UofTMed

University of Toronto Medicine

SPRING 2015

The Future

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SPRING 2015

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PUBLISHED BY
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Printed by Somerset

Cover by Dave Mazierski
Photo of Apollo Belvedere ©Marie-Lan Nguyen/Wikipedia

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LIVING “FORWARDS”

The philosopher Søren Kierkegaard once said, “Life can only be understood backwards — but it must be lived forwards.”

That’s what our researchers, clinicians and educators at the Faculty of Medicine do. We don’t look back at the long legacy of achievement at our Faculty and rest on our laurels. Instead, we look forward at the challenges that lie ahead. And when you speak to our faculty members individually, you soon find that most of us are pretty optimistic about the future.

In this issue, you’ll read about some of our predictions for the future. If some of them seem to come straight out of *Star Trek*, there’s a reason for that. Frankly, a lot of us were inspired to follow careers in science because we were inspired by science fiction — which, in turn, is also inspired by science itself. Many of today’s cutting-edge developments — such as the Gamma Knife — were dreamed up by science-fiction writers. So it’s not surprising at all to hear a number of faculty members describe science fiction as a major inspiration, giving them “the freedom and permission” to explore (p. 20).

Science fiction can also tell us a lot about ourselves because — inevitably — when we look forward we are also projecting our own experiences onto the future. So perhaps 100 years from now, the predictions you read here will provide a fascinating look into the medical mores of the early 21st century. Professor Edward Shorter does just that in his article about last century’s dreams of a cancer-free, mosquito-less and physically fit future (p. 36).

Not all of us agree on everything. Take Big Data, for instance. Many faculty members point to the promise of Big Data as potentially the most important development in our medical future. Others wonder if this revolution will leave Ontarians behind.

So we ask a simple question on page 14: *Are we ready for it*?

Medicine has been slow to benefit from Big Data. Due to legal and privacy reasons alone, developing even a network of electronic health records has in many places, including Ontario, proven easier said than done.

As Professor Michael Julius writes, we may need to call upon everyone in society to help fully grasp the opportunity of Big Data (p. 10). This makes me wonder whether universities — and Faculties of Medicine — are doing enough to lead the way.

As health leaders, we need to ask questions like these: Are we doing a good enough job in communicating to the public and to policy makers that electronic health data is a worthy investment? Do we have a role to play in making Canada’s health dollars go further while improving patient care?

I would very much welcome your thoughts on these questions. I invite you to tweet **@UofTMedDean** with **#futuremedicine** — or email me at **medicine.communications@utoronto.ca**

Let’s encourage each other to “live forwards” so that 100 years from now, when someone looks back at this issue of U of T Medicine, they’ll be amazed at how right we were.

Trevor Young MD, PGME (Psychiatry) ’88, MSc ’89, PhD ’95
Dean, Faculty of Medicine
Vice-Provost, Relations with Health Care Institutions

We Asked ...

What will medicine look like in 20, 50 or even 100 years? Will microscopic cameras rove through our bodies, uncovering cancer cells and killing them on the spot? Or will disease be a distant memory, its genetic roots long since programmed out of the human race?

Will it be impossible to tell where flesh ends and bionics begin? Will we find a cure for aging — or run out of land and water and become a spacefaring species?

In the following pages, we asked professors and alumni from every part of the Faculty of Medicine to predict our medical future, both near and very far. We hope you are inspired by their ideas.

The Future

Photos by Jacklyn Atlas

The Avatar

In 100 years, we'll all have avatars made up of our own cells. Medical procedures will be performed on them first to see the real consequences in real time. This will open a whole new field of medical bioethics — where does the person end and the avatar begin?

←

Professor Alison Buchan, Vice-Dean Research and International Relations.

The Unknown Maladies of a 150-Year-Old Brain

In 20 years, I hope that in the area of mental health and addiction, diagnosis will be much more specific, with the help of neuroimaging, genetics and biomarkers. I expect we'll also have a much better understanding of the role of epigenetics and how environmental experience influences gene expression. All of this should allow us to find the "sweet spot" between therapeutic effects and unwanted side effects in medications.

I think we'll be able to make excellent use of neuromodulation interventions targeting specific areas of the brain causing illness. We'll know how to tailor psychological and psychosocial therapy and provide interventions and help through smartphones and other mobile devices. We already have texting-based psychotherapy that seems to work. And as this trend continues, we'll gather a massive body of evidence about the kinds of therapeutic approaches that work and why one provider is achieving more success than another.

We also hope to understand much more about neuroplasticity and how damaged brains can heal. And in an ideal world we'll be able to identify and repair the genes that cause schizophrenia before it starts.

But with the kinds of medical advances on the horizon, you never know how psychiatric needs will change. Nobody anticipated we would face so much dementia, and that's because we're living longer.

—

Molyn Leszcz is Interim Chair of the Department of Psychiatry and Psychiatrist-in-Chief at Mount Sinai Hospital.

We'll be sending in nanotechnology to bandage up your DNA.

↓

Star Trek Got It Right

The price we pay for evolution and natural selection is cancer. Genetic mutations may cause cancer, but they also have allowed humanity to progress — without it, we'd still be living in the swamp. I don't see cancer disappearing for this reason alone, whether in 20 or 100 years.

However, our capacity to detect cancer has skyrocketed in the past few decades — and the rise of Big Data will only speed up this progress.

It's amazing to think we didn't have CT, MRI and PET scans just four decades ago. And yet, in 20 years, people may laugh at us for using radiation to look into the human body. When that point comes, when imaging is totally non-invasive, then everybody will be imaged.

Star Trek got it right: the first thing you do is scan the patient to find out what's wrong. Every door to a hospital will have an MRI scanner, and you don't walk into a medical appointment without a full body scan. Diagnosis and therapy will be in the same space: use a tracer to find the tumor, but tag that tracer with therapy to treat it simultaneously.

By 50 years, you'll be scanned and if a buzzer goes off, that means they found the tumor. Computers will do most of the scan analysis — they're better at recognizing patterns. "Texture analysis" will be used routinely. Even now, satellites can see one person in a military operation, and can look under water and rocks. That's the same technology we'll be using.

In 100 years, radiology won't exist as we now know it. We can't fight against evolution, but we can at least try to repair the damage. We'll be sending in nanotechnology to bandage up your DNA. As a result, we're probably looking at lifespans of 120 years.

—

Alan Moody (PGME '91) is Chair of the Department of Medical Imaging and Senior Scientist, Physical Sciences, Schulich Heart Research Program, Sunnybrook Research Institute.

Stem Cellborg?

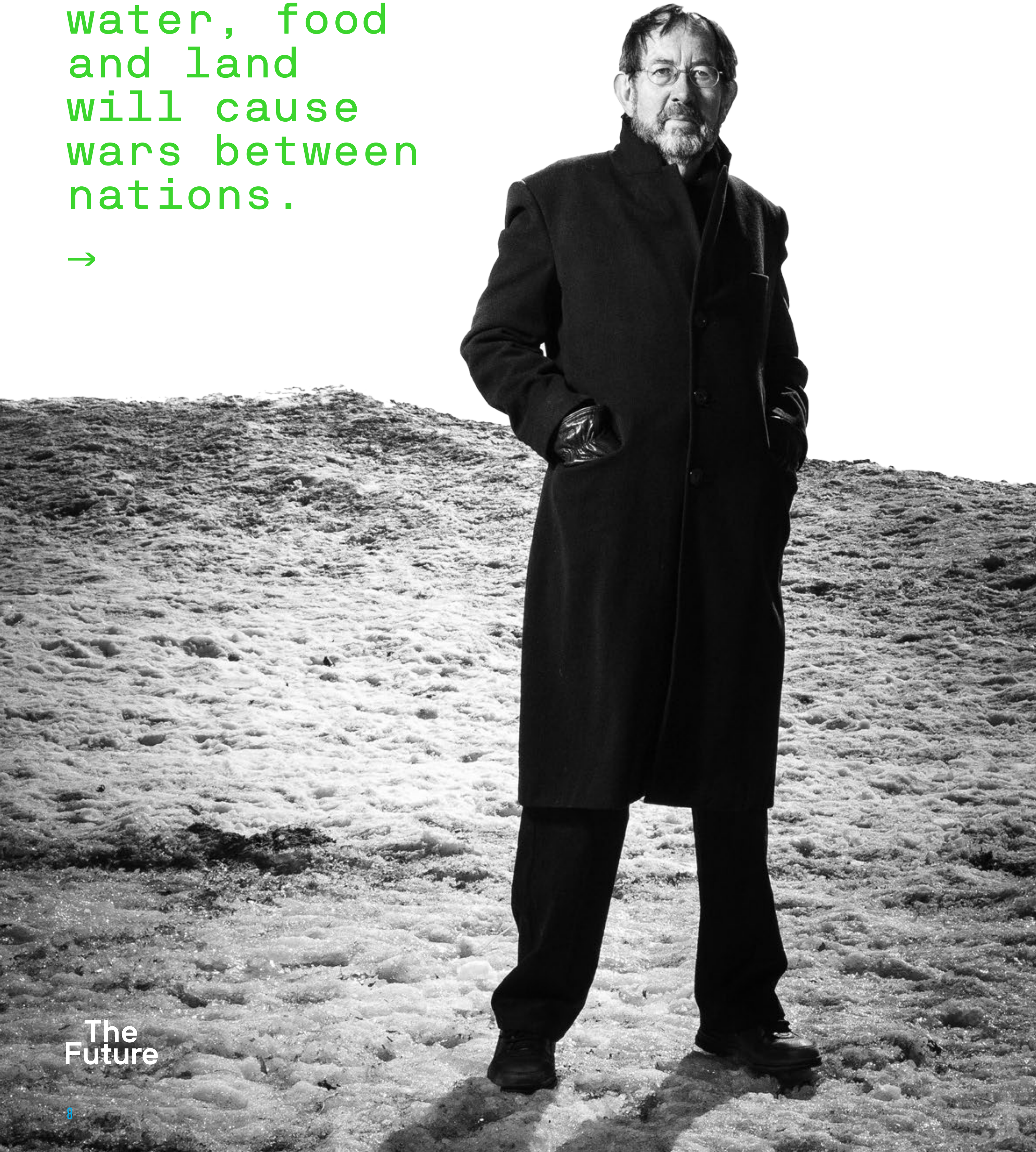
In 20 years, stem cells will at least partly restore vision; and the combination of biomaterials and cells will enable us to use personalized medicine to better predict which drugs will be useful for any person.

In 50 to 100 years we'll be programming the disease right out of people by manipulating their cells. Humans will be more integrated with electronics, leading to bionic people.

I'm most excited about combining stem cells and delivery vehicles. We've invented materials that allow you to inject cells where you want them to be, like the back of the eye or in the brain. These materials promote the survival of the cells in these new locations. The eye is so promising because the retina is a defined space and we know which cells to replace. The brain is much more complicated in terms of which circuits have to be reconnected in order to regain function.

→

Molly Shoichet is Senior Advisor on Science and Engineering to U of T President Meric Gertler. She holds the rank of University Professor, with appointments in Engineering, Medicine and Arts and Sciences.



Access to water, food and land will cause wars between nations.

→

Starvation, Plagues and War

In the next century we may have the technological potential to keep the average person alive past 100, but it won't happen.

What keeps us alive is air, water and food.

Farmland destruction and population growth will lead to food shortages worldwide. Population growth is fastest in parts of the world without stable governments or health care systems. Access to water, food and land will cause wars between nations.

The obesity problem will disappear, but there will be plagues of uncontrollable bacteria for which we'll have no antidotes because of the widespread overuse of antibiotics.

For Canadians, there is a way forward. As the world warms, huge swaths of farmland may open up in northern Canada. We will need to create and use genetically modified sources of foods.

←

G. Harvey Anderson is Executive Director of the Centre for Child Nutrition, Health and Development, and a Professor of Nutritional Science and Physiology.

No Cure for the Common Death

In 20 to 50 years, I don't think we'll see significantly extended lifespans, despite advances in medical research. This is for social reasons: effective immortality would be incredibly selfish to future generations and we'd simply stagnate without the turnover. But there will be improvements in health such as Artificial Intelligence Immunity, which will be capable of bolstering the immune system through surveillance and eradication of damaged cells and infections. Such designer immunity may make antibiotics irrelevant by supercharging our own immune systems.

The biggest challenges in the developed world will be obesity, lack of exercise and mental illnesses. These won't be overcome by medical innovation but by social restructuring.

We tend to overestimate progress in medicine. The hard part is always the implementation. For example, genomics has enormous positive potential — but this will be for nothing unless the public trusts that their genomic data won't be used against them. I see this as a major problem in the next 20 years as we realize privacy and trust can never be guaranteed.

In 100 years, hospitals as we know them won't exist. We'll still have medical needs but these will be provided by smaller, specialist "hotels." Chronic care will be provided autonomously, including through life-sustaining mobile machines. Quality of life will be better appreciated and people will have far greater say in their fate. Physician-assisted death will evolve into patient-empowered end-of-life care.

I'm most excited about the development of CAR T cell therapy (a type of immunotherapy), which is enormously promising for cancer treatment but will probably be adapted to broader uses.

—

Jim Woodgett is a Professor in the Department of Medical Biophysics and Director of Research at the Lunenfeld-Tanenbaum Research Institute, Mount Sinai Hospital.

The Sky's the Limit

"I wouldn't be surprised if bionics becomes a reality. For that matter, are humans going to be a species that remains on earth forever, or will humans become a spacefaring species? Our imaginations shouldn't have limits."

↑

Former astronaut **Dave Williams** is an Assistant Professor of Surgery at U of T and President and CEO of Southlake Regional Heath Centre.

The Future Is Here — But It's Stuck in Trials

Today, we're treating the disease. In 50 years, we'll be treating the person's manifestation of disease, based on her genetic and other health information. But when will this precision medicine come to the patients of Ontario? Unless our health care system creates the capacity to use this information, we'll fall behind. We are already falling behind.

Medical imaging, advances in biological science and developing the technology to deliver it are moving at a fair clip. It's blending it all that will help us to realize a time when disease can be treated as just an irritation, to be brushed away like a pesky fly; when genetic aberrations are identified and fixed at birth.

Our ambition has to be systemic. University teaching has to be in tune with the medical landscape. Government has to recognize our need to speed up the glacial pace of progress.

And the public has to let us in. We will ask them to participate in this health care revolution, to let us collect the biological, imaging and other needed information to realize our ambition. We need hundreds of thousands of data points for every question we ask. We need multiple millions for a disease-free future.

Getting there is not the job of one hospital or one health care system. It's the job of each and every one of us. It's the job of the world.

—

Michael Julius is Professor of Immunology and Vice-President of Research at Sunnybrook Health Sciences Centre.

Rising Above Our Bodies

In 50 to 100 years, I can imagine touch screens operated with the eye or the mind! The physical body will be less and less important — it will become an accessory. There might be “body clubs” where hobbyists go to use their bodies for nostalgic or other specific reasons, just as now there are still photographers who develop film in a darkroom for specific effects.

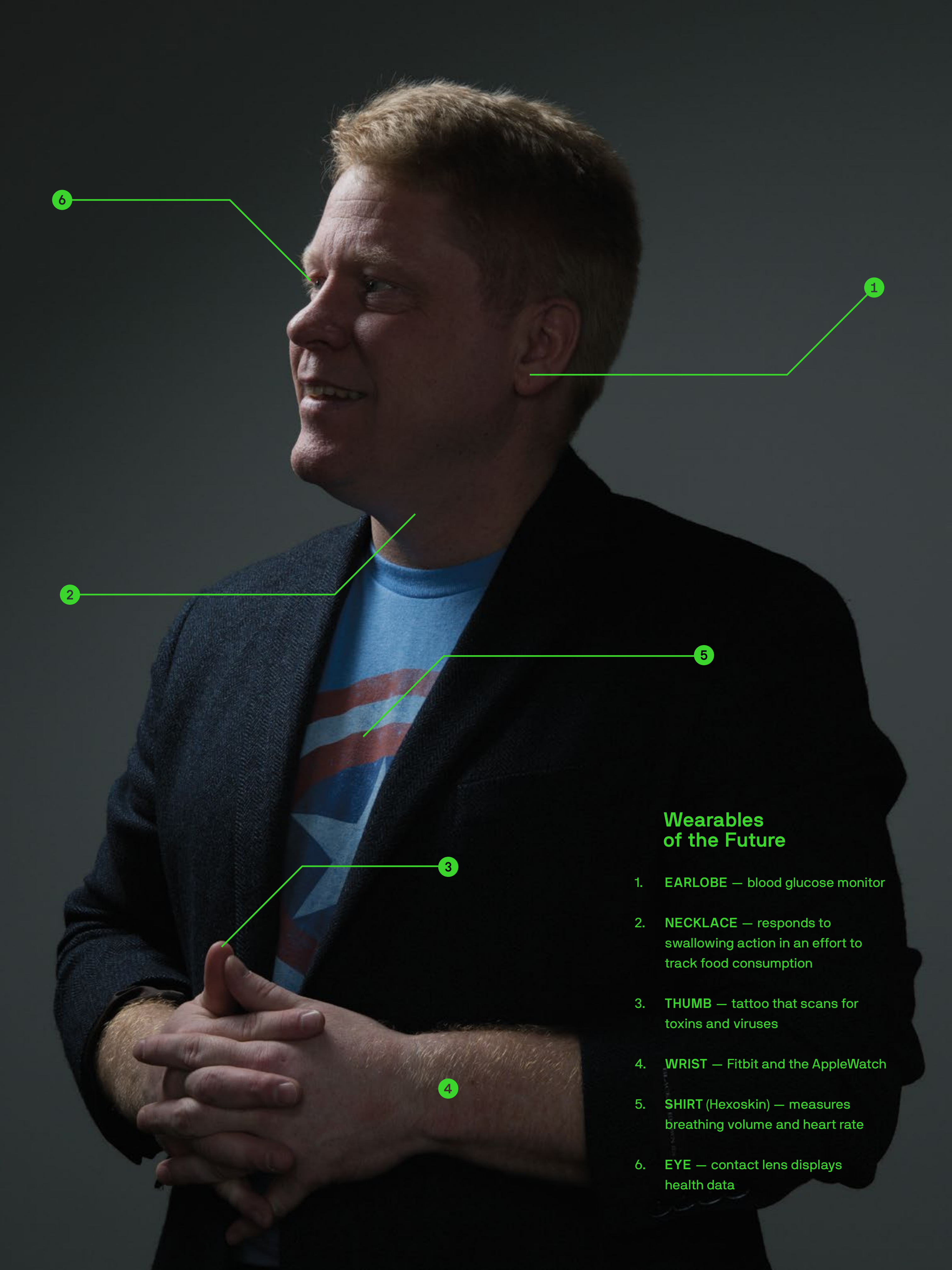
Health providers will be more like mentors, empowering the individual to create a meaningful and purposeful life. For example, maybe in rehabilitation sciences, we’ll be giving you what you need to climb mountains bionically.

Right now, our bodies keep us down. We spend so much time and energy trying to keep our bodies healthy, but in the future machines will do that. A machine will print a new knee, a better heart. Taking care of bodily problems will be mundane.

Think of Stephen Hawking. His body traps him — it’s worse than useless. But if you think about what his mind is doing, he’s probably the most able human being alive.

↑

Helene Polatajko (MEd ’78, PhD ’82) is a Professor in the Department of Occupational Science and Occupational Therapy and Interim Director of the Rehabilitation Sciences Institute.


Wearables of the Future
1. EARLOBE — blood glucose monitor
2. NECKLACE — responds to swallowing action in an effort to track food consumption
3. THUMB — tattoo that scans for toxins and viruses
4. WRIST — Fitbit and the AppleWatch
5. SHIRT (Hexoskin) — measures breathing volume and heart rate
6. EYE — contact lens displays health data

Follow the Money

I wouldn't dream about genomics and drugs because progress is so slow, and the cost of drug development doubled to an average of $2 billion per medication in just the past two decades.

The structure of DNA was discovered in 1953. Today, we don't have genetically engineered monkeys running around doing work for us. Gene therapy is still a dream for the most part. We're still attacking autoimmunity with the same framework we did 50 years ago. The truth is we don't have the financing or the science to properly support drug development. It may take a full 100 years, or more, for the optimism about the usefulness of genetic sequence information to pay off in a practical way that is evidence based.

But the medical device world operates on a completely different life cycle. The cost of sensor technology, in particular, is coming down. We'll use it to record massive amounts of lifestyle information that will be the most immediate and perhaps most important future of Big Data in medicine.

Within 20 years, wearable technology is going to break out of the niche fitness market and explode for managing chronic diseases like Parkinson's and MS. It will be as pervasive as the Internet. This could start very soon if smartwatches (e.g., Apple Watch) take off.

In 50 years, we'll be synthesizing data from our whole lives — heart rate, exercise, blood sugar and millions of other data points. We'll have our own personal life data series of all our responses to food, entertainment, the personal relationships that cause anxiety. This will lead to preventative medicine on a level much more sophisticated and finely textured than telling people to eat right and exercise. What triggers a migraine for you? What's your risk of heart attack based on how much you've been sitting lately? The data explosion will completely recast personalized medicine.

This will lead to a sea change in our society. Insurance companies will rise in power, and may displace technology companies to become the largest firms in the world. They will support a wearable outpatient system that will provide them with real-time updates on your lifestyle habits, which they will use to update their risk models of you and adjust your premiums. Physicians are neither equipped nor paid to analyze all this data, so an entirely new industry of privately funded analysts will spring up.

The end result: Right now the medical system is organized around hospitals and focused on treatment. In the next century, it will shift to the private sector and prevention.

←

Jayson Parker (BSc '91, MSc '93, PhD '99) trained as a neuroscientist and worked as a stock analyst in the health sciences. Currently, he is a biotechnology lecturer in the Department of Biology (UTM), Faculty of Law and at the Institute of Biomaterials and Biomedical Engineering. He also serves as an adviser to a hedge fund.

The Importance of a Sheep

I don't think the end of disease will happen anytime soon. I don't think we know enough about the cellular equipment and how to fix it. The human system isn't engineered. We were put together ad hoc over a billion years, and we're still learning about the layers of complexity that need to be uncovered.

Because people developed so haphazardly, maybe it's no surprise that the greatest medical discoveries have come by accident, often when scientists were looking for something else. I work in genomics and computational biology, but the big moment for me in science wasn't the decoding of the human genome or the explosion of Big Data. It's when we cloned Dolly the Sheep. That achievement went against expectations because it showed that genetic programs are much more malleable than anybody thought.

—

Tim Hughes is a Professor with the Donnelly Centre for Cellular and Biomolecular Research.

FROM TREK TO TECH

How Sci-Fi Inspires Medical Research

By Erin Howe

Progress happens when people start to dream about the worlds science fiction authors write about.

***Star Trek* featured** a version of the Gamma Knife. Mary Shelley predicted transplant surgery. Many of today's medical technologies and procedures were first imagined in science fiction. And experts say we shouldn't be surprised.

"Good science fiction deals with existential questions about the meaning of life, our roles with respect to each other, with respect to society, and with respect to the physical universe," says Raywat Deonandan (BSc '90, MSc '93, BEd '93), an alumnus of the Department of Physiology and — like many people in the medical professions — a sci-fi fan. "Science fiction has the breadth and the freedom to explore the nuances and texture of any kind of sentient existence. Beyond any other kind of genre, I think science fiction has the freedom and permission to do this."

Deonandan is a University of Ottawa epidemiologist who specializes in global health, but he also edits a science fiction website called Skiffy.ca. (The site's name is a play on a common mispronunciation of "sci-fi").

Space may be the final frontier, but Deonandan is already thinking about how extraterrestrial organisms could affect human health.

One of his research projects looks at the ways human health might be impacted if pathogens from outer space made their way to earth and caused an outbreak. Deonandan says the idea was inspired by the sci-fi theory of panspermia, which holds that the building blocks of life on earth came from outer space.

"If in fact these complex, organic molecules exist outside the earth and if they ride these strange interplanetary transit systems involving meteor impacts, then why wouldn't we expect one result of that to be some kind of disease? And if that happened, then how would we deal with it epidemiologically?" asks Deonandan, who grew up reading books by authors like Arthur C. Clarke and Isaac Asimov. He says he loves sci-fi for inspiring readers to be courageous and ask big questions.

Quaid Morris (BSc '96), an Associate Professor at the Donnelly Centre for Cellular and Biomolecular Research, read many of the same books as a child and, like Deonandan, he finds them inspiring.

"Progress happens when people start to dream about the worlds science fiction authors write about, and then try to create some of the things in the books — or try and understand why they can't," says Morris. "They make science interesting by writing books about ideas. And that's why a lot of hard science fiction is really about taking the ideas of science and following through with them to the end."

One such idea: What would happen if computers became as smart as people? It's a question Morris explores in his computational molecular biology research.

"For me, it all seems to come down to this initial interest in artificial intelligence," he explains.

Morris points to Lieutenant Commander Data, *Star Trek's* self-aware android on the *Starship Enterprise*, as one inspiring example of artificial intelligence. On television and in movies, Data is an invaluable member of the ship's crew, programmed to calculate information quickly — much like some of the software Morris develops in his lab.

"Following that path leads to the idea of computer programs that can recognize patterns the same way people can," says Morris, who is cross-appointed to the Departments of Molecular Genetics, Computer Science and Electrical and Computer Engineering. "Humans are the best pattern-recognizers in the world, but you can't get someone to sit in front of a computer and look

JACKYLN ATLAS

at terabytes of data. We need artificial intelligence to do that for us."

Though there's seemingly endless potential for technology to help people, sci-fi writers have also predicted what would happen if we became overreliant on it. Authors like Ray Bradbury and Philip K. Dick imagined what would happen when people stopped being able to distinguish the virtual world from the real one.

"I'm seeing technology dependence all the time and it's actually affecting people on a clinical, social and cultural level," says Bruce Ballon (PGME '00), a Professor in the Department of Psychiatry. "Technology is rampant and people walk around with cell phones, looking like cybernetic creatures from *Star Trek* called The Borg that are all hive-minded together."

While Bradbury's *Fahrenheit 451* featured a dystopian world where people's minds are controlled by what they see on television, Ballon aims to empower people to think critically about their interactions with emerging technology.

"We need to think about how we deal with technology and how it affects our relationships with the people around us. Because if we don't, we could leave ourselves vulnerable to being influenced," says Ballon, author of *Swimming in Cyber: Learning to Live Healthily in the Intersections of the Virtual and Real Worlds*. He is also Director of the Advanced Clinical and Educational Services for Problem Gambling, Gaming and Internet Addiction at CAMH.

"I think we're in an interesting time," Deonandan says. "The mainstream now understands the maturity and the possibility of science fiction, where a generation ago, it was perceived as the rarified domain of the socially repressed fanboy. Now we're recognizing there are some important, real-life philosophical imports to this particular kind of narrative."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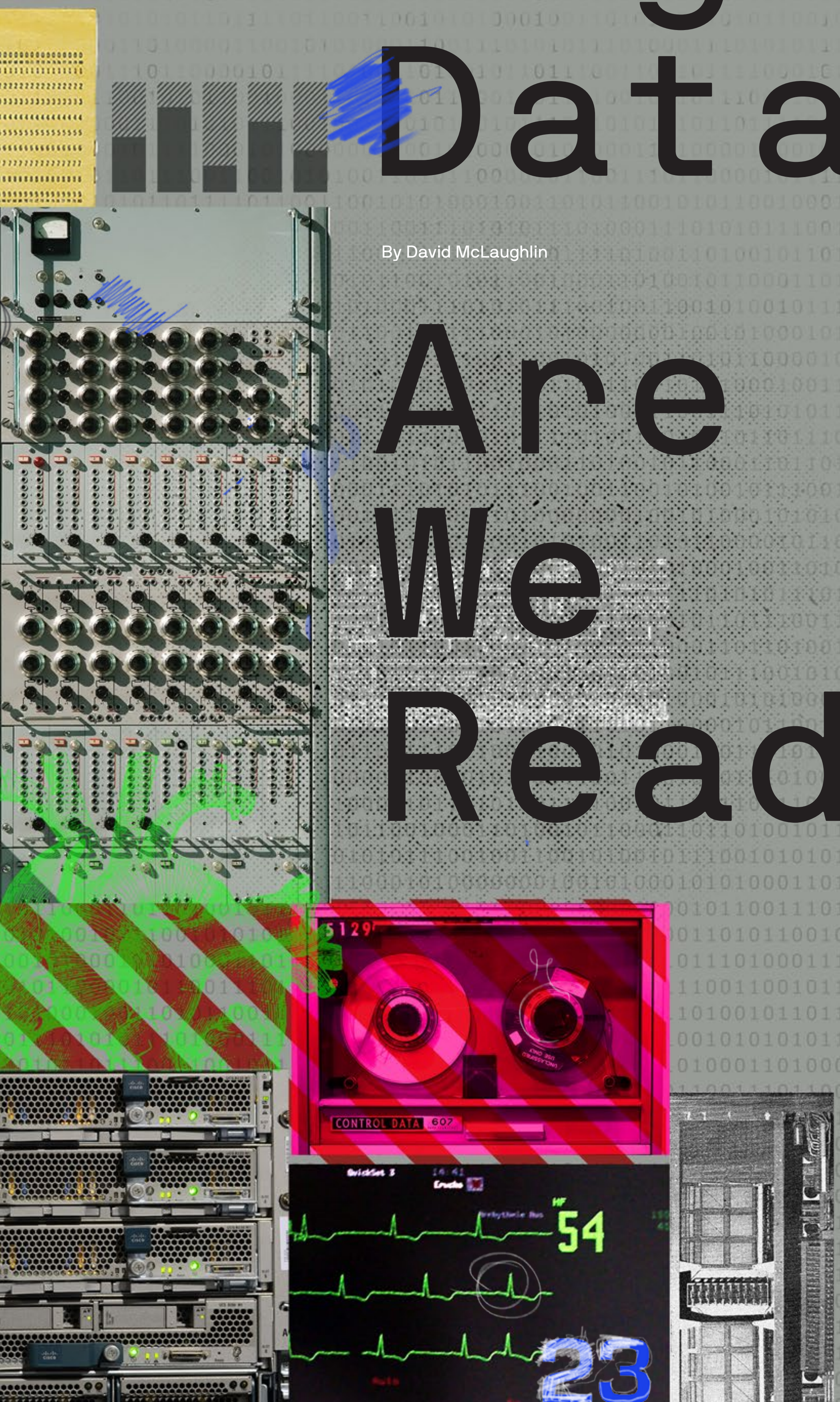
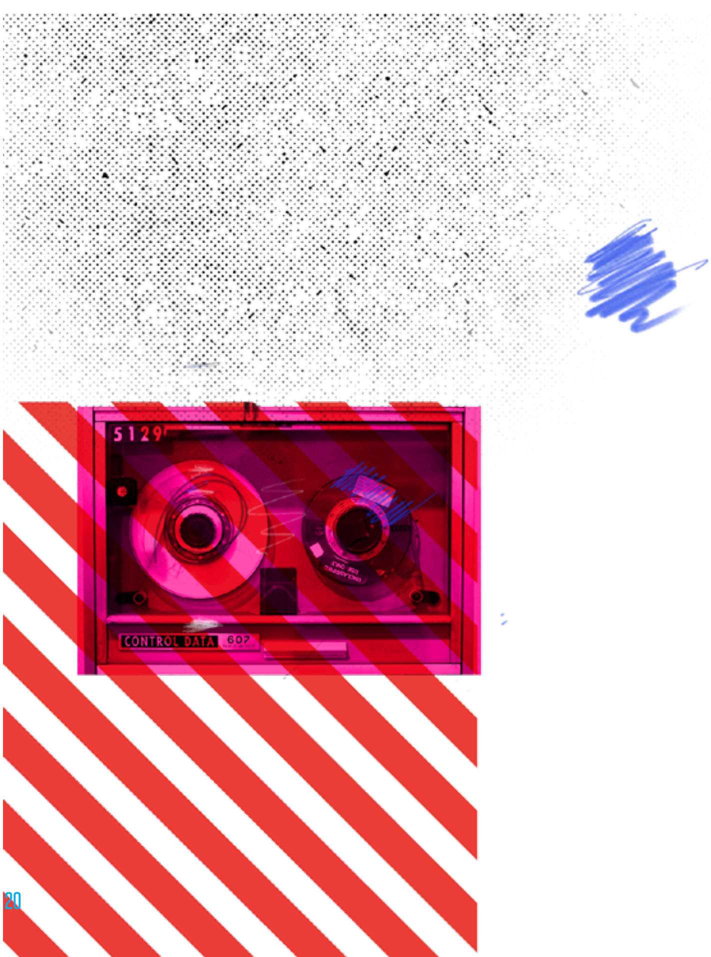
Big Data: Are We Ready?

By David McLaughlin



We're living in such a fascinating time. The digital age is like the beginning of the Industrial Revolution.



“Take your medicine.” No — *really* — take your medicine. In the not-too-distant future, the phrase will take on a whole new meaning.

Many health researchers agree that personalized medicine — treatment that's tailored to your unique genetic inheritance and habits — is already emerging as the future of medicine.

“We're living in such a fascinating time. The digital age is like the beginning of the Industrial Revolution,” says Professor Jay Rosenfield (MD '82, PGME '87, MEd '98), Vice-Dean of Undergraduate Medical Education. “This is just a different revolution and we have no idea how it will affect human beings. But we know it will have a profound impact.”

Big Data will drive this new chapter of medicine. It will come from hospital records, genomic research and MRI scans. It will stream in from wearable EKG devices, home monitoring systems and patient records. The result will be improvements to patient safety, patient outcomes and population health.

But data itself has no real value. It's what we are able to glean from the data that improves care and saves lives. Reaping these benefits comes down to a lesson we learned in kindergarten: it's good to share.

And that's where Big Data has bogged down in medicine.

“In biological science, our Big Data challenges are very different from those faced by other disciplines, such as astronomy of physics,” says Professor Trevor Young (MD, PGME (Psychiatry) '88, MSc '89, PhD '95), Dean of the Faculty of Medicine. “They study things, and have fairly uniform data sets — there's no controversy. In medicine, we're still searching for ways to get the data sets ‘talking to each other,’ and we're still figuring our legal and ethical issues — because our data is about people.”

Despite this lag, genomic science is producing the really big data sets that delve into the unique nature of every human. In this area, Toronto has already emerged as a world leader.

Big Data is bringing in "the small."

The U of T research community is already among the largest contributors to the massive sets of genomic data for GenBank, the open-access source for genomic data run by the U.S. government. Professor Stephen Scherer (MSc '91, PhD '95), director of the McLaughlin Centre for Molecular Medicine, launched the Personal Genome Project Canada in 2012. So far, it has sequenced the genomes of 100 Canadians as part of an academic research effort together with Harvard Medical School's Personal Genome Project. Combined, the projects will sequence 100,000 people over 10 years and the genetic information collected will be deposited into a public repository that researchers from around the world can use as control data.

The MSSNG (pronounced "missing"), a project by Autism Speaks, is another Big Data project. It has made the whole genome sequence for autism available to the global research community through an open science database, an effort led by Scherer, who is also Senior Scientist and Director of the Centre for Applied Genomics at the Hospital for Sick Children (SickKids). "This is an exemplar for a future when open-access genomics will lead to personalized treatments for many developmental and medical disorders," Scherer says.

Genomic data is increasingly being stored in "the cloud." Cloud computing allows for data and software to be housed in off-site centres. These enormous data sets are available to any lab around the world along with software tools. This means that health care discoveries could come from almost anywhere, and the potential for progress is only limited by the capacity for human curiosity. It's possible for smaller teams to make major contributions in ways they simply could not have done 10 years ago, when access to mainframe computing was expensive and harder to come by. But for this type of collaboration to happen, open science is vital.

In some ways, the era of Big Data in biomedical research is bringing about the age of small, but not insignificant, discoveries. Using genomic sequencing, U of T researchers at SickKids recently identified the gene responsible for Parkinson's-like symptoms that paralysed eight siblings and cousins. Then they found a drug that provided an almost complete cure to most of the children — all in only two years.

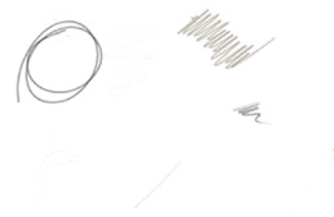
There may be thousands of drugs already developed that could help such smaller groups of potential patients. Pharmaceutical companies have developed vast libraries of compounds. These compounds gather dust on the shelves because the reality of their business is that it only makes sense to focus on developing, testing and eventually marketing the blockbuster drugs that work for the widest range of people. Rapid advances in genetic sequencing could make it easier to begin identifying which compounds could help patients with rare diseases, or which drug works best for a particular patient.

"The doctor-patient relationship won't change dramatically. When a person doesn't feel well, they will seek out care from a person they trust for their judgement and skill," says Professor Frank Sullivan of the Department of Family and Community Medicine. "What will be different is that instead of the clinician thinking, 'This is the drug that usually works with cases like this, and this is the average adult dose,' a doctor in the future might look at your genetic profile and determine which drug and dosage has the highest likelihood of working for you."

As much as Big Data promises to accelerate progress in human health, the tsunami of data has created a management and analysis challenge. Already, people with expertise in computational science are in heavy demand throughout scientific research, especially in astronomy and high-energy physics, not to mention the broader economy.

To put the challenge in perspective, a report by the McKinsey Global Institute (Manyika et al. 2011) predicted that by 2018, the United States alone will face a shortage of 140,000 to 190,000 people with deep

Every day that data sits underutilized, we miss opportunities to save lives.



analytical skills, as well as a shortfall of 1.5 million data-savvy managers with the know-how to analyze Big Data to make effective decisions. The so-called geeks have the potential to do great things in medicine — just don't call them that around Professor Alison Buchan, Vice-Dean of Research and International Relations.

"There's a scarcity of people with critical skills in computing science and we need to get them interested in tackling health challenges using Big Data," says Buchan. "They can contribute to medical advances that are unparalleled in human history. It may be possible to create new organs with 3D printers. Using gene editing, it could even be an organ tailored to improve your overall health."

While Ontario researchers are generating large and valuable data and sharing globally, there is less sharing locally.

"Primary care providers in Ontario are using 10 different software products to create electronic medical records. Home care uses its own system. Hospitals are developing their own systems. They can't talk to each other," says Dr. Sanjeev Goel (MD '95), who is Lead Physician for the Wise Elephant Family Health Team in Brampton.

Goel led the development of an integrated data-sharing platform for Wise Elephant, which is now used by over 40 family health teams serving half a million people. "Patients not only can see their data, but interact with it — they can message their providers or video chat or have prescriptions filled," he says. "But we can't create greater efficiencies or improve the quality of patient care without sharing."

At one time, Ontario set out to be a leader in this area. Governments set ambitious targets to create an electronic health record for every Ontarian. In fact, the eHealth project made front-page news across the province, but not the right kind. The first time most Ontarians became aware of the effort to harness Big Data, it was by reading stories about contracting and expense issues at the government agency established to do the job. As a result, in public policy circles, there's been more focus on the cost rather than the value.

"The reality is that there's no stopping the advance of electronic health records. We live in a digital age," says Young. "Yet in Ontario it's happening within, and despite, a fractured health system. When our institutions collect information differently, data can't be put together to create a coherent picture. As health leaders, we need to consider whether we're doing a good enough job in communicating to the broader public, and to policy makers, that electronic health data is worthy of investment, and could make health dollars go further while improving patient care."

Buchan points out that patients need to be engaged in the effort to accumulate and share data that can lead to health improvement. "In Ontario today, only about 25 per cent of patients who come through hospital doors are ever enrolled in a study. At the Mayo Clinic it's 100 per cent," she says. "How can we get that to 75 per cent in Ontario — and not only the patients but the families? We need to address the communication and ethical issues so that we start building communities of people engaged in health research."

Every time you swipe your OHIP card, you've added couple of bytes to the data pile. Every test, procedure, consultation and diagnosis becomes another piece in the human health and population health data puzzle. "At any given time in Ontario, there are lots of patients getting different medicines for a combination of conditions. There are no clinical trials for that particular combination, but if they all have electronic health records, we can study a sample of 500 to 600 patients," says Sullivan.

In Ontario, however, those pieces are not all in one box. They are scattered. And that needs to change.

"The reality of operating a universal health care system that is unique to us, serving a population that is unique to us, means that no one will do this for us," says Young. "Every day that data sits underutilized, we are missing opportunities that could save and improve lives."

Three Reasons to Read U of T Medicine Online

Bonus Stories:

The Low-Tech Revolution

What if the most revolutionary medical advances had nothing to do with stem cells or gene editing? What if the next world-changing medicines were as simple as a hand-held scale or an antibiotic gel …

Videos:

Professor Richard Horner, discusses his book, *The Universal Pastime: Sleep and Rest Explained*, and how he turned it into a play (book is reviewed on p. 25).

Expanded Stories & Photos:

More from Professor Edward Shorter and Susan Bélanger about the medical predictions of the past in Old School.

More photos of favourite faculty spots in Snapshots.

—

→ uoft.me/medmag

On the Bookshelf

WHY WE SLEEP

By Professor James Duffin

—

THE UNIVERSAL PASTIME: SLEEP AND REST EXPLAINED

RICHARD L. HORNER, BOOKBABY, 2014

—

In *The Universal Pastime: Sleep and Rest Explained*, Richard Horner provides new insight concerning what sleep is for, why it developed and why it is universally found across species. Horner, Professor of Medicine and Physiology at U of T, explains the physiological basis for sleep through a carefully and detailed reasoning from fundamental evolutionary principles that I found fascinating and brilliantly explained. The book is more than just about sleep; it is a lesson in scientific reasoning.

It is written for a wide audience, not just fellow scientists. For example, explanations of all Latin and Greek terms ensure you don't have to be an expert to follow the developing themes. The writing style is detailed, with arguments presented slowly and surely, building to the conclusions. While the ideas of Darwin and other scientists feature prominently in these explanations, the important concepts are grounded in everyday life.

In the introduction to this book, Horner explains why he wrote it. He provides insight into the life of a scientist in the current world of which the general public is largely unaware — a service to all who labour in scientific research. In the chapters that follow, readers will not only find an explanation of sleep but also how and why brains have developed to be so adaptable across many organisms, and the universality of sleep and the circadian rhythm. There are detailed explanations provided, such as the biology of timekeeping and the rhythm of brainwaves. And in the final chapter the author emphasizes the links between sleep, mental health and well-being — which are good lessons for us all.

—

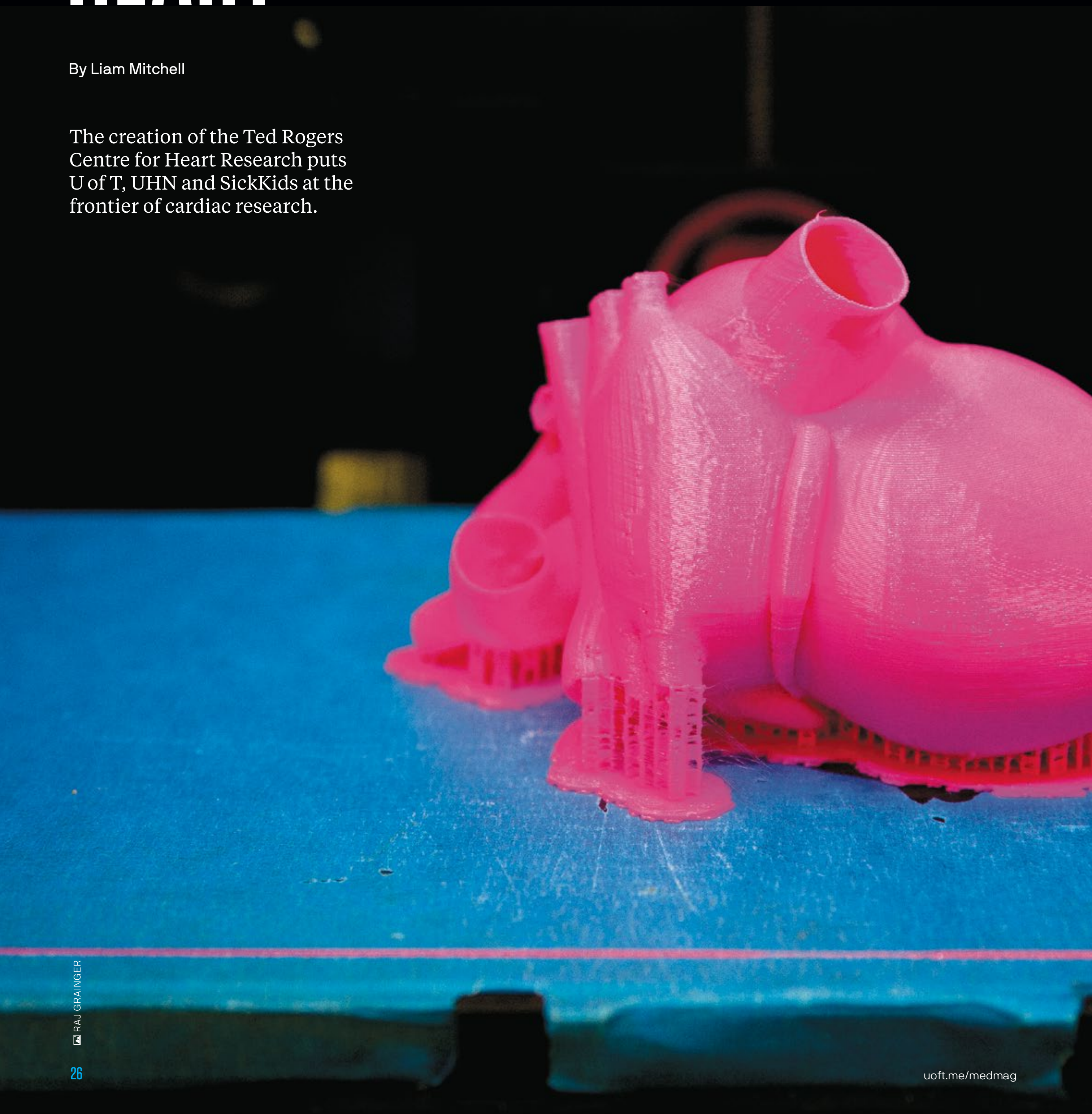
James Duffin is Professor Emeritus in the Departments of Anaesthesia and Physiology.

BOOK JACKET PICTURED

MODELLING A HEALTHY HEART

By Liam Mitchell

The creation of the Ted Rogers Centre for Heart Research puts U of T, UHN and SickKids at the frontier of cardiac research.



RAJ GRAINGER

MODELS HAVE BEEN known to break hearts, but now can they be a cure for them as well?

For a research team at the University of Toronto, the future of cardiac care begins with new complex models of the human heart derived from stem cells. These models could lead to a better understanding of heart function, and ultimately heart failure — resulting in earlier diagnosis and better outcomes. And, of course, less need for drastic measures like heart transplants.

This is one of the approaches made possible thanks to a landmark donation in memory of late business mogul and philanthropist Ted Rogers, who died of congestive heart failure in December 2008. The $130-million gift from the Rogers family has established the Ted Rogers Centre for Heart Research, which brings together researchers and clinicians from the University of Toronto, the University Health Network (UHN) and the Hospital for Sick Children (SickKids). With matching funds from all three partners, that leads to a total investment of $269 million. The result is a powerhouse that stands ready to be one of the top cardiac research centres in the world.

"The Rogers Centre gift is an extraordinary opportunity for us to accelerate many areas of medicine, particularly cardiovascular research, in order to be prepared for the medicine of the future," says Mansoor Husain (PGME '93), Interim Executive Director of the Ted Rogers Centre for Heart Research and Director of the Toronto General Research Institute. He is a specialist in cardiovascular disease and nuclear cardiology, as well as a Professor in the Departments of Medicine, Laboratory Medicine and Pathobiology and Physiology.

Each of the three partners will lead different aspects of cardiac research. SickKids researchers — including Chief of Clinical and Metabolic Genetics Dr. Ronald Cohn and Dr. Seema Mital, Head of Cardiovascular Research — will target individualized medicine by harnessing the power of genomic science to decode the genetic foundations of cardiac disease.

UHN will lead an integrated program for excellence in heart function that will improve quality of life and reduce readmission to hospital for patients with heart failure. And U of T — through the Translational Biology and Engineering Lab — will capitalize on the work of researchers in medicine and engineering to understand how genetics, molecular signalling and cellular networks relate to heart disease.

But the true strength of the Centre is its interdisciplinary approach — to many, a necessity as science becomes more complex.

"We're studying heart disease in new ways; in ways that require engineers, electrophysiologists, developmental biologists and computational biologists to all come together and that may lead to a better understanding of specific patient models," says Peter Zandstra, a Professor in the Institute of Biomaterials and Biomedical Engineering and interim leader of the newly established Translational Biology and Engineering Lab at U of T.

"Biology is moving to an era where really in-depth systems modelling and engineering is necessary to understand complex tissue and organ function and to accelerate strategy that may have significant clinical benefit. What we're doing here at the Ted Rogers Centre for Heart Research, which is really exciting, is starting to bring those pieces together."

The new lab will draw from the extensive talent already present in the Institute of Biomaterials and Biomedical Engineering, which is led by Professor Chris Yip, along with researchers in Medicine, Engineering and Dentistry. This includes Professor Milica Radasic, whose work focuses cardiac tissue engineering and biomaterials, as well as Professor Paul Santerre, who specializes in the development of synthetic materials to improve health care, including tissue regeneration.

Professor Husain foresees a time in the not-to-distant future when analysis using computer models and model systems will be able to move quickly and seamlessly to tests on human cells, tissues and ultimately human subjects.

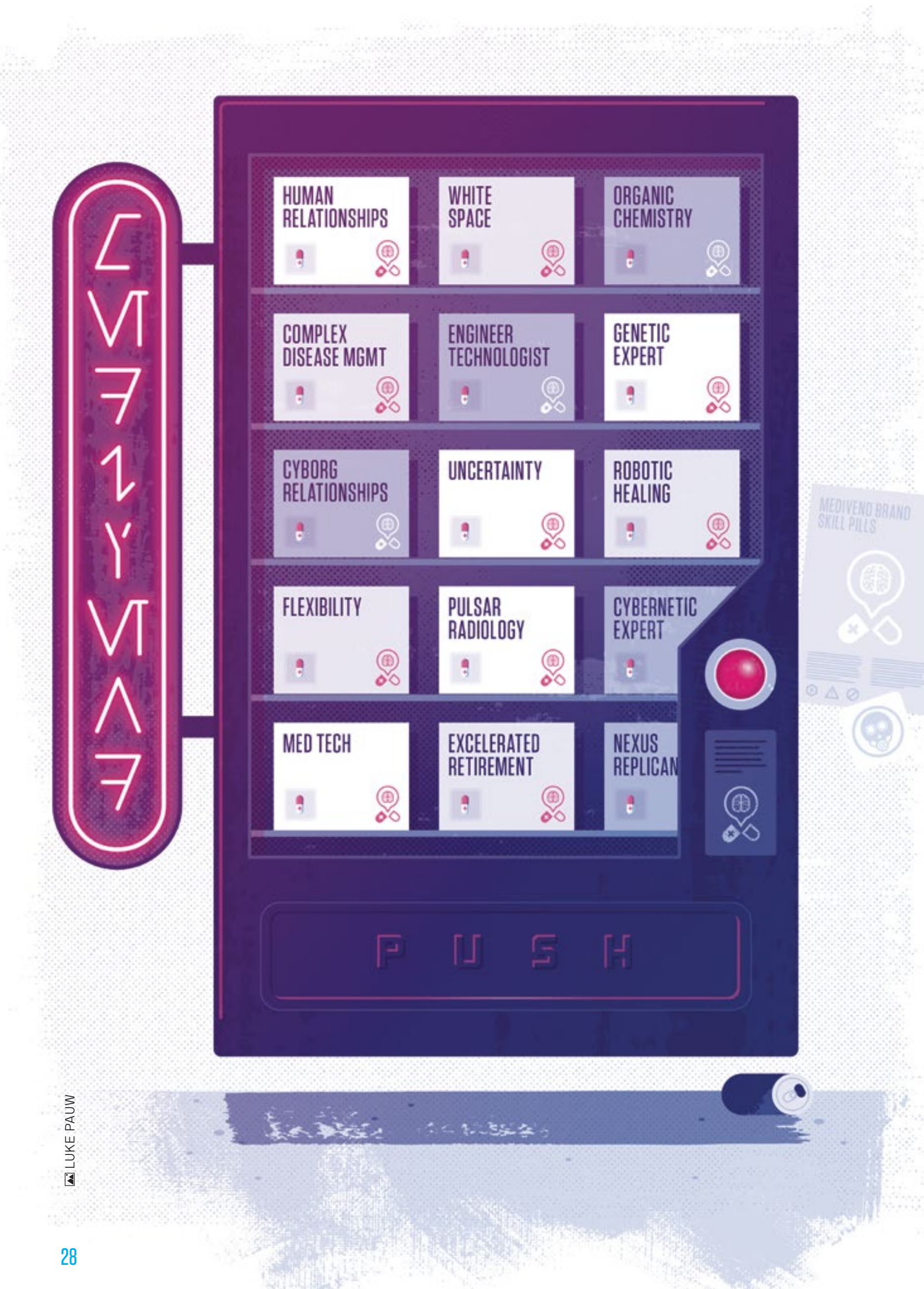
With genetic sequencing becoming faster and cheaper, "there is an opportunity to study the human organism directly," says Husain. "With regenerative medicine and tissue engineering, you just make the human heart tissue or blood vessel with that defect and study it."

It's estimated that heart disease costs the Canadian health care system upwards of $2.3 billion per year. One million Canadians are living with heart failure and one in five Canadians over the age of 40 has a risk for developing heart failure.

It's what makes the Centre so vitally needed now.

"Now we have the opportunity — and this is really new and exciting — to really integrate discovery, genetics, patient databases and clinical treatments around heart failure," says Zandstra.

DOES THE FUTURE NEED THE PAST?



LUKE PAUW

By Heidi Singer

Doctors and other health workers will have to reach into the past to fully grasp the promise of our high-tech medical future.

That's one ironic twist predicted by U of T educators who plan for the medical landscape that awaits us in the next half century.

Whether it's honing the art of the doctor-patient relationship or developing the personal skills to cope with rapid technological change, future medical workers will provide the crucial human touch in a mechanized, data-driven environment. Already the need is growing.

"Patients are telling us they feel lost and ignored because everything is so techy," says Pier Bryden (BA '86, PGME '01), Pre-Clerkship Director in the Faculty of Medicine. "As medicine gets more complex and sped up, we actually need to train physicians to integrate, to communicate; to convey to people that 'I'm going to help you navigate this extraordinarily complex intellectual, emotional and technical world.'"

For example, as Bryden points out, the newest research shows that a closer relationship between patient and practitioner leads to better diabetes outcomes.

"We need to get back to those skills that are being lost," says the Associate

“The doctor of the future must be nimble at transforming her role overnight.”

Professor of Psychiatry. “The ability to listen; more time with the patient, not less. Perhaps a more rounded education that includes humanities.”

At the same time, medical schools must put more, not less, emphasis on human relationships to prepare for a more complex health care landscape, and to take advantage of the wired world, says Jay Rosenfield (MD ’82, PGME ’87, MEd ’98), Vice-Dean of Undergraduate Medical Professions Education.

“The barriers between universities are going to be less obvious,” he predicts. “If Stanford has a better lecture on pain management, students will use that. The curriculum can be delivered anywhere, anyhow, by anyone. It’s the access to top-notch researchers, individual longitudinal mentoring from expert clinicians and our huge network of major hospitals that will attract future students.”

High-tech innovations will create a need for two very low-tech skills, he believes: comfort with uncertainty and flexibility. The doctor of the future must be nimble at transforming her role overnight, as technological developments render one procedure, subspecialty or field obsolete in a flash — or create entirely new ones.

To prepare medical students for these shifting sands, Rosenfield believes educators should create more “white space” — unscheduled time in a student’s day to pursue individual interests and passions.

“If a student wants to do a joint degree in medicine and computer science, we want them to do that,” he says. “And we need to attract the kinds of students who might like to branch out in new and different ways. Every kind of doctor and skill set will be needed.”

That means educators must be as flexible as the students they’re training — doing away with the generic admissions process, which puts equal weight on everyone’s organic chemistry score, he says, and admitting students with very diverse intellectual interests and temperaments.

At the same time, technology will put more, not less, focus on the individual students and their needs, says Dimitri Anastakis (BSc ’84, MD ’88, PGME ’95), Vice-Dean of Continuing Professional Development.

“Health care Big Data will not only contribute to personalized medicine but also to personalized medical education,” he predicts. “As education technology evolves, including eLearning and simulation, we’ll have access to huge amounts of learner data: when each person engages in learning, how they learn within a given module or simulation, how often they learn at point-of-care or in a virtual classroom.”

The learner data could also help to teach future physicians those all-important coping skills such as tolerance for uncertainty and flexibility. But with medical education becoming so personalized, will there be a need for broad categories such as “doctor” and “nurse” in 100 years? Rosenfield and Anastakis aren’t so sure.

“Maybe instead there will be advanced technocrats, super-specialized counsellors, complex disease managers or genetic experts,” says Rosenfield. “Or maybe the equivalent of a surgeon will be a master engineer technologist who can run the robot perfectly and replace your diseased coronary artery.”

But Ben Chan (BSc ’87, MD ’88, PGME ’89), Assistant Professor in the Institute for Health Policy, Management and Evaluation at the Dalla Lana School of Public Health, disagrees.

“I think there will still be doctors and nurses, albeit working at a higher level of complexity,” says Chan. “There will still be the need for that person-to-person touch, that empathy, that support. That’s one thing you can’t replace.”

Once, the physician had little to offer except caring, Bryden points out.

“When there was less medicine and less science, physicians relied more on the healing power of their relationships with patients — something we’re relearning is extraordinarily powerful,” she says. “That’s why the future needs the past.”

SNAPSHOTS

Photos by Erin Howe

What's your favourite spot in the Faculty of Medicine? We asked students, staff and alumni for their picks. Some were charmed by dark wood and high ceilings, others by dark corners and secluded nooks. A few remember an ordinary classroom as an almost magical place because of the people they met there.

Share your stories:
#UofTMed

↑

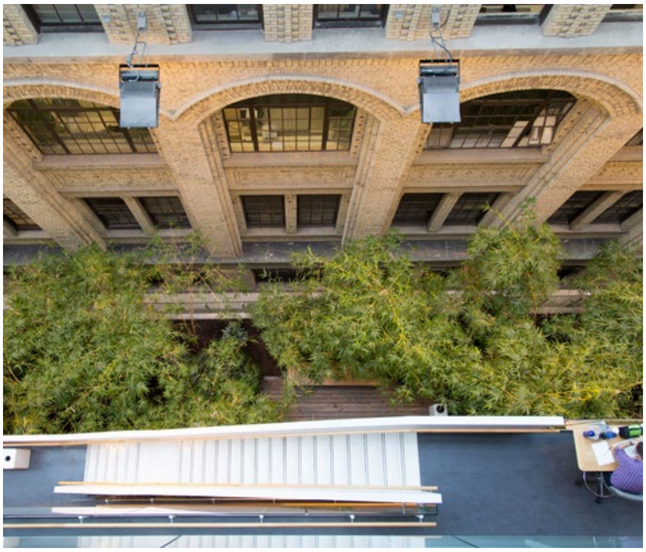
MSB Room 3154 is a place where the process of medical education comes alive through the interaction of human beings, and this is why I come to class whenever I can. Being in class reminds me how incredibly intelligent, kind and passionate my fellow students are, and how they make my years in medical school the true privilege that it is.

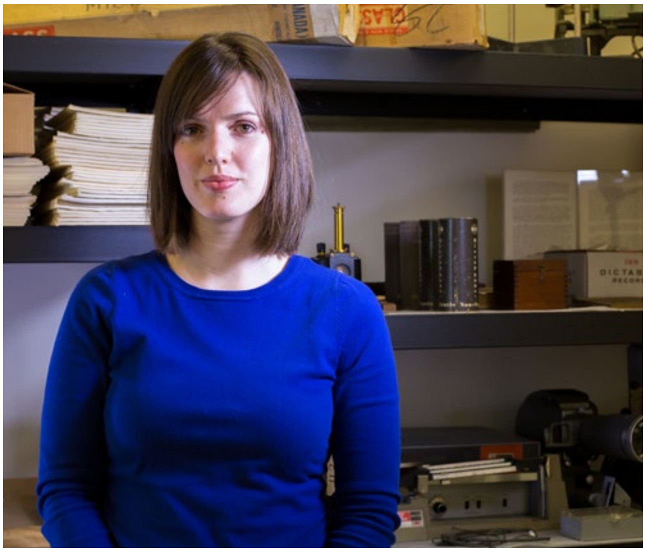
Justin Lam
Medical Student, Second Year

↑

In my opinion, there is no better place to gather your thoughts than in the calm ambience of the Heritage Reading Room in the Gerstein Science Information Centre. The soft lighting and historic atmosphere provide the perfect place to catch up on reading, and gather your thoughts after a long day of experiments, meetings and seminars. Time seems to stand still in this breathtaking room.

Irakli Dzneladze
PhD Candidate, Department of Medical Biophysics





TOP

My favourite place is the Imperial Oil Lecture Hall, where I met my perfect, most amazing husband Ali one year ago!

Anum Haroon Furgan
Alumnus

↑

I'm from B.C. During my interview last year, my sister brought me to the bamboo garden in the Donnelly Centre atrium first thing. She said, "I've got to show you the little forest they have. We can't miss the trees!"

Sarah Chadwick
Medical Student, First Year

↑

Recently, we inherited a fascinating bunch of artifacts, including an old wooden slide viewer, some World War I–era notebooks, and a photo inscribed by Banting showing the bench where he discovered insulin. That's why an ordinary storage room in the Tanz Building is my favourite spot in the Faculty. We're turning it into a proper collection that the public can see — one day.

Erin Nisbet
Facilities Coordinator, Faculty of Medicine

Q AND A

FORGET WHAT'S RATIONAL

By Veronika Izabela Bryśkiewicz

ILLUSTRATION BY LUKE PAUW

Q&A WITH DR. MICHAEL GREENBERG

←

Michael Greenberg (PGME '87) attended the Faculty of Medicine's neurosurgery residency program. After achieving success as a young surgeon, Dr. Greenberg took a leave of absence to immerse himself in technology and start-ups. That curiosity led to a decades-long career as an entrepreneur in the tech sector, and the result of Dr. Greenberg's work is saving lives around the globe.

Why did you decide to become an entrepreneur and not a neurosurgeon?

I came to U of T to pursue a residency in neurosurgery and a post-doc in biophysics. I was interested in learning hard-core basic science that I could then use to apply to clinical problems. But there was something missing. I realized that I knew so little about so many things.

I was fascinated by technology — how does something go from being an idea to something that is being used without even thinking about it? A start-up company contacted me to help see if their product, a hardware board set for video games, could have use in medical imaging. I said sure, and took a leave of absence. For me, I was just solving a problem.

But then I realized that I was no longer a surgery resident — I was doing something broader. I was free to invent something, and see what happened.

Your company, Fio, received a grant from the Bill and Melinda Gates Foundation to help with the Ebola crisis. Tell me about this work.

We've built intelligent sidekick devices that help health care workers to more accurately diagnose and treat infectious diseases, on the spot, including Ebola. These devices upload data to cloud information services that inform local and global health care decision makers.

Our device uses data-capture technology that prompts health workers through clinical workflow to ask certain questions, then tracks the answers. We capture clinical and operational data: how many patients each worker sees, the length of patient interviews and whether health workers comply with policies and best practices — all in real time. Because health workers are "talking to a patient" through our device, every screen-touch is captured and the data can open new conversations within the health care management.

Is there such a thing as too much data?

No, not at all. But if it's inaccurate, undifferentiated or distorted data — even by just a little — it's too much.

What current development in medicine is most exciting to you?

I am totally enamored of the decentralization of health care. There are about 10 million physicians in this world and over 7 billion people. So health care has to be delivered by lots more people than physicians. Also, I think these rapid diagnostic tests are going to have a serious future.

Decentralized health care is efficient and provides rapid access to care, which is thrilling. But linking that to data-guided decision making will be huge. I think it has the capacity to eliminate hundreds of billions of dollars of waste from the system, which can then be used to improve it.

What words of wisdom do you have for today's medical students?

The thing about getting a medical education is that you really work hard to absorb a ton of objective knowledge. It's an extraordinary and noble subordination of the self. This knowledge is vital and precious. But in the process, one tends to lose touch with one's own intuition.

But life isn't simple. A career isn't simple. Intuition is indispensible. I would urge today's students to discover their intuition, which gets subordinated by that knowledge tsunami. Listen to it — it's an amazing faculty — and then be courageous enough to follow it. At that point, forget what's rational. Whether it's a career move, or anything else, my advice is to fish out that intuition sitting on top of all that knowledge and learn to apply it.

The Future Is Now

Groundbreaking research and faculty making news around the world

Visit our website for the latest medicine news!
uoft.me/medmag

NSERC

↑

The Unexpected Genetic Roots of Major Disorders

Which DNA mutations cause disease? Scientists have struggled to answer this question since the genome was sequenced in 2003. But a team of Canadian researchers — led by Professor Brendan Frey (PhD '97) — have developed the first method for "ranking" genetic mutations based on how living cells "read" DNA. The discovery helps researchers determine how likely any given alteration is to cause disease.

Frey — a Professor in the Department of Electrical and Computer Engineering and the Donnelly Centre for Cellular and Biomolecular Research — and the team used their method to uncover unexpected genetic determinants of autism, hereditary cancers and spinal muscular atrophy, a leading genetic cause of infant mortality.

↑

A Glimpse into the Cause of Autism

Very small segments of genes called "microexons" influence how proteins interact with each other in the nervous system, according to research lead by Professor Benjamin Blencowe of the Donnelly Centre for Cellular and Biomolecular Research and Department of Molecular Genetics. His findings, published in the journal *Cell*, open a new line of research into the cause of autism.

The team discovered hundreds of microexons associated with the formation of the nervous system. In people with autism, they found microexons are often skipped in protein-coding gene messages, suggesting the resulting proteins don't interact properly.

"This opens a major avenue of research and possibilities for new treatments," says Blencowe.

ERIN HOWE

Check out our website for profiles of interesting faculty and students, such as **Tara Justice** (above), a 3rd year student at the Mississauga Academy of Medicine:
uoft.me/medfaces

Tackling Restaurant Menus Head On

Doctoral student Mary Scourboutakos (BSc '11) and Professor Mary L'Abbé (Department of Nutritional Sciences) have discovered troubling information about Canadian chain restaurant menus.

In the first of two studies, Scourboutakos and L'Abbé found that sodium levels in meals at chain restaurants had changed little since 2010, despite the food industry's commitment to offer more options with less sodium.

Limiting salt intake is important because high dietary sodium is a risk factor for hypertension, which is the leading preventable risk factor for death worldwide.

The duo's second study found that half of kids' meals at chain restaurants exceed the World Health Organization's daily limit for sugar, with some meals accounting for several days' worth of the daily allowance.

"These results shed light on the issue of sugar in the food supply and suggest that Canada should consider some of the sugar-focused policies up for debate in other parts of the world," said Scourboutakos.

© CTANKCYCLES/WIKIPEDIA

U of T Residents Learn Forensic Radiology

U of T radiology residents are learning about forensic pathology through a new partnership allowing them to rotate through a provincial pathology unit.

The residents, part of the departments of Medical Imaging and Laboratory Medicine and Pathobiology, analyze CT and MRI images to help pathologists determine better approaches for autopsy. Full-body scans began at the facility in 2013, but the forensic pathologists who work there have no formal radiology training.

The partnership teaches the pathologists about medical imaging, and residents gain exposure to a wide range of trauma and untreated diseases across all age groups.

Six Faculty Members Named to Order of Canada

U of T Medicine Professors Brenda Gallie, Shafique Keshavjee (MD '85, MSc '90, PGME '93), Laurence Klotz (MD '77, PGME '83), Wendy Levinson, Norman Emilio Marcon and Catherine Zahn (MD '78, PGME '83, MHSc '95) have been named to the Order of Canada — the nation's highest civilian honour.

The Order has recognized outstanding achievement, dedication to the community and service to the nation since its creation in 1967. Appointees from U of T Medicine were recognized for achievements including innovative contributions to thoracic surgery, better doctor-patient relationships, and advocacy for people living with mental health and addiction issues.

No-Strings Science: From U of T to Brazil

Open-access research into drug discovery came to South America in March, with the opening of the Structural Genomics Consortium's third outpost.

The new centre, based at the University of Campinas in São Paulo, examines the protein kinases in the human genome that are key regulators of RNA biology and epigenetics. It explores the application of the new discoveries to plant research. The centre is advancing unrestricted discovery as part of the SGC — a public-private partnership, headquartered at U of T, that supports the discovery of new medicines through open-access research.

"Through our international public-private partnership, we're building a robust, efficient and effective network that can identify new drugs to address unmet medical needs in cancer, metabolism, inflammation and other diseases," says Aled Edwards, CEO of the SGC and Professor in U of T's Department of Medical Biophysics.

Turns Out We Were ~~Right~~ WRONG.

Cancer would be cured. Insects eradicated. And the right mix of hormones would make women young and beautiful forever. In the first half of the 20th century, many scientists saw a rosy future for medicine. Some of them were even … right?

BY PROFESSOR EDWARD SHORTER AND SUSAN BÉLANGER

Taller, Fitter, Longer Lived

IN A 1907 letter to the *British Medical Journal*, English physician Augustus H. Bampton wrote that "man is an organized collection of differentiated and highly specialized cells." Decades before the discovery of stem cells by U of T's Ernest McCulloch (MD '48) and James Till, Bampton predicted that the way forward lay in studying "the unit of life, the living cell."

After consulting with many of the greatest medical minds of his time, American civil engineer John Elfreth Watkins Jr. predicted in the December 1900 issue of *Ladies' Home Journal* that by 2001 we would have "microscopes" displaying "the vital organs, through the living flesh" and "rays of invisible light" which would permit doctors to not only "see a living, throbbing heart inside the chest" but also "to magnify and photograph any part of it." Five years after the invention of the X-ray, here was modern medical imaging.

Watkins also correctly predicted that Americans would be "one to two inches taller" by the year 2000 and would enjoy a longer lifespan. But he greatly overestimated the impact of the emerging physical fitness movement, predicting that training in "gymnastics" would begin in infancy and that "a man or woman unable to walk ten miles at a stretch [would] be regarded as a weakling."

There was no obesity epidemic in his vision of the future. There were also no noxious insects: The eradication of "mosquitoes, house-flies and roaches" was a reasonable extrapolation from the discovery in 1900 by Walter Reed's U.S. Army team that mosquitoes were responsible for transmitting yellow fever, but this goal proved unachievable. (Vaccines were ultimately developed instead.)

A Cure for the Common Cold — Surely!

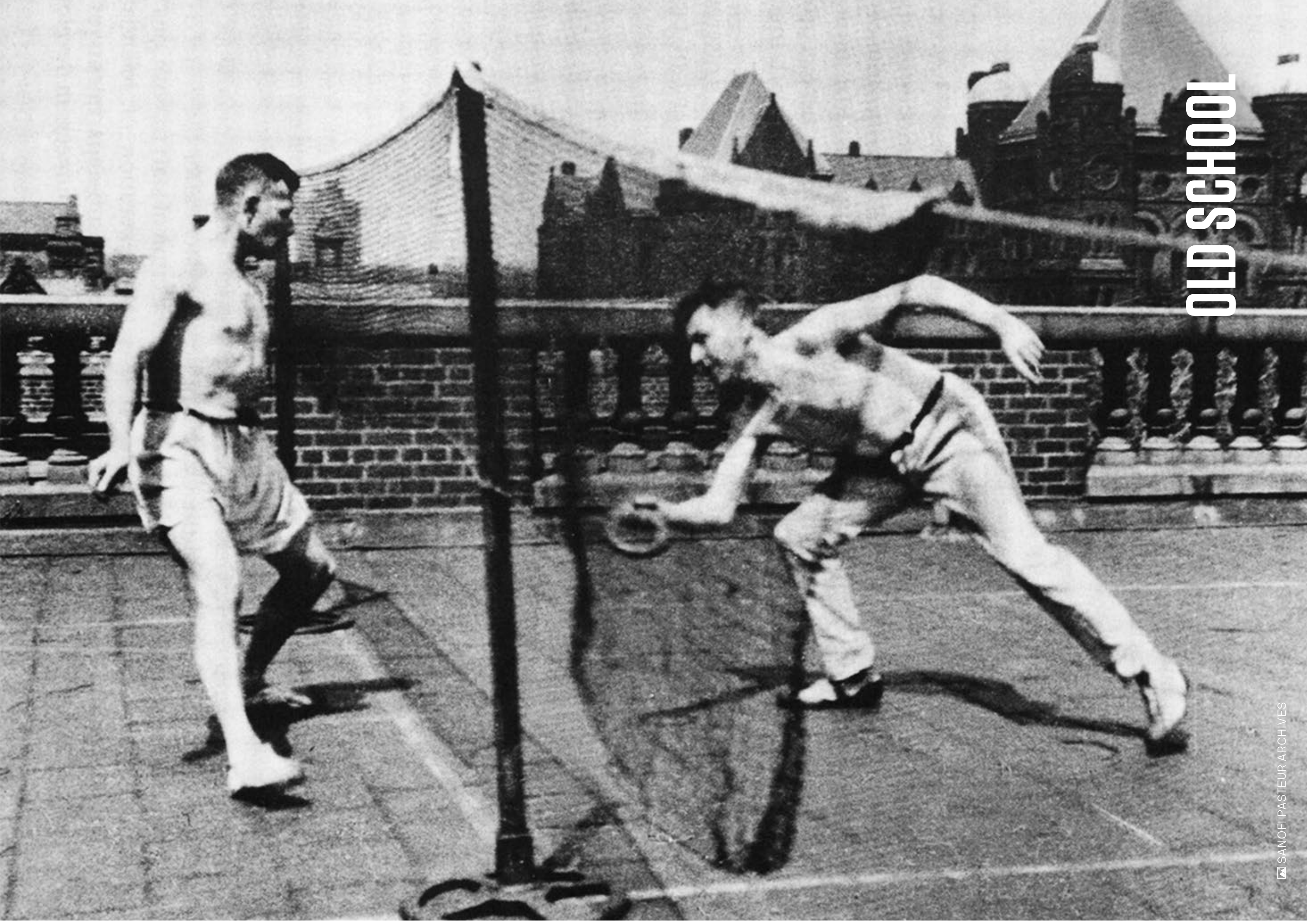
DURING THE 1950s and '60s, scientific prediction became a serious business, involving large corporations like General Electric, the U.S. military and think tanks such as Santa Monica's Rand Corporation. Serious medical experts were eager to prophesy future advances.

Many of their forecasts were wildly optimistic — but why not? Medicine had "made more progress in the first half of the 20th century than in the 6,000 previous years," veteran Arkansas physician Lowry McDaniel told the American Medical Association in 1955.

His 10 predictions for 1999 included the eradication of "all human infectious disease," including "the common cold and even the more serious respiratory virus infections." With the discovery of effective treatment for cholesterol-clogged arteries and other degenerative conditions, the human lifespan would swell to 150 years with "a minimum of senility." Better still, "hormones" would keep women "young, beautiful and shapely indefinitely."

Solving the cancer problem with a virus vaccine or radioactive compounds was one of the less far-fetched items on McDaniel's wish list for 1999.

This had been the big question directed at medical experts as soon as medical breakthroughs began to pile up in the early 20th century. In 1923, Harvard surgeon David Cheever asked the Nova Scotia Medical Society the rhetorical question: "Can anyone doubt that the problem of cancer will be solved?" Insulin had been discovered the previous year at U of T, so why not a cure for cancer? "Within the year," Cheever continued, a means of conferring immunity to cancer "may be found, as simply and as logically as was insulin."



SANOFI PASTEUR ARCHIVES

"Can anyone doubt that the problem of cancer will be solved?"

Harvard Surgeon David Cheever, 1923

Artificial Organs and Motorized Limbs

EXPERTS QUOTED IN a 1966 *Time* essay on "The Futurists" were confident that developments in immunology would "make possible the widespread transplanting of organs from either live donors or the recently dead."

Artificial organs and tissues were also expected to be commonly available by the year 2000, along with technologies restoring sight and hearing, "motorized and computerized" prostheses, perhaps linked to the brain," and "human tissues built to specifications."

Some of these predictions sound as improbable today as they did in the 1960s: Willem J. Kolff, the eminent Dutch-born pioneer of hemodialysis and artificial organs, suggested that "artificial skin with all the appendages built in, such as ears and nose," would be developed.

Yes, there was wild optimism. But who better to predict the future than the physicians and scientists who were also inventing it?

Edward Shorter is the Faculty of Medicine's Jason A. Hannah Professor of the History of Medicine and also a Professor in its Department of Psychiatry. He has authored numerous books on the history of psychiatry and mental illness.

Susan Bélanger is research coordinator in the History of Medicine program.

Pictured: Public health leaders J. Gerald FitzGerald (R), Dean of Medicine 1932–36 and G. Donald Cameron (DPH '28) taking a mandated physical activity break on the roof of the School of Hygiene (now the FitzGerald Building), early 1930s.

Supporting the Future of U of T Medicine

By Monifa Miller

—

Every success starts with an idea.

The idea behind our unprecedented Boundless Campaign is simple: to transform medicine.

Many of the ideas about the future of medicine in this magazine are astounding, inspiring and deeply transformative. Our Boundless Campaign is helping to advance the best of these ideas in brain health, complex disease systems, global health and human development. To date, the campaign has raised over $400 million — a tremendous milestone that motivates our Faculty to expand groundbreaking research initiatives while preparing our future health care leaders.

It is no secret that campaign success relies heavily on a fully engaged community of supporters. As we look towards our $500-million campaign goal, we're finding new ways to engage broader groups of our alumni community to help advance the exciting work underway at U of T Medicine. To learn how you can help, please visit **www.boundless.utoronto.ca/medicine**

Calling All Alumni!

Events

May 13
Physiology Macallum Lecture & Alumni Reception

May 19
Psychiatry Alumni Event

May 21
Nutritional Sciences Lecture & Networking Night

May 29
Physical Therapy & Occupational Science & Therapy Spring Reunion Reception

May 30
Nutritional Sciences Spring Reunion Luncheon

June 2
Pharmacology & Toxicology VIP Day Alumni Reception

June 5
Molecular Genetics Career Development Day

June 12
Speech-Language Pathology's J.F. Walker Lecture
Sponsored by The Donalda Jean McGeachy Memorial Lecture Series

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For more information about any of the above events, please contact **alumni.medicine@utoronto.ca**

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