic testing over a lifespan to see how changing epigenetic patterns relate to a given environment, a given experience, or a particular exposure."

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WHEN STRESS GETS IN YOUR HEAD

The links between stress and depression are strong and mysterious. Joelle LeMoult is learning how we can feel better when things go wrong.

BY JARED DOWNING | ILLUSTRATIONS BY GRACIA LAM

THINK BACK TO the spring of 2020. The streets are empty. Your favourite bar is closed. And your boss wants to try working remotely with this new "Zoom" thing. How did you feel? Were you bored and lonely? Or was all the time at home a relaxing change of pace? Dr. Joelle LeMoult wants to know. As director of the Depression, Anxiety, and Stress Laboratory at UBC, she has devoted her research to exploring how and why we respond to stressors. These might be small things, like being stuck in a traffic jam, or big things, like a global pandemic. Why do these events motivate some of us but leave others anxious and depressed? And how can we help people feel better?

"We encounter stress in our daily lives. We encounter major life event stressors. We encounter daily hassles. And I've always just found it really fascinating to observe how differently people respond to the same stressors," LeMoult explains.

The links between stress and depression are more mysterious than you might think. A research review that LeMoult and her colleagues recently published in Current Opinion in Psychiatry reveals how responses to stressful events vary widely from person to person.

"Even taking people in the same family who had a pretty similar experience of COVID, some people might look back and remember the positive parts of their experience, maybe the times that they got to commute less or take a break from some of the other stressors in their life," LeMoult explains. "And someone else might look back on the same objective scenario and remember all the negatives, how lonely they felt."

To put LeMoult's research in terms of Winnie the Pooh characters: Some of us might respond to a stressful event like cheerful Tigger, others like gloomy Eevore. Which one you are most likely to resemble depends on your unique set of "biopsychosocial pathways" - the tangled mix of nature and nurture that scientists are only beginning to unravel.

Childhood trauma, for example, can play a tremendous role in how you (or rather, your brain) deal with stress later in life. This can include poverty, physical abuse, sexual abuse, and emotional abuse. The latter, emotional abuse, may be the most dangerous of them all, according to LeMoult's research. While something like poverty is usually a feature of one's larger environment, she says, emotional abuse can permanently alter someone's self-identity.

"When you've been exposed to some forms of abuse early on, it changes that idea of 'this is who I am," LeMoult explains. "So for instance, a student at university who had been exposed to emotional abuse early on might, if they don't do well on an exam, have a harder time coping with that. They might develop more negative cognition about themselves and about their ability to do better on future exams. Whereas someone else might think, 'Oh, I did badly on one exam. I'm sure the next one will go better." And of course, to answer these questions scientifically, LeMoult must observe people when they get

problems can make some of us feel better, an activity psychologists call "co-reflection." But for others, talking things out can actually lead to unhealthy "co-brooding," which can make them feel worse.

"One of my students is really interested in self-compassion," LeMoult continues. "Can adopting a more self-compassionate stance towards something like a recent failure facilitate emotional and biological recovery from stress?"

She adds: "I've been talking mostly about emotional wellbeing, but we always measure biological wellbeing too."

Even before she decided to move into psychology, LeMoult had been fascinated with the way stress can affect not only how we feel, but also the decisions we make. She had originally studied economics and business in college, but during a job at Stanford University's neuroeconomics lab, she became fascinated by the way our emotions influence the decisions we make.

"The more time I spent in the psychology department, the more fascinated I was by the influence that our

"Can adopting a more selfcompassionate stance towards something like a recent failure facilitate emotional and logical recovery from stress?"

stressed out. In her experiments, LeMoult and her colleagues expose people to stressful stimuli and track things like eye movements, heart rate, and inflammation to determine levels of the stress hormone cortisol. "Are there gender differences in how people might cope with stress?" asks LeMoult. "Are there age differences? Are there cultural differences?" And, of course, LeMoult also experiments with ways to help people

de-stress. Effective remedies, too,

can vary from person to person. For example, talking about our

decisions, not just economic ones." Sometimes, stress makes us want to sit in a dark room, eat ice cream, and binge Netflix. But it can also make us lash out at loved ones, text an ex, or do something else we'll regret later.

emotions have over so many of our

Fortunately, scientists like LeMoult are trying to learn how to make us all feel better.

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HEALTHY BRAI

The Science of Forest Therapy

Connecting with nature, particularly in forests, can benefit our mental and physical health. Professor of forestry Guangyu Wang (PhD'09) is a member of the Multidisciplinary Institute of Natural Therapy (MINT) at UBC. We asked him about its aims to promote forest therapy and bridge the scientific gap between its practice and the physiological and psychological impacts on human beings.

PHOTOGRAPHY BY KAI JACOBSON



WHAT IS FOREST THERAPY AND WHEN DID IT FIRST EMERGE?

Shinrin-yoku (forest bathing) is a Japanese term that emerged in 1982. It describes a way of connecting with nature by immersing yourself in a forest and engaging all of your senses. Forest therapy focuses on activities that relieve stress and help with related medical conditions. Participants are encouraged to be aware of their environment - to hear the birdsong, take deep breaths, touch the soil and the trees, and emotionally connect to "Mother Nature." It's quite a mindful practice.

Various studies have indicated that forest therapy can have considerable health benefits. For example, it can lower blood pressure and reduce the risk of cardiovascular disease, and it has been shown to increase the activity of the human body's natural "killer" cells, which are responsible for fighting viruses and cancer cells. People who are generally healthy - for example, students experiencing stress – can go to the forest for 15 minutes, follow a forest therapy procedure, and experience some relief. For medical benefits, it's best to be guided through certain procedures. For anxiety and depression, guides may teach meditation. For immune system disorders, they may guide participants through exercises such as forest yoga to build their strength. Unlike Japan, where there are over 200 forest therapy facilities for people to use, Canada has hardly any. MINT is looking into how we can create more.

WHAT EVIDENCE IS THERE THAT FOREST THERAPY CAN IMPROVE **EMOTIONAL AND COGNITIVE HEALTH?**

When an individual is under stress, the hormone cortisol is released into their body. Recent studies have discovered that forest therapy walks can significantly reduce cortisol levels, indicating a decrease in stress levels. Furthermore, these walks can enhance activity in the prefrontal cortex, an area of the brain linked to decision-making and cognitive function, and also in the parasympathetic nervous system, which is responsible

for relaxation and rest. Psychological evaluations have demonstrated that forest therapy can decrease tension and depression and increase feelings of well-being and vigour.

WHAT IS THE SIGNIFICANCE OF A FOREST SETTING?

Forests have complex ecosystems and there are natural chemicals present in trees and plants that can have physiological and psychological effects on humans.

These include phytoncides - volatile organic compounds released by trees and other plants to protect themselves from insects and other pathogens. When inhaled, they can have a calming effect, improve mood, and boost the immune system.

Terpenes are another class of organic compounds found in plants. They have a range of health benefits, with anti-inflammatory, analgesic, and antibacterial properties. Some terpenes are used in aromatherapy for their relaxing and uplifting effects.

Another example is negative oxygen ions, which are molecules containing an extra electron. These have been studied for potential health benefits, such as reducing stress and enhancing overall well-being. Some studies suggest they can help increase the flow of oxygen to the brain, which can improve cognitive function and reduce fatigue.

WHAT ASPECTS OF FOREST THERAPY IS MINT EXPLORING?

Forest therapy is quite new and there are a lot of unknowns. MINT is working with medical professionals and facilities, such as the BC Cancer Agency and UBC Medicine, to understand the complex mechanisms behind the relationship between forests, forest therapy, and human health. A lot of forest therapy focuses on the cultural and the spiritual, but as a scientist I think we need to find evidence.

We are currently researching the effects of guided forest therapy on a diverse range of participants. At the same time, we are mimicking natural environments indoors to test the impact of various factors and their combinations.

In Pacific Spirit Park, we have red cedar, hemlock, and Douglas fir. We capture the forest air and do tests to see what kinds of chemicals are being released from those trees. Then, we create essential oils to mimic them, and test these on participants to observe their different effects on heart rate, blood pressure, and brainwave activity to discover the best combination. We also create forest landscapes and sounds in virtual reality and compare their effects with real forests. Our ultimate goal is to understand the reactions between forests and humans and introduce forest elements into indoor environments. VR has positive effects, but it's not as good as the real thing.

HOW DOES THE PRACTICE OF FOREST THERAPY DIFFER AROUND THE WORLD?

There are environmental, cultural, and regulatory differences. As part of the Forest Therapy Alliance formed last year, MINT is collaborating with forest therapy groups in different areas of world, including South Korea (a temperate area similar to British Columbia), China (tropical and sub-tropical areas), and Arizona (an area more like a savannah, with trees and grasses). We hope to share and compare the results of our studies into these different forest environments at a conference in Sweden next year. Forest therapy is also quite related to culture, and different cultures have different mindsets, which influences the practice. I have a master's student studying the comparisons to see how they affect the standards that are developed in different countries. Forest therapy has become a significant industry in the Asia-Pacific region, with many organizations being primarily motivated by financial gain. However, our alliance takes a different approach, prioritizing the regulation of this industry. To achieve this, we aim to establish a third-party entity consisting of representatives from industry, academia, government, and the general public. This entity will collaborate to develop internationally recognized standards (criteria and indicators) that ensure ethical and sustainable practices within the forest therapy industry.



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INSIDE

Elizabeth Denham. BA'81 MAS'84 **>>** Data privacy expert **>>** Next challenge: Work to put children's safety and rights at the very heart of digital design

FEATURES

40 Collective Wisdom 52 Should Canada Become a Republic?

DEPARTMENTS

36 Changemakers 43 Rewind 44 My Town 48 Findings 54 Watch & Listen 56 The Scoop 59 In Memoriam 60 The Last Word

Read her story on the next

CHANGE/ MAKERS

"PRIVACY HAS CONE MAINSTREAM"

As AI becomes embedded in everyday lives, Elizabeth Denham has helped place personal data security high in the collective consciousness.

BY DAVID SILVERBERG

NAME A MAJOR technology trend in the past 20 years - from social media to Google Street View to online gaming - and Elizabeth Denham has been leading the charge to safeguard our data from the companies behind them. If you've ever wondered how much data social media giants are storing and perhaps even sharing with third parties, Denham has been there, tackled that, fined that company. She's battled mainstays in Big Tech, such as Facebook and Google, and spent countless hours devising ways to mitigate the harms caused by eroding privacy rights.

"I've always sat at the intersection of technology and society in my career," she says. "While Silicon Valley giants have connected us in such a world-changing way, we're dealing with the kinds of technologies that could be a boon or destructive force for us."

Her government positions have given Denham a vantage point few ever experience. She was Assistant Privacy Commissioner of Canada from 2007 until 2010, when she was appointed Information and Privacy Commissioner for British

Columbia. Six years later she moved overseas to take on the role of UK Information Commissioner.

During her five-year term there, she investigated political consulting firm Cambridge Analytica and its business relationship with Facebook. She interviewed whistleblowers who claimed that the Facebook profiles of millions of people had been collected via an app without consent and used to influence the outcomes of political campaigns, notably those of Donald Trump and Ted Cruz in the US. Her office seized Cambridge Analytica's servers, eventually prosecuting the company and fining Facebook £500,000 (the highest fine available to her office at the time) for failing to keep the personal information of its users secure.

"Revelations around misuse of data by social media companies, political parties, and data brokers were deeply concerning to many people," Denham says. "Increasingly accurate micro-targeted messages based on inferences of our political leanings were threatening free and fair elections."

Denham has long taken an interest in social and political issues.

Growing up in Richmond, BC, she learned about the civil and women's rights movements, and voraciously read books on politics, history, and foreign affairs. She was close to her grandfather, Donald Denham, who served as a deputy minister for the BC Government, and was influenced by his interest in public service. At UBC, she studied history and political science before earning a master's in archival studies. Her passion for history led to a position as Chief Archivist for the City of Calgary. As her career evolved from managing historical data into safeguarding private data, Denham became as mindful of the future as she had been attentive to the past. She was acutely aware of the fundamental social change being driven by ever more pervasive applications of artificial intelligence - and of her own role in shaping its trajectory.

"We are at a defining moment, which requires a sense of responsibility and a long-term view," she said in a speech at the Alan Turing Institute, shortly after the Cambridge Analytica scandal broke in 2018. "Future generations will thank us if the way in which we

develop artificial intelligence today looks at the true value it can deliver while respecting data protection and ethical principles."

As a result of the ICO investigation and multiple others, practices have improved, says Denham today. "This is true across the tech sector. Privacy and data security are key to users' trust. The concerns of consumers and the focus of lawmakers have dramatically shifted in the past few years; privacy has gone mainstream."

Denham has also tackled government transparency, looked into the fundraising practices of charities, and spearheaded a "first-of-its-kind" framework for a code of practice to guide the use of Facial Recognition Technology. But she is particularly satisfied by the guardrails she helped place around children's online privacy. Children have been exposed to new and serious risks, says Denham. Their data can be used to deliver inappropriate content, including pornography, violent images, and references to self-harm. Their profiles and location data can expose them to online predators. And the addictive nature

of gaming and video streaming have helped behavioural advertising to commodify them.

In 2020, she moved decisively to implement the Children's Code, a set of enforceable standards for online services intended to prevent the exploitation of children's data and keep them safe. The code's recommendations include items such as making sure location-sharing options are turned "off" by default.

"The most important, overarching standard in the code is that companies must consider the best interests of the child in their design of services," says Denham, grandmother of three. "It is unlikely that the economic interests of a company will trump the best interests of a child."

The code has since been replicated in countries such as Ireland, the Netherlands, Denmark, and the State of California. Canada, however, has yet to implement one. Denham addressed this lack in a guest op-ed published in the Globe & Mail in October 2022, closely coinciding with the 10th anniversary of the death of Port Coquitlam teenager Amanda Todd







due to online bullying and sexual extortion. "Reasonable, even obvious, modifications like these are long overdue," she wrote. "And they have yet to be implemented universally. We must act urgently and thoughtfully. Lawmakers from around the world should work together to keep children safe in the digital world they have inherited."

While she has public interest at heart, Denham has not always worked in a regulatory capacity. When Canada enacted new privacy laws in the late 1990s, she set aside her archivist career and started a consultancy to help enterprise firms navigate stricter standards for the management of customer data. "It was a booming business to be in and all these issues were so interesting to me," she says. Today, she is back in BC and has returned to consulting as an international advisor on data and technology for the law firm Baker McKenzie.

She continues her fight for children's privacy rights online with her role as a trustee of 5Rights, a children's online safety charity, and remains vigilant about the evolution of Al.

"AI and applications using personal data cross a boundary between predicting human behaviour with increasing accuracy and nudging our behaviour in ways that risk our ability to decide for ourselves what is best," she says. "Will the machine decide our social benefits, our children's educational streams, the politically targeted messages and the news we receive? The scale and speed of adoption of AI is moving ahead of the laws and regulations that ensure there is a human in the loop. There is an urgency for governments to act now to preserve our future."



MacKenzie, BASc'09, PhD'14 C Biomaterials entrepreneur C Next challenge: To advance the production of plastic alternatives with 100% Canadian based resources.

Jordan

FANTASTIC Plastic

Jordan MacKenzie's team has created a bio-based alternative to single-use plastic.

BY RACHEL GLASSMAN, BA'18, MA'20

ANY SPARE MOMENT he gets, Jordan MacKenzie spends in the mountains around Vancouver. An avid hiker, rock climber, and skier, he's witnessed up close the human impact on the wild places he loves: backcountry trails strewn with plastic, campsites left littered with waste. It's a close-to-home glimpse of a staggering problem. The World Economic Forum estimates that we produce about 400 million tons of plastic waste globally each year. "That drives me nuts," MacKenzie says.

What if we could eliminate single-use plastic altogether? It's a question at the heart of Bioform Technologies, the business MacKenzie co-founded with UBC professor Mark Martinez to create a 100 per cent bio-based alternative to single-use plastic. Their patented biomaterial is inspired by spider silk and transforms wood fibre and kelp into a new kind of tissue that behaves like a sustainable version of plastic. Think compostable food packaging, water bottles, and cutlery. BioForm even makes their own mulch film, a replacement for the plastic sheets farmers use to protect crops. At the end of the season, instead of disposing of yards of plastic, farmers can simply plough the BioForm sheets back into the ground to nourish the soil.

MacKenzie's vision for sustainability encompasses both the environmental and the economic. Most biomaterials are 3D-printed, a time-consuming process that also makes them expensive for consumers. So BioForm dreamed up a faster, cheaper process: "We wanted to run this as something as big and fast as an oil pipeline," MacKenzie says. The solution lay in an old but efficient technology: Paper-making machines, adapted to "print" their signature wood and kelp blend. It's a move rich in possibilities for Canadian rural economies. MacKenzie dreams of revitalizing towns where paper-making machines often sit idle today: "I really want to train personnel to start using this classical technology to produce a new product," he says.

MacKenzie's vision is big, but it took some time to get there. He and his teammates didn't immediately realize just how transformative their new biomaterial could be. It was only through consultations with entrepreneurship@UBC that they realized the magnitude of what they had created - a real alternative to single-use plastics. The team's original product was biomaterial tubing to help reduce medical waste from procedures such as dialysis or the use of IV drips. (The tubing also helped mitigate blood clots - nothing to sniff at, but no solution to a global environmental crisis, either.) To test the tubing's properties, the lab workers were their own guinea pigs: "I think I donated blood a half-dozen times," MacKenzie recalls. Ultimately, the tubing took a back seat - agriculture and consumer packaging offered more impactful ways to combat plastic waste - but with a team willing to literally give blood in the name of innovation, it's little wonder they've found success.



Lawrence Paul Yuxweluptun Lets'lo:tseltun

Native Comes To Check On The Endangered Killer Whales In The Salish Seas Lawrence Paul Yuxweluptun's environmental paintings span decades and speak to land and water issues with vivid style and critical insight. In this work, Lawrence addresses the environmental deconstruction of our oceans and the troubles it perpetuates. This painting depicts the bold truth of our environment that cannot be ignored. The Adnani family is a supporter of multi-disciplinary climate and sustainability initiatives at the University of British Columbia.

visit www.adnani.ca

COLLECTIVE WISDOM

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Should Canada dispense with its tipping culture?



Canadians have tip fatigue

DAVE KORZINSKI, BA'11

Research Director at the Angus Reid Institute

If you ask the average Canadian? Yes, it's time to move on from tipping. According to our recent poll, there is a particular exhaustion evident within the public that we haven't seen in previous data. Overburdened by inflation and post-pandemic financial fatigue, Canadians currently feel they're seeing tipping requests that are more common, in less traditional spaces, and for higher values. More than 60 per cent say they're being asked to tip more and more often than they've been used to in recent years. This is seemingly undercutting the spirit of tipping in many people's eyes. Four in five say they don't feel their tip is about showing appreciation for service anymore; rather, it's an obligation or an uncomfortable social pressure. So-called "tip-flation" has driven a 19-point increase since 2016 in the number of Canadians who would scrap tipping altogether and absorb gratuities into "a service-included" model in places like restaurants and coffee shops. Whether businesses would agree to pay higher wages is another question, but a firm majority three in five - are now ready to make this change.



The tipping culture is unfair

KIMBERLEY BROWNLEE

Professor, Department of Philosophy; Canada Research **Chair in Ethics and Political** & Social Philosophy

A mischievous English tour guide told me that "tip" was originally T.I.P.S., standing for "to insure prompt service." Pubgoers would drop coins into a box upon arrival to incentivize barkeepers to serve them first. Nowadays, people leave a gratuity afterward, ostensibly to reward quality.

Yet this gratuity no longer feels gratuitous. Many restaurants add a tip to the bill. Coffee shops' contactless machines propose different tips, which customers review under the server's gaze. And the amounts grow year-on-year, from 12-15 per cent 20 years ago, to 18-25 per cent now. This culture is unfair. First, why tip taxi drivers, stylists, porters, and waiters, but not cashiers, actors, substitute teachers, fruit-pickers, and others who perform precarious work? Second, in some tip-receiving sectors, backroom staff automatically get a share. But others must rely on the front-staff's decency. Third, tipping is unfair to customers who cannot absorb an exorbitant tip. This reflects a social welfare system gone sour. If the state guaranteed a basic income or living wage, casual workers wouldn't need to rely on this hit-and-miss custom. Canada's "tip" should

be renamed the "Select Worker

Wage Contribution."



Tipping shields businesses from operating costs

SUPRIYA ROUTH Associate Professor, Allard School of Law

Canada's tips culture is economically and socially problematic. The rationale for tips is reward not entitlement. Tips permit businesses to externalize their cost in a core area of their operation, thereby insulating their profits from the very "service" that they provide. Dissociating part of the "serving" costs (tips) from the restaurant "service" is logically incoherent and morally indefensible. What is "rewarded" with tips is a worker's labour, and labour is an integral cost of business, not a voluntary supplement to it. Businesses should pay their labour forces without expecting customer largesse to shield them from operating costs.

Furthermore, because a customer has the capacity to "reward" a server, the system tolerates, even encourages, condescending behaviour - including harassing and discriminatory behaviour - by the payer. On the other hand, tipping behaviour of customers stands the risk of being stereotyped as an identity issue (e.g., boomers v. millennials; men v. women; non-racialized v. racialized). Such stereotyping exposes customers - particularly marginalized ones - to unconscious biases of servers and businesses. In this way, the tips culture is inimical to the foundational values of Canadian society.



Tipping is discrimination

AZIM SHARIFF. MA'06. PHD'10

Professor, Department of Psychology; Canada Research Chair in Moral Psychology

Tipping gives people freedom in paying for service, allowing them to incentivize good service over bad. This sounds great economically, but what about psychologically?

The problem with offering people the chance to be discriminant in how much they pay is that people tend to discriminate on a lot more than service quality (which in restaurants, for example, ends up accounting for only two per cent of the variation in tipping). Many studies show that even equated for the reported quality of service – people tip White people more than Black. They tip more to the thin, to the young, to the attractive. People are free to do so, but that's a freedom we've sought to limit in other circumstances. Equal pay for equal work? Not really.

These challenges get compounded by cultural diversity. Tipping norms vary between cultures. In places where people from different cultures intersect – like, say, Vancouver – this creates ambiguity, confusion, and often sour feelings. If we were more homogenous, this might all work as it's supposed to. But I'd rather eat a diversity of foods, served by any type of person, and know exactly how much I'm supposed to pay for it.

FOR MORE RESPONSES, SEE: magazine.alumni.ubc.ca/tippingculture



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REWIND

Arts County Fair

Thousands of students hundreds of kegs of beer many, many porta potties



Arts County Fair, 2000 (AMS Archives).

BY RACHEL GLASSMAN, BA'18, MA'20

FOR A GLORIOUS run of 15 years, the last day of class on UBC's Vancouver campus was synonymous with the Arts County Fair (ACF) - a beloved eight-hour concert extravaganza at Thunderbird Stadium run by the Arts Undergraduate Society. In its peak years, ACF drew up to five bands,

five DJs, and a whopping 15,000 students, making it the largest student-run event in Canada. According to The Ubyssey, when ACF debuted in 1992, the organizers booked "then little-known Canadian rock band the Barenaked Ladies," the same year that their debut album, Gordon, topped charts.



Just like that, a legendary UBC tradition was born. Each year, great musical acts - including the Philosopher Kings, the New Pornographers, and Matthew Good - played for crowds of happy students, who over the course of the day collectively enjoyed, as former AMS president Jeremy McElroy told The Ubyssey, "500 kegs of beer."

The all-day event took festivities to athletic lengths, so it required some preparation. The 2007 ACF Safety Committee advised students to drink plenty of water "to keep you lucid" and to enjoy a hearty meal first: "If you're going to be rocking out for eight hours, then you really shouldn't be doing that on an empty stomach." Along with a helpful reminder for partygoers to attach their U-Pass to their pants and not to "lose either (pass or pants)," they begged "For pity's sake, do not urinate on the hill... We have many, many porta potties."

Inevitably, despite the impressive musical talent present, the celebrations weren't to everyone's taste. Mike Kushnir, who helped plan ACF for several years, told The Ubyssey that "People who buy property [on campusl want to make sure they get their beauty sleep." Neighbours' complaints, along with stricter liquor licensing laws, rising costs of insurance and security, and general financial trouble combined to bring the party's long run to a halt after 2007.

The end of ACF met with immediate outcry, spawning a "Bring Back the Arts County Fair!" Facebook group within days. Students formed the Radical Beer Faction and organized "flash beer gardens" to call for more on-campus social events. For UBC's tight-knit community, a last day of classes unmarked by an epic celebration was a sad prospect - one that luckily never came to pass. In 2008 the Alma Mater Society reimagined ACF as today's Block Party, a smaller but just as beloved annual celebration. Springtime still brings sunny days, final exams, great music, and "many, many porta potties" to the Point Grev campus and hopefully, it always will.

MY TOWN

Insider travel tips from alumni in the know.

Porto, Portugal



Robyn Freiheit (BKin'15) is a freelance marketing. communications, and project management specialist, who recently completed her Master of Public Health with a focus on food insecurity. She has been living in Porto for the past four years and was previously the alumni UBC Global Alumni Ambassador for Portugal.

WHAT DO YOU LIKE MOST ABOUT LIVING THERE?

The abundance of great, local food at affordable prices. There are never enough days to try all the restaurants in town - whether traditional hole-in-the-wall tascas (traditional eateries) or trendy new finds. To experience Porto is to eat your way through the city.

DESCRIBE YOUR FAVOURITE NEIGHBOURHOOD.

Each neighbourhood in Porto has something special to offer. That being said, the neighbourhood of Miragaia in the historic portion of the city will really appeal to the meanderers at heart. Not only does it feature iconic Porto architecture and exude old-world charm, but its streets are also full of the sights, smells, and sounds of locals going about their daily lives. Miragaia is also my favourite neighbourhood to celebrate Porto's patron saint at the annual São João festivities in June.

IF YOU COULD CHANGE **ONE THING ABOUT** PORTO, WHAT WOULD IT BE?

The humidity in the winter paired with no insulation in homes. Although the outdoors is significantly warmer than the winters back in Canada, never have I felt so cold indoors than when I faced a winter in Porto. Hot water bottles and dehumidifiers are your best friends.

affordable lifestyle, easy

overall vibe. I moved to

Porto is home for me.

access to the ocean, and

Porto in August 2018, and

haven't looked back since.

WHAT MIGHT SURPRISE A **VISITOR ABOUT** PORTO?

Most people are unaware that Porto's city centre is less than six kilometres away from the ocean. Gorgeous beaches, waterfront walkways, surfing spots, the best seafood - these are all a quick bike or bus ride away. Porto also offers easy access to many other historic towns and gorgeous natural attractions. Places like Guimarães, Douro Valley, and Peneda-Gerês National Park are located within a one- to two-hour commute.

WHAT ARE **YOUR FAVOURITE** HIDDEN GEMS OR **ACTIVITIES THAT ONLY LOCALS**

KNOW ABOUT? I can't give away all my spots as some places are best kept secret! But here's what I'll divulge: Oficina dos Rissois is one of my favourite places to dine. It's a farm-to-table restaurant that serves delicious comfort food, like fish and prawn rissois (a Portuguese-style savoury turnover). Another hidden gem is Jardins do Palácio de Cristal - a beautiful, multi-level park

BEST TIME OF YEAR TO VISIT

June for the festival season or September for more consistent weather and smaller crowds.

BEST PLACE **TO STAY**

Boutique hotels or guest houses in the Cedofeita neighbourhood.

BEST VIEW

WHAT'S THE MOST OVER-**RATED TOURIST** HOTSPOT?

das Sardinhas

Portuguesas

- a gimmicky

canned sardine

chain that is found

all over town. Skip

inauthentic tourist

take the Conservas

Pinhais Factory Tour

in the nearby town

of Matosinhos for

an interactive and

authentic experi-

ence of an operat-

ing sardine factory

with a rich history

canned fish too!).

(and premium

trap, and instead

souvenir shop

the brightly lit,

to walk, read, picnic,

or watch a sunset.

Full of good views,

pretty flowers, and

wild peacocks and

chickens, it's not

to miss. Finally, I'd

recommend visiting

traditional grocery

stores scattered

throughout Porto,

delicacies such as

meats, cheeses,

wines, and jams.

featuring local

Jardim do Morro (technically in the nearby city of Vila Nova de Gaia) at the golden hour overlooking historic Porto.

BEST CULTURAL

EXPERIENCE Visiting the city for the São João celebration in June.

BEST STREET FOOD

Cachorrinhos (the Porto version of a hot dog) paired with some French fries and a cold beverage of choice.

COOLEST STREET

Rua de Miguel Bombarda, which is full of art galleries and funky shops.

LATEST TREND Getting around town on electric scooters.

HOW EASY IS IT TO MEET **NEW PEOPLE?** It truly depends on the places you visit and the activities you engage in. But overall, people from Portugal, and particularly people from Porto (and the north), are very kind and open. If you

44 UBC MAGAZINE / ALUMNI UBC



O Mundo Fantástico make an effort to engage with the culture or learn a few simple Portuguese words, a little can go a long way.

WHAT ISSUES ARE PARTICULARLY **IMPORTANT TO** THE PEOPLE **OF PORTO?**

A major concern for locals is the increased cost of living and housing costs, due to an influx of tourism and expat immigration movements, paired with low salaries.

WHAT IS ONE LOCAL CUSTOM THAT EVERY **VISITOR SHOULD** KNOW ABOUT?

During the São João festivities, people go around hitting others on the head with plastic hammers to celebrate and pass along good luck.

Alumni volunteers host fun My Town Meetups in locations around out our Meetups page to see if there's a gathering near you - or sign up to host one in your location.

🦻 alumni.ubc. ca/my-townmeetups



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FINDINGS

Zapping "forever chemicals"

UBC engineers are making our drinking supplies safer.



Fatemeh Asadi Zeidabadi, a PhD student in Dr. Mohseni's group, with a water treatment setup that is being piloted at locations across BC.

THE RESEARCH

"Forever chemicals" used in the manufacture of certain products can leach into the environment and are linked to a wide range of health problems. Chemical and biological engineering professor Dr. Madiid Mohseni wanted to devise an effective treatment for ridding drinking water of these substances.

THE BOTTOM LINE

His team developed a unique adsorbent material effective at removing the chemicals safely, efficiently - and for good. "Think Brita filter, but a thousand times better," says Mohseni.

Forever chemicals, formally known as PFAS (per-and polyfluoroalkyl substances), are a large group of substances that make certain products non-stick or stain-resistant. While PFAS are no longer manufactured in Canada, there are still more than 4,700 PFAS in use, incorporated into imported consumer products such as raingear, non-stick cookware, stain repellents and firefighting foam. They are linked to a wide range of health problems including hormonal disruption, cardiovascular disease, developmental delays, and cancer. Most people are exposed to these chemicals through food and consumer products, including cosmetics and sunscreens. but they can also be exposed from drinking water - particularly if they live in areas with contaminated water sources. To remove PFAS from drinking water. Dr. Mohseni and his team devised a unique adsorbing material that is capable of trapping and holding effectively all of the PFAS present in the water supply. These are then destroyed using special electrochemical and photochemical techniques, also developed at the Mohseni lab. While there are treatments currently on the market,

like activated carbon and ion-exchange systems which are widely used in homes and industry, they do not effectively capture all the different PFAS. or they require longer treatment time, Mohseni explains. "Our adsorbing

media captures up to 99 per cent of PFAS particles and can also be regenerated and potentially reused," he says. "This means that when we scrub off the PFAS from these materials, we do not end up with more highly toxic solid waste that will be another major environmental challenge."

INFECTION-HALTING COMPOUND

THE RESEARCH

Scientists have identified a compound that shows early promise at halting infections from a range of coronaviruses, including all variants of SARS-CoV-2 and the common cold.

THE BOTTOM LINE

Having established how the compound stops viruses, the researchers are working toward treatments that can be broadly effective against all types of coronaviruses, including future pandemic threats. Faculty of Medicine

The researchers credit and the study's first the compound's broad author. "This comeffectiveness to the pound blocks GSK3 unique way it works. beta, which in turn Rather than targeting stops the virus from



the virus itself. the compound targets a human cellular process that coronaviruses use to replicate. Since viruses can't reproduce on their own, they rely on protein-synthesis pathways in host cells to create copies of themselves. In the case of coronaviruses, they use a human enzyme called GSK3 beta that exists in all human cells. "We found that coronaviruses hijack this human enzyme and use it to edit the protein that packs its genetic material," says Dr. Tirosh Shapira, a postdoctoral fellow at UBC's

reproducing and maturing its proteins." Since the late 1990s, scientists have been studying such GSK3 inhibitors for their potential as treatments for a number of diseases, including diabetes, Alzheimer's and cancer.

~ Dr. Tirosh Shapira

"By targeting this cellular pathway, rather than the virus itself, we see broad activity against multiple pathogens. We're also acting on a pathway that is so far immune to changes

between variants and different coronaviruses," says Shapira, who worked on the project with senior author Dr. Yossef Av-Gay, a professor of infectious disease. To identify the compound, the research team screened a library as T-1686568, inhibited both viruses.

"While these are early days, it's encouraging to see broad levels of effectiveness in tissue models," says Shapira. "Because these compounds require many years of testing and regulatory approval before they can potentially reach patients, we need to be thinking about long-term applications and how this could apply broadly to future viruses and variants."

The research was conducted at UBC FINDER, a level-3 biocontainment facility at UBC where researchers are working with highly infectious pathogens with an aim to develop future treatments.

"We're not just fighting SARS-CoV-2, we're looking ahead at what's next," says Shapira.

"We're not just fighting SARS-CoV-2, we're looking ahead at what's next."

of nearly 100 known GSK3 inhibitors, testing them in cell and tissue models infected with SARS-CoV-2 and the common cold virus. The most effective compound, identified

BIRTH MODE AND BABY **GUT HEALTH**

THE RESEARCH

UBC researchers examined the longstanding assumption that a baby's gut microbiome is primarily shaped by their mother's vaginal microbiome.

THE BOTTOM LINE

The team concluded that the vaginal microbiome does not substantially shape a baby's microbiome, and that other factors play a larger role.

When babies are born, their gut is a nearly sterile environment. But that quickly changes as the infant's digestive tract becomes home to trillions of microbial cells. This gut microbiome is an important part of overall health, and alterations early in life have been associated with negative health outcomes later on, including asthma and obesity. It has long been assumed that exposure of newborns to their mother's vaginal microbiome during delivery greatly affects the

development of a baby's gut microbiome. This has given rise to practices like vaginal seeding, which aim to expose babies born via C-section to their mother's vaginal microbiome.

The new study involved more than 600 Canadian women who planned to deliver either vaginally or via C-section. Maternal vaginal swabs were collected prior to delivery, and stool samples from the babies were collected within 72 hours of delivery, as well as at 10 days and three months after birth.

The scientists found that regardless of birth mode, transfer of vaginal bacteria

to the infant gut is limited, and mothers' vaginal microbiome composition does not predict the composition of babies' stool microbiome at 10 days or three months after birth.

This suggests there is no rationale for vaginal seeding as a practice, says Dr. Deborah Money (BSc'81, MD'85), a professor of obstetrics and gynecology and the study's senior author.



The study's findings suggest there is no rationale for practices like vaginal seeding, which aim to expose babies born via C-section to their mother's vaginal microbiome.

"Other maternal sources like breast milk and exposure to the environment likely play a much larger role," says Scott Dos Santos, a PhD candidate at the University of Saskatchewan and the study's first author. UBC PhD student Zahra Pakzad (BSc'11, MSc'14) is conducting further work to analyze the breast milk microbiome and better understand its relationship with infants' gut microbiome. Although the scientists found statistically significant differences in microbiome composition by mode of delivery, these seemed to be primarily influenced

by exposure to antibiotics around the time of birth something they also hope to investigate further.

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IN CONVERSATION

KING CHARLES'S CORONATION: SHOULD CANADA BECOME **A REPUBLIC?**

BY PHILIP RESNICK Professor Emeritus, Political Science, UBC

ON MAY 6, 2023, Charles III was officially crowned King of the United Kingdom in a coronation ceremony at Westminster Abbey.

As King, Charles is also the head of state of 14 other Commonwealth countries, including Canada. The coronation raises an important question for Canada and the other countries: should we retain a British monarch as our official head of state?

Several Commonwealth countries have already removed the British monarch as their head of state, opting to become republics. Others are considering making a similar change.

In 2021, Barbados became the latest Commonwealth country to cut ties with the British royal family, opting to make Sandra Mason, the country's governor-general, its first president. Australia recently announced that King Charles will not be appearing on their \$5 banknote. This may prove the opening gambit in what could lead to a second Australian referendum on whether to become a republic. Australia's current Labor government has announced its intention to hold such a referendum if it is re-elected to a second term.

CANADA AND THE CROWN

Canadians of a certain age will remember the heated debate back in 1965 when the Pearson government moved to replace the Red Ensign, with its Union Jack in the corner, with the Maple Leaf flag. John Diefenbaker and other Tories huffed and puffed about the terrible break with tradition this would represent. But who in Canada today would want to return to the Red Ensign?

The Crown has had an important place in Canadian history. It was a symbol of the British connection and of the country's tie to the British Empire at the time of Confederation and for many decades thereafter.

It is also worth noting that, demographically speaking, a clear majority of the country's English-speaking population was of British origin for much of the country's history.

But this has been much less the case since the Second World War. Immigrants from around the world have made Canada a much more diverse country. Nor do those Canadians with British ancestry necessarily identify with Great Britain as the mother country in the way previous generations might have done.

A BORROWED CROWN

Constitutional monarchy is a perfectly legitimate option for liberal democracies. It has worked well in Scandinavia and the Benelux countries, and reasonably well in the UK, Spain, and Japan.

The problem for countries like Canada or Australia is that ours is a borrowed crown. The Royal Family is British and no attempt to Canadianize the Crown can disguise the fact that our head of state is not and cannot be a Canadian, as long as this last vestige of the colonial tie is retained.

We need to have a proper debate in this country about the monarchy, now that the queen who reigned for 70 years has passed away. The House of Windsor has had its share of problems, and the current royals do not enjoy the same level of popularity that Queen Elizabeth may have had. Nor is it clear why the Canada



▼ King Charles III during his May 6 coronation ceremony in Westminster Abbey, London. (Aaron Chown/Pool Photo via AP) of today would want to retain its ties with an institution steeped in aristocratic and feudal privilege.

It would be helpful if our political parties, beginning with the New Democratic Party and the Liberal Party, were prepared to open a debate on the subject. But it needs to go well beyond their ranks and include society at large. What is at stake is the symbolism associated with having a British monarch as our head of state a century and a half after confederation. Some might argue that replacing King Charles would open up a constitutional can of worms. A key ques-

tion is how a future Canadian head of state might be designated. Clearly, we would not be replacing a parliamentary system with a presidential system of the American or French variety.

If we were to become a republic, it's important to agree on a mechanism by which a president might be chosen. This was a problem that dogged the republicans in Australia at the time of their 1999 referendum.

A POSSIBLE PATH FORWARD

One model that comes to mind for a federal state like Canada is Germany. Their president is elected to a five-year term (renewable once) by a Federal Convention made up of all the members of the

Bundestag (the lower house of parliament), and an equal number, proportionate to their respective populations, elected by the legislatures of the 16 Länder (provinces).

The system has functioned well until now, with the figures who have occupied the presidency being well-suited to the role. Germany, like Canada, remains a parliamentary democracy. Effective political power rests with the chancellor, as it does with the prime minister in this country.

Were Canada to go the republican route, we would need to do so through a long constitutional process. The Canadian constitution states that there must be unanimity of the provinces for changing the head of state. In addition, treaties between First Nations and the Crown would have to be carried forward into a Canadian republic.

However, where there is a will there is a way. And Canadians should no longer shirk the question: does the British monarchy reflect how we see ourselves in the 21st century?

This article was originally published in The Conversation: theconversation.com/ king-charless-coronation-should-canada-become-a-republic-200408

THE CONVERSATION

AGENDA

Watch x Listen

PODCASTS

From Here Forward shares stories and ideas about amazing things UBC and its alumni are doing around the world. It covers people and places, truths, science, art, and accomplishments with the view that sharing better inspires better. Join hosts Carol Eugene Park and Rumneek Johal, both UBC School of Journalism grads, in exploring solutions for the negative stuff out there focussing on the good for a change, from here forward.



alumni uвс

magazine.alumni. ubc.ca/podcasts/ here-forward

UBC Podcast Network



Control Con

Carol and Rumneek speak with UBC's Dr. Pieter Cullis (BSc'67, MSc'70, PhD'72), whose pioneering research on lipid nanoparticles (LNPs) has received global acclaim. Without the development of LNPs, which serve as the "delivery system" for life-saving therapeutics, the mRNA COVID vaccines by Pfizer-BioNTech and Moderna would literally not work. Cullis's success did not happen overnight, but was the result of years of collaborative effort, sprinkled with happy accidents along the way plus critical early support from UBC.

THE POWER OF STORYTELLING FOR HUMAN RIGHTS

UBC alum and digital activist Daniella Barreto (MSc'17) joins From Here Forward to discuss her new podcast with Amnesty International Canada – *Right Back* At You - which explores anti-Black racism, policing, and surveillance in Canada. A public health graduate turned podcaster, Barreto is "passing the mic" to people working towards a more equitable future - and revealing the power of audio storytelling in the process.

THE THREE BILLION DOWNLOAD MAN >>

Carol and Rumneek talk with rapper and singer bbno\$ ("baby no money," aka Alex Gumuchian) about his path to astounding musical success that coincidentally began in a big way on the day of his graduation from UBC Okanagan in 2019.



WEBCASTS



Learn from the experts.

magazine.alumni.ubc.ca/webcasts

MAKE MORE HAPPINESS >>>

We could all use more joy in our lives. But did you know that happiness is made, not found? That's what renowned happiness expert and UBC psychology professor Dr. Elizabeth Dunn has discovered through her research. Learn some strategies for enjoying life through this engaging dialogue about how your everyday choices regarding time, money, and technology can cultivate happiness.



WHEN FOOD BECOMES MEDICINE

In recent years, scientists have recognized the important role that the human microbiome - the colony of microorganisms in and on our bodies - plays in determining health and disease. Diet is a significant factor influencing gut health. While we know that certain foods are good for us and others detrimental, what's the science behind this dietary wisdom? UBC experts share their research insights about gut health and how to promote it.

FOSTERING RESILIENT FORESTS

Forests can slow down climate change by absorbing carbon dioxide. But how can we support forests as climate warming and wildfires continue to intensify? Renowned UBC forest ecologist Dr. Suzanne Simard (BSF'83) is searching for answers. She's been unlocking the secrets behind how trees communicate and interact with each other, and is leading the testing of forest renewal practices. She's also launching the Mother Tree Network, a community of people working to support forest health. Learn about natural solutions for ensuring a healthy future for our forests and ourselves, and how we can take part.

CONTRACT OF A SUSTAINABLE FUTURE



As we attempt to meet energy demands while combatting climate change, rechargeable batteries offer one solution. UBC researchers are now tackling the challenges that prevent progress in transitioning to this renewable energy. At UBC's Okanagan campus, Dr. Jian Liu and his team are designing batteries that will be safer, longer lasting, more efficient, and more affordable. Find out how we can create a stable supply chain, ensure energy security, develop a circular economy, and more.

MAPPING OUT MODERN MORALITY

In a world experiencing rapid social and technological change, how do we apply morality to emerging or unprecedented situations? Forward thinker and moral navigator Dr. Azim Shariff draws upon scientific data and moral psychology to explore topical questions we don't yet have answers to. As religions recede, what will replace them? How will self-driving vehicles make ethical decisions about potential risks on the road? Explore these complex issues with a delve into morality, modernity, cultural attitudes, and more.

ORWARD

CAREER WEBCASTS

Enhance your work life.

ACE THAT INTERVIEW

Job interviews can be challenging. Even scary. But knowing what to expect and how to handle them can help you feel more confident and at ease. With certified coach Elena Giorgetti, discover how to effectively conduct yourself in interviews by understanding what interviewers are looking for, how to outshine the competition, and what the most common interview questions are.

NAVIGATING IMPOSTER SYNDROME AS A NEWBIE

Imposter syndrome is a common experience, especially when you're kickstarting your career, but there are things you can do to manage the feeling and learn from it. In this alumni UBC x Scholars Community webinar, four UBC alumni share their experiences navigating imposter syndrome and provide some relatable advice on how to recognize and deal with it when it arises.

BOOST LEADERSHIP WITH COACHING SKILLS

So, you've invested in yourself and your education, and you want your contribution to count - but how can you maximize your impact as a leader and build the skills you need to advance in an uncertain future? Spoiler alert: develop your coaching skills. Professional Certified Coach Molly Edge (BA'02) will help you understand what coaching is all about and explore how to increase your leadership impact while empowering others to do the same.

BUILDING BACK FROM BURNOUT

From stressed-out health-care workers to overworked educators, we've heard a lot about employees suffering from burnout. Ioana Birleanu answers questions about this debilitating condition, helping you to recognize the signs of burnout, and know what to do when you're chronically worn out.

USING CULTURAL INTELLIGENCE AT WORK

Today's workplace teams often consist of people from various cultures who may also be working remotely. So what's the most effective way to encourage cohesion and collaboration? This webinar explains what cultural intelligence is and the challenges and benefits of intercultural teams, and shares everything you need to know about cross-cultural interactions in the professional world.

THE SCOOP

Quaffles, Quacks and Quirks

- **1. BEFORE THE NAME "THUNDERBIRDS" WAS CHOSEN, UBC SPORTS TEAMS WERE GOING TO BE CALLED:**
- a. The Eagles
- b. The Seagulls
- c. The Ravens
- d. The Ducks

2. WHICH STUDENT CLUB WAS **POPULAR IN THE 1940'S?**

- a. Stamp Collectors Club
- b. Scrabble Club
- c. Varsity Jokers Club
- d. Jitterbug Club

3. IN ADDITION TO BOOK LENDING LIBRARIES, THE UBC VANCOUVER **CAMPUS ALSO HAS A:**

- a. Clothes lending library
- b. Tool lending library
- c. Bike lending library
- d. Seed lending library

4. THE UBC SKATEPARK:

- a. Was visited by Tony Hawk in 1997
- b. Was where Justin Trudeau (BEd'98) spent most of his time as an undergrad
- c. Was the first campus skatepark in North America
- d. Is the smallest official skatepark in Canada

5. THE SORORITIES AT UBC CONDUCT THE LARGEST AND MOST SUCCESSFUL RECRUIT-MENT IN ALL OF CANADA. HOW MANY WOMEN JOINED

- LAST YEAR? MORE THAN:
- a. 250
- b. 400 c. 800
- d. 1000
- 6. WHICH UNUSUAL COMPETI-**TIVE SPORTS TEAM DOES UBC** HAVE?
- a. Quidditch
- b. Bowling
- c. Pickleball
- d. Disc Golf

1: b) Before "Thunderbirds" was finally chosen in 1934, the name "Seagulls" won a student-wide vote to determine the issue. The Ubyssey, which conducted the first vote, didn't like the result, so in the finest tradition of democracy refused to accept it and held another one. 2: c) The UBC Varsity Jokers Club was a ragtag team dedicated to staging practical jokes on campus. Along with running an annual frog race, members of this zany club also staged protests by piling junk into the offices of their enemies.

3: d) The Seed Lending Library on UBC's Vancouver campus has a mission to conserve precious seed varieties by allowing members of the public to sign out seeds in order to grow, harvest, and pass them on to other gardeners. 4: c) The UBC skatepark was the first campus skatepark in North America. Opened in 2013, the project cost \$500,000 and was headed by the university in partnership with the University Neighbourhoods Association. 5: b) More than 400 women joined UBC

6: a) UBC has a quidditch team. Members compete at major events in North America, representing UBC and the city of Vancouver. Past players have also participated on the quidditch world stage as part of Team Canada in the World Cup.

NEWS FLASH





VANCOUVER

STUDENTS UNEARTH

TIME CAPSULE In October, UBC students and alumni gathered to dust off the dirt from a time capsule buried half a century ago on the 50th anniversary of the Great Trek. The ceremony, held at the Great Trek Cairn. commemorated the student-led march in 1922 that called on the government to resume construction of the Point Grey campus after it had been stalled by WWI. Guest speakers included former Canadian Prime Minister and alum Kim Campbell and 1972/73 AMS president Gordon Blankstein. Alumni from the class of '72 looked on as students pried open the fire-extinguisher casing used to hold the treasures of yore. These included a student registration list, a copy of the notorious and long-defunct EUS newspaper The Red Rag, and an invitation to the 1972 ceremony. The students then buried a new capsule containing (spoiler alert) a COVID-19 test kit and medical mask, an old iPhone, and an "Every Child Matters" T-shirt contributed by Musqueam Indian Band representative Jordan Wilson. The new capsule will be opened in 2072.



OKANAGAN **UBCO DOWNTOWN**

Perched on the outskirts of the city for more than 16 years, UBC Okanagan is poised to expand its presence to the heart of downtown Kelowna. The planned 9,000+ square feet building at St. Paul Street and Doyle Avenue will support community-based academic work and student learning opportunities.

"With UBC Okanagan's ongoing commitment to community-engaged research, it makes sense to open a collaborative, multi-use space in the heart of downtown Kelowna," says Dr. Phil Barker, vice-principal of Research and Innovation. "The goal is to create opportunities for knowledge exchange, social innovation, and creative expression, and this new facility will help us explore that in interesting new ways." The schools of Nursing

and Social Work, for example, will be able to enhance existing relationships with local organizations. The building will also have an art gallery, supporting creative innovation and community engagement, and a Public Engagement Suite to facilitate community discussions about shaping regional socioeconomic development. There will also be rental housing and student services including mental and physical health counselling, academic and career advice, and recreational space.





56 UBC MAGAZINE / ALUMNI UBC



Number of gymnasium courts

UBC's new Recreation Centre North is under construction at the western end of Student Union Boulevard. It will provide much needed recreation space, including an indoor track. cardio and weightlifting areas, and gyms. Completion is anticipated by late next year.



The estimated cost of the project.



The facility's approximate indoor space, spread over four levels.



Approximate indoor recreation space currently available to students.



Number of undergraduates enrolled at UBC.

200 metres+

Length of the elevated indoor track



UBC RECEIVES \$33.8M GIFT FOR MS RESEARCH

A \$33.8 million gift has been donated to UBC and VGH & UBC Hospital Foundation for multiple sclerosis (MS) research and care - the largest donation ever for MS research worldwide. The private donation was made by a BC philanthropist and will be used to establish the BC MS Cell Therapies Translational Research Network, a world-class research and patient-care hub that will use the latest advances in cell and gene engineering to develop, manufactured, and test next-generation cell-based therapies (see page 18). It will also help augment clinical services for patients and families.

Canada has one of the highest rates of MS in the world, with more than 4,000 people newly diagnosed each year. Despite UBC being a powerhouse of biomedical research, most MS patients in BC whose lives may depend on next-generation therapeutics do not benefit from the university's discoveries. There are gaps in BC's research capacity that impede the delivery of advanced therapeutics developed in the lab into treatments given to patients, but the donation will enable the rapid acceleration of new disease-modifying therapeutics to move through the development pipeline to reach patients faster. At UBC, \$14.85 million will support recruitment of world-class researchers, while \$15 million will go toward biomanufacturing infrastructure for local development and clinical testing of homegrown cell and gene therapies. Headquartered at UBC's Djavad Mowafaghian Centre for Brain Health, the MS Research Network will collaborate with research partners across the province, country, and globe to leverage advancements with the potential to improve outcomes for patients with MS sooner.

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IN MEMORIAM

Due to a large backlog of submissions and only two issues a year, UBC Magazine has long been unable to publish obituaries in a timely fashion. For this reason, the majority of tributes will now be published in full on the magazine's website at **magazine**. **alumni.ubc.ca/in-memoriam**, with listings included in our spring and fall print issues. Please submit obituaries at **magazine**. **alumni.ubc.ca/memoriam-submissions**.

Florence Sinclair (née Roussel), BA'37, BEd'55 John Leslie, BA'40, MASc'41 Beryl Forgay (née Gaff), BHE'47 Margaret Trehearne (née Mackay), BSc(Agr)'47 Robert Irwin, BSc(Agr)'48, MSc'50 Stewart William Martin, BA'49, BEd'57, MEd'64 Robert McLennan, BCom'49 Dedar Sihota, BA'49 June Alexander, BA'50 Doris Kavanagh (née Larkin), BSc(Agr)'50 Donald Waldern, BSA'51, MSA'53 Robert Wadsworth, BCom'52 Conrad Namiesniowski, BA'53 Daryl Rankine (née Muir), BHE'53

Bruce MacMillan, BCom'55 Maureen Pepin (née Sankey), BEd'55 Frederick Robert (Bob) Stewart, BCom'55 John Hansuld, MSc'56 Edward Knight, BCom'56 Clarence Madhosingh, MSc'56 Norman Fletcher, BASc'57 Karoly Charles Deminger, BSc(Forestry)'59 Shawn Lamb (née Harold), BA'59 Luke Nakashima, BSc'59 Donald Shore, BA'59 Ignace (Walt) d'Hondt, BSc'60 David Hunter, BASc'61 Harold Gopaul, BSc(Agr)'62 Ping Wah Chan, MSc'64, PhD'66 Barry (Joe) Irish, BSc'64, MD'68 Louise Parker, BASc'66 Barrie Humphrey, MD'67 David Baker. BASc'69 Jeremy Sumner, BSc'70 Joyce Campkin, BSN'71 Douglas Heuman, BCom'74 (John) Michael Patterson, MA'74 Harjindro Sall, BEd'76 Darshan Sihota, BSc(Forestry)'79 Edwin Landale, BSc'80 Siegfried Kemmler, BA'88 Gurjeet Sivia, BSc'89 Russil Alden, BA'99

Melissa Jouen, BSc'13

Avrum Soudack, Professor

Iola Musfeldt Knight, BA'45, MA'47 (Zoology and Agriculture)

Iola passed

away after a

lengthy illness on November 2, 2021. A UBC science student during WWII, Iola was brought into teaching anatomy for the fall of 1945 while she pursued her master's degree studying parasites in local muskrat populations. Post graduation, she worked in wildlife management as one of very few women in that field. She was very active in the Varsity Outdoor Club, and it was there she met Gordon Knight (BASc'49) who would be her husband and best friend until his passing in May 2014. Iola is survived by son Tony Knight (BASc'81) and daughter Tami Knight, as well as grandchildren Isaac and Dominique LeBlanc (BA'15).

Dr. Alexander Boggie, BA'50, MD'54, CCFP, FCFP April 6, 1923 – December 28, 2022 Born in

Vancouver, Al attended Templeton and Britannia schools. At 18, he joined the RCAF and served overseas from 1942 to 1945. After the war, he was accepted to UBC, making use of the Department of Veteran Affairs offer to help returning veterans. In 1948 he married Rhoda Bowes. In 1950 he was offered and accepted a place in the first class of UBC's new medical school.

Medical school. After Al graduated and completed his internship in Vancouver, the family moved to Vernon, where he joined the Vernon Medical Clinic. In 1961 he completed a year of Pathology at VGH/UBC. This was followed by an exciting year in London, England, where he completed surgical post grad studies at Hammersmith Hospital. In 1963, he went back to his busy practice in Vernon.





In 1969, Dr. Clyde Slade asked Al to join the faculty in Vancouver as a full-time teacher and mentor in the new department of Family Practice. The last eight years before retiring in 1988 were spent practicing and teaching half time, while also acting as associate dean of Admissions to UBC's medical school.

Please read Dr. Boggie's full obituary at: *give.ubc.ca/memorial/ alexander-boggie/*

Henry David Currey,

BASC'50 Henry David ("Dave") Currey passed away peacefully on May 24, 2022,



age 95. Predeceased by his Swedish wife Birgit and second wife Loree, he leaves son Marvin (BSc'73, MBA'89) and daughter Ingrid (BA'78, MEd'97) plus relatives, direct and through marriage.

He was born on an Alberta farm (Vermilion) to a family of one sister and five brothers, then three stepsisters and a stepbrother. The family moved to the West Coast in 1944, where he completed high school then attended UBC. Dave graduated as an agricultural engineer before successfully running several companies focused on agricultural and industrial markets.

Living in his North Vancouver home for 70 years, he played bridge socially and enjoyed travel opportunities, especially after retirement. Always interested in the world around him, Dave contributed generously to educational institutions (including UBC, Douglas College, and BCIT) focusing on Nursing (recognizing Birgit's and Ingrid's careers), Forestry, and Land & Food Systems. Dave joined in Rotary Club and never ceased pursuing his engineering-based solutions to problems. He enjoyed fostering connections with family and friends. He always demonstrated integrity, strength, positive energy, and an active imagination.

THE LAST WORD



Bonnie Henry OBC, DSc'21

Kindness is her superpower, shoes are her weakness.

WHO WAS YOUR CHILDHOOD HERO? Sherlock Holmes.

DESCRIBE THE PLACE YOU MOST LIKE TO SPEND TIME.

Anywhere near the ocean (especially in Victoria, where I live, and Charlottetown, PEI, where I grew up).

WHAT WAS THE LAST THING YOU READ?

Carlo Rovelli's The Order of Time (wonderful work on physics), the incredible Miriam Toews book Fight Night, and the important book 21 Things You May Not Know About the Indian Act by Bob Joseph. (I always have a few books on the go at any one time!)

WHAT IS THE MOST IMPORTANT LESSON YOU EVER LEARNED?

That kindness is a superpower.

WHAT IS YOUR IDEA OF THE PERFECT DAY?

A run along the water, a good book, listening to music, and a glass of wine!

WHAT IS YOUR MOST PRIZED **POSSESSION?**

My passport that allows me to travel and experience the world (and my Fluevog shoe collection :)).

WHAT WOULD BE THE TITLE OF YOUR BIOGRAPHY?

Being Kind, Being Calm

 \mathbf{X} **KNOWN FOR**

As BC's

provincial health

officer, she

guided the public health response

to the COVID-19

pandemic. Her frequent and

compassionate TV

briefings made her

a household name.

 \mathbf{X}

UBC

CONNECTION

She received an honorary degree in

the spring of 2021

for her role during

the pandemic, and

is an associate

professor in

the Faculty

of Medicine.

8

FUN FACTS

After completing

her medical de-

gree at Dalhousie

University, she

spent a significant

amount of time at

sea as a medical

officer with the

Canadian Navy.

She knew

she wanted to

become a doctor

at the age of sev-

en, having visited

her older sister in

hospital after she

had her appendix

removed.

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

To be able to travel more with my dear friends.

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

Marie Curie, an incredible scientist who was never fully recognized.

WHAT WOULD YOU LIKE YOUR EPITAPH TO SAY?

She leaves the world a kinder place.

IF YOU COULD INVENT SOMETHING, WHAT WOULD IT BE?

A tool that makes people kinder and more compassionate.

WHAT ARE YOU AFRAID OF?

Personally, I fear dementia, but professionally I fear not making progress in addressing the tragedy of the toxic drug crisis we are experiencing.

WHAT IS YOUR LATEST PURCHASE?

(Another) pair of beautiful Fluevog shoes in pink patent leather.

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

To be able to sing or play a musical instrument.

WHAT IS YOUR PET PEEVE?

Procrastination! (In myself, of course.)

WHAT IS THE SECRET TO A GOOD LIFE? Finding joy in every day.

DO YOU HAVE A PERSONAL MOTTO? In patience lies wisdom.

WHAT IS THE MOST IMPORTANT THING **LEFT ON YOUR BUCKET LIST?**

I had a trek booked to Machu Picchu this past December, but sadly that was cancelled because of the political situation in Peru.

-0- -0- -0- -0- -0- -0- -0-

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100

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