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HEALTH RESEARCH INSTITUTE

HEALTHIER LIVES START WITH REMARKABLE IDEAS

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FAST FACTS:

RANKED IN THE **TOP TEN** OF CANADA'S TOP 40 RESEARCH HOSPITALS

OVER 250,000 SQUARE FEET
of dedicated research space in hospital sites across London, Ontario

Lawson is a key part of London's life sciences sector, which has a rich history of medical achievements. We are home to over 100 national and world firsts in research.

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Lawson partners on over 600 research projects annually with industry and academic partners from around the world

More than 2,500 active clinical trials with 500 new studies each year enrolling over 8,000 research participants

Our top scientists publish over 1,000 research findings each year, which are cited more than 10,000 times annually

OVER 1,900 PEOPLE WORK AND STUDY AT LAWSON
including researchers, technicians, support staff, students and trainees

Lawson delivers disruptive innovation with the potential to positively impact the health of individuals in the region, and across Canada and the world

"Lawson scientists bring knowledge to clinical care providers and to industry partners so they can move it forward for the benefit of patients. To do that, we have a simple philosophy: follow your curiosity."

– Dr. David Hill, Scientific Director

LAWSON
HEALTH RESEARCH INSTITUTE

The Research Institute of London Health Sciences Centre and St. Joseph's Health Care London.

Our research happens where patient care is delivered

Lawson Health Research Institute (Lawson) is the research institute of London Health Sciences Centre (LHSC) and St. Joseph's Health Care London (St. Joseph's), working in partnership with Western University.

As one of Canada's top ten health research institutes, we are committed to furthering scientific knowledge to advance health care around the world. Hospital-based research at Lawson expands the continuum of life, from birth to death. This is reflected in our research themes, which mirror the clinical areas of LHSC and St. Joseph's.

We encourage a "bench to bedside" approach to medical research. This means that Lawson researchers focus their efforts on the development of new knowledge that can be applied directly to patient care within the hospitals.

Through collaboration and the sharing of their discoveries, Lawson researchers make a difference in the lives of patients and families every day.

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SMART TECH

SMART TREATMENT

How two Lawson researchers are taking a digital approach to improving patient care

At first glance, it may not seem like the studies of Lawson researchers Drs. Mandar Jog and Cheryl Forchuk have much in common. A neurologist at London Health Sciences Centre (LHSC), Dr. Jog works on treatments for neurological movement disorders, including tremor and Parkinson's disease, while Dr. Forchuk's research at LHSC and St. Joseph's Health Care London focuses on improving mental health care and the transition from hospital to community.

However, an underlying principle is the same: adapting technology to address symptoms where, in many cases, no successful intervention has existed.

The results are delivering individualized solutions to unsolved problems. They give us a glimpse at the future of discovery in our increasingly digital world.

A combination of existing technologies that create something entirely new

"The pen, the paper and the ink exist. But what you write with them, that comes from the mind. That's the intelligence. Can we solve this unmet need using what is already available?"

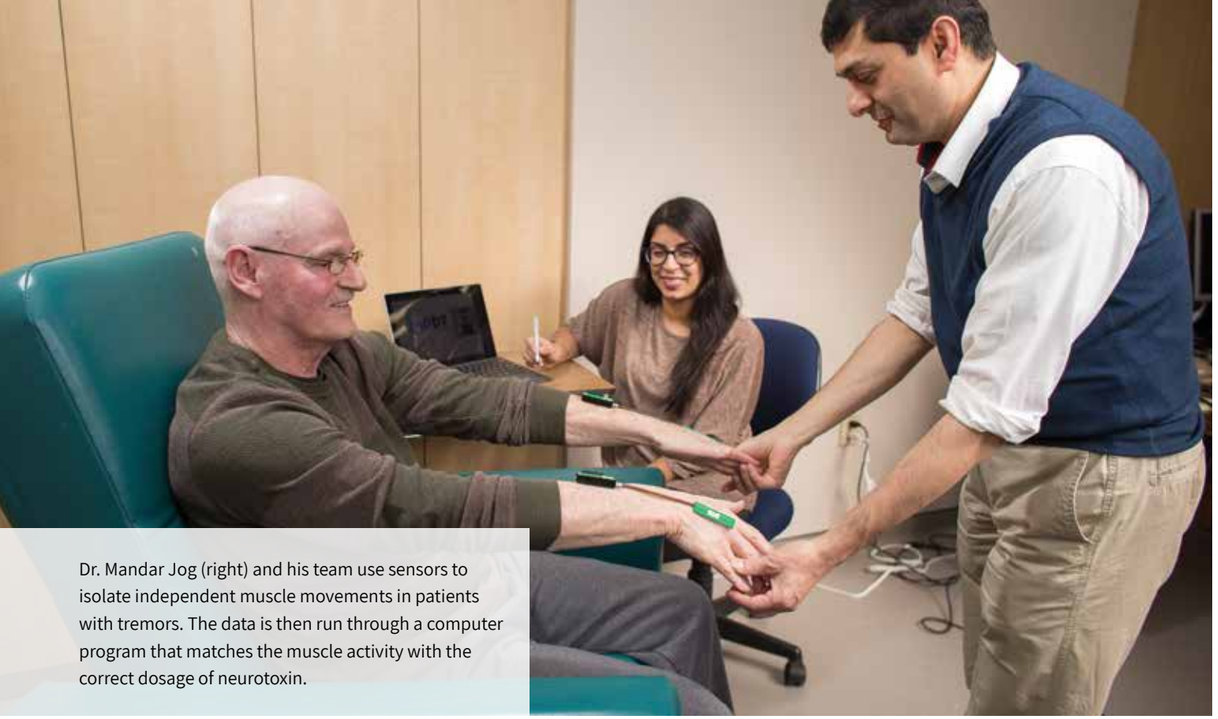
This question, Dr. Jog explains, drove the development of TremorTek, a wearable sensor technology that has already successfully treated over a hundred research patients who suffer from tremors in their arms and hands.

These tremors, typically caused by Parkinson's disease or essential tremor, are a common movement disorder symptom yet there is no effective treatment. Everyday actions like writing a grocery list or taking a drink from a cup can be a struggle.

"There is no oral medicine or treatment available specifically for tremors. Patients are sometimes given anti-hypertensive or anti-convulsant medication but these aren't a great solution because they're not individualized," he says. "Often they aren't used and patients go untreated."

Neurotoxin therapy has been identified as a possible treatment for tremors. Some neurotoxins reduce muscle activity and are already on the market for a variety of uses.

The catch is that it's necessary to know which specific muscles are causing the tremor. If the injection of neurotoxin is given in the wrong place or the patient isn't given the correct dose, it could cause negative side effects.



Dr. Mandar Jog (right) and his team use sensors to isolate independent muscle movements in patients with tremors. The data is then run through a computer program that matches the muscle activity with the correct dosage of neurotoxin.

The Botulinum toxin used is commercially called Xeomin, made by Merz Pharma Canada Ltd.

The goal is for TremorTek assessments and dosing recommendations for injections to be made widely available to patients for the treatment of tremors.

Dr. Mandar Jog is developing two other sensor-based technologies based on the same smart technology principles. They will be used for both targeted and whole body assessment of movement disorders, including those caused by Parkinson's disease and stroke.

Another hurdle is that everyone experiences tremors in different ways. The location and strength of the movements, and how often they occur varies widely.

"It's not uncommon to see tremor movement that is actually in three different joints and moving in six different directions, at the same time. We aren't able to detect that with the naked eye."

"This is an unmet need in how we treat patients in general – to measure the abnormal movements we observe and then target therapy towards that, taking into account specific symptoms and their severity."

Dr. Jog and his research team set out to bridge the gap, taking existing systems and making them intelligent for use in the clinic.

Using commercially available sensor technology, they were able to isolate independent muscle movements. They created a system that matched the muscle activity pinpointed by the sensors with the correct amount of toxin to administer.

Through clinical trials, participants have experienced striking improvements to the severity of their tremors after receiving the assessment and tailored injections.

"This makes it easier for them to complete their regular activities, maintain careers or hobbies, and keep their independence."

Smart technology can extend mental health treatment beyond a clinic room

Most of the participants in Dr. Forchuk's studies are very familiar with some of the technology involved. It's already all around them.

Many mobile applications are on the market to help people struggling with mental health issues, but these aren't necessarily created or used by health care providers.

Creating an entire smart mental health system is one of the strategic priorities of the Lawson Mental Health Research Group, led by Dr. Forchuk. Numerous projects have been identified as components of a plan spanning seven years.

With a smartphone pilot project called the Lawson "SMART" record, participants received an iPhone loaded with a custom-designed app. This gave them access to their personal health information and allowed them to easily stay in contact with their health care provider in a secure environment. A mood monitor was built in, but unlike other tracking apps, the information was instantly sent to the care provider.

A patient can share what kinds of text messages might be helpful for them to receive, such as a reminder to take medication or even a simple check-in, like "how is your day going?" Their care provider can then monitor the responses and engage in dialogue.

"We found that using this technology and individualized system improved patients' quality of life and community integration, as well as reduced outpatient visits, psychiatric hospitalizations and arrests."

In a similar pilot project, they created an app to help seniors with depressive symptoms, which Dr. Forchuk says are commonly seen in this age group. Having depressive symptoms means someone hasn't necessarily been diagnosed with clinical depression but is at risk of developing it.

The study looks at whether some mental health services could be done virtually, such as face-to-face visits through secure video chats and tools like mood monitoring.

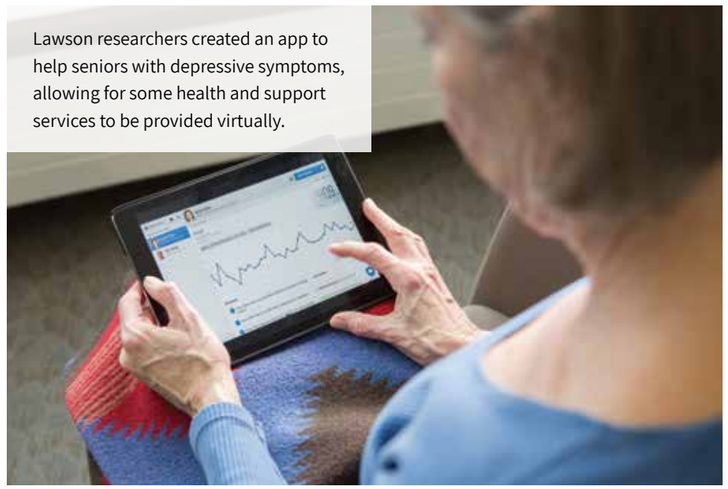
"This would save the healthcare provider time, but really it would reduce the burden on a population for which face-to-face visits can be a huge ordeal, especially in the winter."

Using the app is not meant to eliminate structured appointments, but to avert crises between visits.

Moving forward, they will pilot two smart home prototypes to study the benefit of technologies built in the home, including automatic medication dispensers, blood pressure monitors, smart mirrors and smart TVs.

With these smart tech treatments, the 'dose' of technology would vary. A lower dose could be a text, a medium dose could be something you access through an app or online, and a higher dose would be having technology set up right in the home.

"It depends on the unique needs of the individual. Someone might only need a text message, but since he has trouble remembering to take medications, an automatic medication dispenser could be installed."



Lawson researchers created an app to help seniors with depressive symptoms, allowing for some health and support services to be provided virtually.

Dr. Mandar Jog leads the Neurological Disorders research program at Lawson. He is a Professor in the Schulich School of Medicine & Dentistry and the Faculty of Engineering at Western University.

Dr. Cheryl Forchuk leads the Mental Health research program at Lawson. She is a Distinguished University Professor in the Schulich School of Medicine & Dentistry and the Faculty of Health Sciences at Western University.

Could better connection be the key to improving in-home dialysis?

Dialysis treatment from the comfort of home can be extremely beneficial but patients often feel disconnected from their care team. Dr. Arsh Jain is studying how smart technology could be used to improve the patient experience.

Participants from London Health Sciences Centre's Regional Renal Program are given a tablet with an app to track vital information on a daily basis, such as weight, blood pressure and fluid amounts. This information is transmitted instantly to the care team, notifying them of any problems and allowing for proactive decisions. Equipment inventory and use can also be managed through two-way video and photo messaging.

This keeps participants in touch with the care team from the comfort of their home, and could help reduce hospitalizations and infection rates.

BEYOND THE LAB

How early-stage academic research becomes a commercialized treatment available to patients

You could say that the story of Novare Pharmaceuticals begins with a discovery Dr. Eva Turley made during her post-doctoral training.

She found a protein called RHAMM (Recepter for Hyaluronan-Mediated Motility), a breakthrough that would open up a whole new area of research.

This protein plays an important role in regulating spontaneous cell movement and stem cell differentiation. Dr. Turley and her colleagues learned that manipulating RHAMM would allow them to selectively stimulate subcutaneous fat, moderate destructive inflammation and reduce fibrosis, which causes scarring.

This ability could be used to treat inflammatory conditions such as arthritis, and fibrotic diseases like pulmonary fibrosis, which causes lung scarring and interferes with breathing.

It could also promote scarless healing for burns and post-surgical wounds, and reduce or eliminate excess scarring. With further applications, it would be possible to regenerate and reconstruct women's breasts after mastectomy, and treat breast and prostate cancer.

Allied Minds – an American company that forms, funds, manages and builds startups based on early-stage technologies from research institutions – became interested in Dr. Turley's work. Together they created Novare Pharmaceuticals to develop RHAMM-based therapeutics and are currently working on treatments for lung fibrosis.

In 2015, Novare entered into a Master Research Collaboration Agreement with Lawson, making London a discovery and validation incubator for the company. The relationship is managed by WORLDiscoveries®, Lawson's business development arm. The agreement combines Novare's business acumen with Lawson's expertise in translational science and specialized facilities.

WORLDISCOVERIES®

WORLDiscoveries® is the business development arm of London's extensive research network, created through a partnership between Lawson Health Research Institute, Robarts Research Institute and Western University. With their industry connections, sector-specific market knowledge, and business development expertise, the WORLDiscoveries® team helps researchers and local inventors commercialize their discoveries through licensing and new company spin-offs.

"The WORLDiscoveries® staff has a lot of knowledge about the industry and is experienced in dealing with material transfer, confidentiality and licensing agreements. Our time isn't taken up by that so we can focus on the research instead."

– Dr. Eva Turley

HOW RHAMM-BASED THERAPEUTICS CAN TREAT LUNG FIBROSIS

Lung fibrosis starts out as inflammation. Hyaluronan, the sugar that binds to RHAMM, is important in this process.

Hyaluronan is everywhere in our bodies and performs protective functions, but when it is fragmented it initiates inflammation.

When someone gets a tissue injury, oxygen free radicals and enzymes are released, breaking down hyaluronan into smaller fragments that bind to RHAMM and initiate inflammation.

In lungs, however, only a small fraction of hyaluronan is broken down into fragments, so peptides that mimic RHAMM are able to bind to them, thus preventing their binding to RHAMM and initiating inflammation. This prevents out of control inflammation and blunts fibrosis.

The partnership was attractive because Dr. Turley's RHAMM research was already being conducted at London Health Sciences Centre's London Regional Cancer Program (LRCP). Novare was also interested in Dr. Len Luyt's work in peptide chemistry at LRCP.

Before Dr. Turley began collaborating with Dr. Luyt, there were limited molecules known to interfere with RHAMM. They've now found a number of ways to block RHAMM by building peptide-based molecules.

Dr. Luyt creates the novel peptides, which Dr. Turley then screens in her lab for therapeutic potential. Drug candidates are sent for testing.

Getting to this point wasn't easy. Developing a drug is a long process with many challenges. Dr. Turley worked with numerous companies before finding the right fit with Allied Minds.

"It depends on so many different factors," says Dr. Turley. "A company can change its research focus based on a business decision or they might not want to wait for early-stage research to be developed into a commercial product. You could also be competing with in-house researchers."

"The biggest barrier is being considered a risky investment. You need enough promising data to get buy-in from a commercial partner. That can be difficult depending on available funding."

The fact that Drs. Turley and Luyt are able to develop commercial applications for their academic research demonstrates the strength of their work, and the success of their partnership with Novare and collaboration with Lawson.

"Sometimes companies can be focused solely on milestones and deliverables to get a particular job done," explains Dr. Luyt. "But Novare has offered quite a bit of freedom for discovery and in the end, I think you have a better chance of getting a drug candidate that way."

> "THERE'S SOMETHING VERY EXCITING ABOUT SEEING MOLECULES YOU'VE CREATED BE USED TO HELP PEOPLE"
>
> – DR. LEN LUYT

The relationship has created seven new jobs in London, funded new equipment and attracted research investment.

Both researchers are excited by the prospect of their work eventually leading to a drug that can treat patients. Dr. Turley feels, "it would be really gratifying to translate what I've worked so hard on and pioneered into something clinically useful."

"For a chemist, there's something very exciting about seeing molecules you've created be used to help people," says Dr. Luyt. "That's the greatest achievement possible."

Dr. Eva Turley is a part of the Cancer research program at Lawson and is a Professor in the Departments of Oncology, Biochemistry and Surgery, Schulich School of Medicine & Dentistry at Western University.

Dr. Len Luyt is a part of the Cancer research program at Lawson and is an Associate Professor in the Department of Oncology, Schulich School of Medicine & Dentistry, and the Department of Chemistry, Faculty of Science at Western University.

Believing in a cure

Patients, researchers and clinicians unite to fight rare disorders

Jennie Ogden remembers the first time she heard 'Spinal Muscular Atrophy.' "I didn't know what it was, but I knew the word atrophy was serious."

Jennie's daughter, Sophie Blair, was in hospital with a lung infection. Previously, they had been in for some tests because at age 15 months Sophie was not able to pull herself up, one of the key milestones for developing babies.

When Dr. Craig Campbell began to see Sophie, he found that her muscles were weak and not moving as they should. He is a Neurology Paediatrician at Children's Hospital, London Health Sciences Centre (LHSC) and a researcher with Children's Health Research Institute, a Lawson program.

Following a blood test, the results showed Sophie had Spinal Muscular Atrophy (SMA).

"No one in our families had this condition – no one had even heard of SMA before," says Jennie.

Jennie Ogden shares a special connection with her daughter, Sophie Blair. Sophie has a rare disease called Spinal Muscular Atrophy, which affects control of muscle movement.

SMA is a rare genetic disorder that affects the control of muscle movement. It is caused by a loss of specialized nerve cells, called motor neurons, which travel between the brainstem, spinal cord and muscles.

This leads to weakness and wasting (atrophy) of muscles used for activities such as crawling, walking, sitting up and controlling head movement. In severe cases of SMA, the muscles used for breathing and swallowing are affected.

There are four main types of SMA. Type 1 is the most severe and symptoms start early on in an infant's life. Those with Type 2 and 3 SMA experience weakness later in infancy or childhood and some may be able to sit or walk. The fourth type is rare and usually surfaces in adulthood.

"No one in our families had this condition – no one had even heard of SMA before."

– Jennie Ogden

"Without a cure or effective treatment, a diagnosis of SMA is often devastating for a family. For babies with Type 1 SMA, the life expectancy is only one or two years," says Dr. Campbell. "Type 2 and 3 SMA patients often live into adulthood, but they become progressively weaker. They often have limited use of their arms and legs, and many are not able to eat without a feeding tube."

"All we can do is try and stay one step ahead: treat symptoms, prevent problems and manage any pain," explains Dr. Campbell.

Jennie feels lucky that Sophie has been very healthy for someone with Type 2 SMA. "She can sleep without ventilation assistance and has no curvature of the spine. But she's lost muscle mass over time and we've seen changes in her body shape as she grows."

The focus has been on keeping life as normal as possible. Despite not being able to move around much on her own, Sophie is a happy girl. "She's quiet but sassy. Always my little partner in crime," shares Jennie. Her favourite activities are singing, building doll houses and being outside.

Now that Sophie is six years old, she is in grade one at school. Math is her favourite subject. "She's able to participate fully in class with the help of an education assistant, even in gym class thanks to special accommodations," says Jennie. "Sometimes the other kids forget it's hard for her to keep up though and this can hurt her feelings."

Two years ago, Dr. Campbell told Jennie about clinical trials for a newly developed drug that may change the future for children and families living with SMA.

Nusinersen, marketed as SPINRAZA, is the first treatment shown to improve motor function and reduce weakness for those with SMA.

The biopharmaceutical company Ionis developed the compounds in the

After participating in a clinical trial for a new drug treating Spinal Muscular Atrophy, Sophie, pictured here with Dr. Craig Campbell, can move in ways she couldn't before.

ABOUT SPINAL MUSCULAR ATROPHY

Recessive genetic disorder

SMA is caused by a recessive genetic disorder. Children who are affected have inherited two copies of the mutated gene, one copy from each parent.

1 in 6,000 babies

It is a relatively common "rare disorder" with approximately 1 in 6,000 babies born affected, and about 1 in 40 people are genetic carriers.

More than any other genetic disease

The debilitating and progressive condition kills more infants than any other genetic disease.

drug and partnered with Biogen to lead multinational clinical trials. Lawson became involved in the phase 3 trial, a randomized control study, with London as one of only four clinical trial sites in Canada.

Sophie was among the first enrolled in the trial. "We understood there weren't a lot of reported side effects, but there was a chance Sophie may not actually receive the treatment," remembers Jennie. "Even if nothing changed for her, we knew that this was still a chance to help other families."

With a strong safety profile and evidence showing that Nusinersen not only helped to avoid medical complications but actually improved skills, the children in the trial were moved to open label extension studies – they all received the drug. Additional patients with Type 1 SMA were also quickly moved onto treatment through a Special Access Program.

"Sophie didn't have the lung infections she would usually develop in the winter," says Jennie. "Her muscle mass stopped declining and she's started to bulk up. She is now able to lift her hands above her head."

"One of the most exciting changes was that Sophie can now shuffle on her bum," adds Jennie. "We were used to staying in place wherever she was. One day, she scooted under a table, giggling and hiding. She has never been able to move like that on her own."

"We hope to follow the children on the study long term to systematically measure the benefits of treatment over time," says Dr. Campbell. "It's my hope that the drug can be made widely available in Canada to those families who need it."

"Clinical research fills the gap between the lab and the prescription pad when it comes to new treatment."

– Dr. Craig Campbell

The paediatric neuromuscular clinic at Children's Hospital, LHSC, follows about 20 children with SMA. The dedicated team of clinical and research staff work together to care for children with severe neuromuscular disorders and offer research opportunities.

"Clinical research fills the gap between the lab and the prescription pad when it comes to new treatment. There needs to be a vision and process in place – we've worked hard to become experts in clinical trials. And it's the partnership between patients, families, clinicians, scientists and industry that will most successfully address the unique needs of those being treated for a rare disease."

The team is committed to making the experience of participating in a clinical trial as stress free as possible for families, and regularly informs this community of new opportunities.

He notes that there is a very efficient health research system in London that supports development and clinical trials, giving patients in this region the first opportunity to participate.

"Based on the care we received and opportunity to participate in research, we've decided to stay in London rather than move elsewhere. We truly have one of the best hospitals in the country," says Jennie.

She is trying to keep her hopes for Sophie humble. "My biggest concern is that we avoid having to use assistive devices for breathing."

When she grows up, Sophie wants to be a wedding dress maker. For now, Sophie's biggest goal is to be able to stand on her own.

Children's Hospital at London Health Sciences Centre (LHSC)

Children's Hospital at LHSC, in London, Ontario is a world-class hospital with the latest technology and the best specialists, scientists and health professionals in Canada. As a regional referral centre, they provide specialized paediatric inpatient and outpatient services to children in Southwestern Ontario from birth through to age 18 years.

Children's Health Research Institute (CHRI)

CHRI, a program of Lawson Health Research Institute, has a long and proud history of discovering ways to prevent and treat diseases affecting infants, children and youth, and to determine ways to promote happy, healthy lives. They conduct research of the highest international standards, optimizing the life-long health of children and youth.

chri.org

Dr. Craig Campbell hopes to follow Sophie and the other children taking part in the study long term to systematically measure the benefits of treatment over time.

Dr. Craig Campbell is a part of the Children's Health Research Institute, a research program at Lawson and is an Associate Professor in the Departments of Paediatrics, Clinical Neurological Sciences and Epidemiology & Biostatistics, Schulich School of Medicine & Dentistry at Western University.

Successful clinical trials lead to new and improved treatments, cutting-edge approaches and novel disease-prevention strategies – saving lives every day.

I

PHASE I: Is it safe?

The first time the treatment or intervention is tested in people. Safety and side effects of different doses are evaluated.

II

PHASE II: Does it do what it's supposed to?

The effects (good and bad) of the treatment or intervention are found.

III

PHASE III: How does it compare?

The new treatment is compared to the standard treatment and safety for use is confirmed. Most are randomized controlled trials with eligible participants assigned to either receive or not receive a treatment.

IV

PHASE IV: What happens long-term?

This phase is carried out after the treatment has been approved for use. The treatment may be compared to a competitor; its use may be explored with other patient groups; or, further side effects may be studied.

COOL SCIENCE

Does your morning cup of coffee interfere with medication for high blood pressure?

A research team from Lawson and Western University led by Dr. David Bailey measured how occasional coffee consumption reduces the action of a commonly prescribed class of blood-pressure lowering medication. Calcium channel blockers, such as felopidine, relax and widen the blood vessels, making it easier for blood to flow and in turn lower blood pressure. In the study, one cup of coffee containing a relatively low amount of caffeine lowered the drug's effects at its maximum recommended dose. To overcome the effect of the coffee, you would have to double the dose and so increase the risk of unwanted drug effects. The hope is to increase awareness of how caffeine can affect diagnosis and treatment of high blood pressure.

First clinical guidelines in Canada for pain following spinal cord injury

Neuropathic pain is complex and chronic, and is the most common complication reported by people who have experienced a spinal cord injury (SCI). A team of Lawson researchers, led by Dr. Eldon Loh, worked with care providers at St. Joseph's Parkwood Institute, along with an international panel, to address the complex and unique challenges for managing pain during recovery and rehabilitation. Also on the panel was Dan Harvey, who sustained a spinal injury after falling off a trampoline. Having experienced extensive neuropathic pain himself and working with several newly injured people, he contributed to the project and feels that this advancement will have a tremendous impact for patients. The new guidelines provide recommendations for screening, diagnosis and treatment, helping to develop new resources for both care providers and patients.

Dan Harvey (front) with Lawson researchers Dr. Eldon Loh, Stacey Guy and Swati Mehta (left to right).

Creating room on the liver transplant list

For years, severe liver disease from chronic hepatitis C (HCV) has been the most common reason for liver transplantation, not only in Canada but worldwide. Lawson researchers at London Health Sciences Centre's University Hospital have found that an oral anti-viral treatment improved some patients' severity scores to the point that they could be removed from the liver transplant list. Dr. Paul Marotta and Dr. Bandar Al-Judaibi have reported the first Canadian data showing the benefit of treating and curing patients with HCV, saving them from needing a transplant – and saving the life of someone else on the list waiting for a donor organ.

Leading the way in joint replacement research

Many patients suffering from severe arthritis of the knee, shoulder or hip undergo joint replacement surgery. These implants can wear out over time or leave the patient unsatisfied. To improve patient outcomes, Dr. Matthew Teeter is studying the potential of imaging techniques and sensors to better evaluate the repair of diseased joints. He directs Canada's first and largest implant retrieval laboratory at London Health Sciences Centre and uses a variety of methods to evaluate the effectiveness of different devices. With the belief that joints are made to move, the research team works with partners in London to use techniques such as moving x-rays (called fluoroscopic imaging) virtual reality environments and wearable sensor technologies to measure a patient's condition before intervention and track implant performance.

COOL SCIENCE

Can type 2 diabetes go into remission?

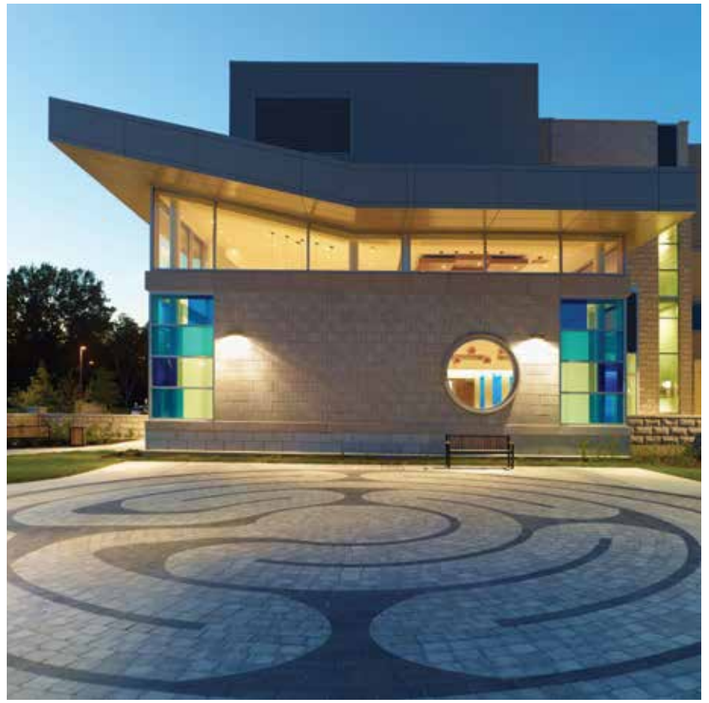
Remission is well-known as the goal in cancer treatment, but is a new idea for those with type 2 diabetes, a lifelong chronic disease. A group of Lawson researchers, led by Dr. Irene Hramiak, are leading clinical trials at St. Joseph's Hospital, one of only seven sites in Canada testing this exciting new possibility. Their hope is that an intensive treatment approach for those recently diagnosed will induce remission. The REMIT Study followed research by the Population Health Research Institute, a joint institute of McMaster University and Hamilton Health Sciences. This research showed early aggressive treatment resulted in up to 40 per cent of the study participants with type 2 diabetes going into remission and not requiring any diabetes treatment for at least three months.

World first in imaging technology developed at Lawson

Lawson scientists, in collaboration with Ceresensa Inc., produced the first commercial imaging product for Positron Emissions Tomography/ Magnetic Resonance Imaging (PET/MRI) scanners available in the world. With this kind of hybrid imaging, the PET gamma rays are absorbed by the coils used in MRI which causes a loss in the quality of data. Dr. Jean Théberge and Adam Farag corrected this problem with the novel design of the PET-transparent MRI head coil, now allowing for unparalleled images in the study, diagnosis and treatment of a wide range of diseases. This research innovation came after Lawson installed Canada's first whole body PET/MRI scanner in 2012 at St. Joseph's Hospital.

A game-changing blood test for concussions

Concussion is a major public health concern. It is the most common traumatic brain injury and can cause long-lasting effects. Yet diagnosis of a clinically significant concussion can be difficult, as it currently relies on a combination of patient symptom assessment and clinician judgement. Equally problematic are the decisions to stop play or activities, and when the individual can return to normal activities without risking further injury. Dr. Douglas Fraser, Lawson scientist and physician at London Health Sciences Centre's Children's Hospital, worked with researchers at Western University to develop a blood test that can identify with greater than 90 per cent certainty whether or not an adolescent athlete has suffered a concussion. The blood test measures a panel of metabolites, small molecules that are the products of the body's metabolism, to search for distinct patterns that indicate a concussion has occurred.



Walking the labyrinth: A path for meaning, insight and reflection

St. Joseph's Southwest Centre for Forensic Mental Health Care has two labyrinths to help patients with a mental illness who have also come into contact with the criminal justice system. Labyrinths are walking paths created using continuous lines with one route to and from the centre. A study by Stephen Yeo, Dr. Clark Patrick Heard and Jared Scott showed that walking the labyrinth contributes to recovery by promoting spiritual self-care, insight development and personal meaning-making reflection. Through the process, individuals may think about what they observed or did, why it mattered and how they might think or act differently based on new knowledge. This allows them to set goals and use what they've learned from the past to inform future action, and to consider the real-life implications.

Solving the mysteries of PTSD

Do patients have the power to reorganize their own brain activity?

After spending 13 years in and out of hospitals, Teresa Kinney had given up hope. She did not expect to get well.

Teresa experienced extended trauma at a young age in the form of repeated sexual assaults.

In the years that followed, she experienced an array of symptoms including flashbacks, light trances that left her unaware of her surroundings and even suicide attempts. It was difficult to understand the symptoms and she was diagnosed with a number of illnesses.

It was not until she met Dr. Ruth Lanius that her illness was diagnosed as post-traumatic stress disorder (PTSD). Dr. Lanius is a psychiatrist at London Health Sciences Centre and a clinician-researcher at Lawson, specializing in PTSD. Teresa met Dr. Lanius in the emergency department following a suicide attempt. Dr. Lanius began working with Teresa in one-on-one and group therapies.

"I was struggling on a day-to-day basis when I met Dr. Lanius," says Teresa. "I knew immediately that she was the right person for me to work with. She had a different approach and was the first to offer me hope for recovery."

Understanding PTSD

Dr. Lanius' research combines imaging and psychiatry to understand the mechanisms of the human brain that produce symptoms. She then uses this knowledge to develop and test new therapies.

A common symptom of PTSD is defensive responses to stress or triggers. Triggers include sights, sounds, smells or feelings that bring back vivid memories of an individual's trauma.

By collaborating with Lawson's Imaging scientists, Dr. Lanius and her PhD student, Sherain Harricharan, were the first to show that people experiencing PTSD are constantly on edge or prepared for defense, even when they seem to be at rest.

There are two kinds of PTSD, each with different defensive responses. Individuals with the more common type of PTSD experience active defensive responses like irritability or even aggression. The other 15 to 30 per cent have more passive defensive responses like shutting down, freezing or out-of-body experiences.

> "I was struggling on a day-to-day basis when I met Dr. Lanius. I knew immediately that she was the right person for me to work with. She had a different approach and was the first to offer me hope for recovery."
>
> – Teresa Kinney

Dr. Ruth Lanius is testing the potential of ‘brain training’ exercises (top right and left) that give people the power to regulate their own brain activity, emotions and PTSD symptoms.

Dr. Lanius and Harricharan wanted to unlock the mechanisms behind the defensive responses. “We knew from existing research that an area deep in the brain called the periaqueductal gray (PAG) plays a key role,” says Dr. Lanius.

“This study suggests that patients with PTSD are always on edge and ready for defense, even when they seem to be at rest.”

– Dr. Ruth Lanius

The team conducted a seven-year study to examine both types of defensive responses by comparing the brains of participants with PTSD to those without. They used fMRI (functional magnetic resonance imaging) to scan participants’ brains while at rest, capturing brain activity by detecting changes in blood flow.

Participants with PTSD had extensive connections between the PAG and other areas of the brain associated with defensive action. Only those with passive defensive responses had unique connections between the PAG and regions of the brain associated with passive coping strategies.

“This study suggests that patients with PTSD are always on edge and ready for defense, even when they seem to be at rest,” says Dr. Lanius. “This is an important finding that could be a first step towards identifying neural and behavioural targets for therapies that address both kinds of defensive strategies.”

Harnessing the power of brain training

Dr. Lanius’ work also includes testing the amazing potential of ‘brain training’ exercises that give people the power to regulate their own brain activity, emotions and PTSD symptoms.

Individuals with PTSD tend to have more random patterns of brain activity. Brain activity involves different parts of your brain communicating with each other, and helps to regulate states of consciousness, thought, mood and emotion.

Her research suggests that those with PTSD can exercise their own brains to restore these patterns to a healthy balance and reduce their defensive responses.

The process is called neurofeedback - training or exercise for the brain.

A neurofeedback loop acts as a mirror that visually displays a patient’s brain activity to them. This is done through a computer interface that records brain signals through sensors on the patient’s scalp. Since the person can see their brain activity, they can complete exercises in ways similar to a gym workout and see the results.

In one study, participants were asked to reduce the intensity of the brain’s dominant brain wave – the alpha rhythm. Brain activity was visualized as a computer game with a space ship flying through a starry background. If patients maintained a heightened alpha rhythm, the space ship remained still. When the alpha rhythm was successfully reduced, the space ship moved forward.

“No further instructions were given,” explains Dr. Lanius. “Each individual figured out his or her own way to reduce the alpha rhythm. Some let their mind wander or thought about positive things, while others reported concentrating their attention.”

The team of researchers, which included post-doctoral student Tomas Ros and collaborators at the University of Geneva, were surprised by the results.

Images were captured both before and after the brain training, which uncovered lasting changes to brain activity. The alpha rhythm rebounded to levels consistent with healthy individuals and patterns of brain activity were much less random.

The participants experienced a decrease in defensive response following the sessions.

“These results are very exciting,” says Dr. Lanius. “Neurofeedback is showing that patients have the power to regulate their own brain activity. As more tools become available, people can take control of their illness and its resulting symptoms.”

Moving forward with hope

Over the years and in working with Dr. Lanius, Teresa was able to acknowledge her trauma and develop strategies for coping.

She participated in neurofeedback studies at Lawson and found that actually seeing the images captured was extremely validating.

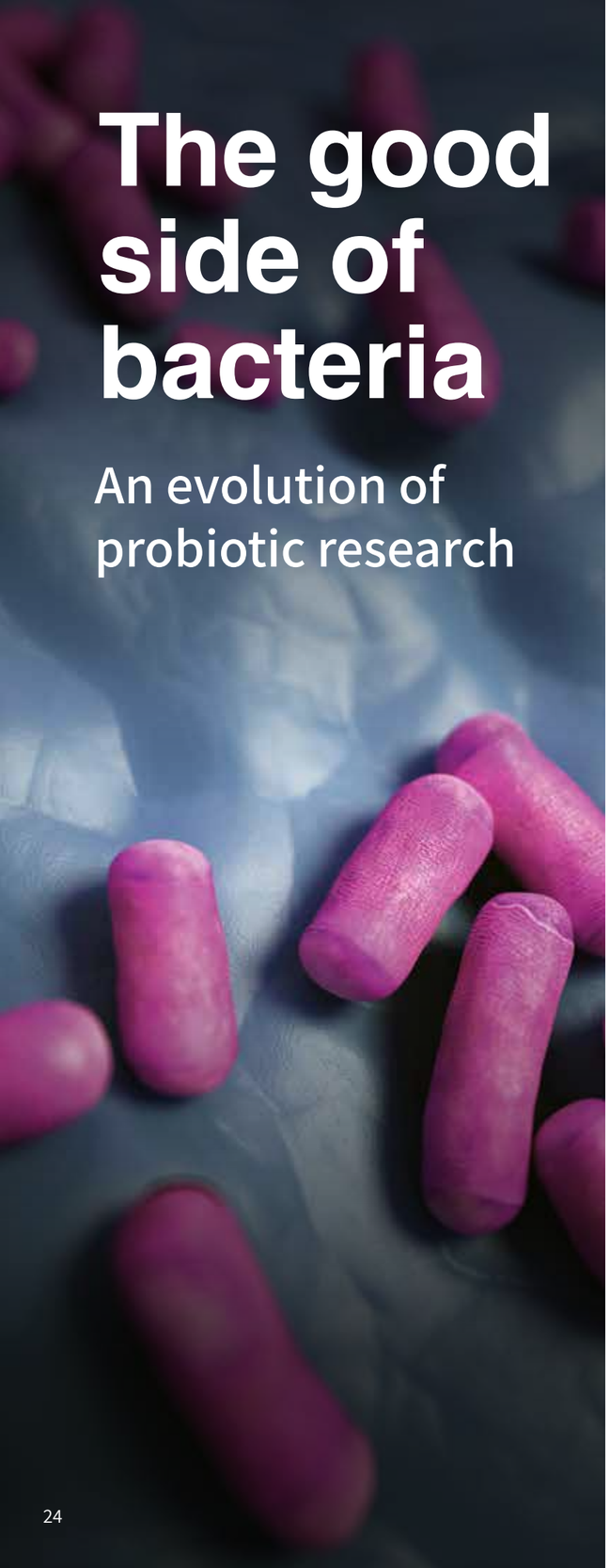
“When it comes to mental illness, some people don’t believe it unless they can see it. This research shows that PTSD symptoms are caused by real changes to the brain. Hearing the results and breakthroughs in Dr. Lanius’ research adds to a personal sense of validation.”

Today, Teresa is doing well and has been teaching English as a second language (ESL) for over seven years. She credits Dr. Lanius with giving her the tools to turn her life around.

Dr. Ruth Lanius is a part of the Imaging research program at Lawson. She holds the Harris-Woodman Chair in Mind-Body Medicine and is a Professor in the Department of Psychiatry, Schulich School of Medicine & Dentistry at Western University.

Post-traumatic stress disorder

- PTSD is a mental illness that some people develop after experiencing or witnessing traumatic events like combat, a natural disaster, a car accident, childhood abuse or sexual assault.
- It can result from a single event or develop after ongoing trauma.
- Anyone can develop PTSD at any age.
- According to the National Centre for PTSD about seven or eight out of every 100 people will experience PTSD at some point in their lives.
- PTSD symptoms vary from person to person.



The good side of bacteria

An evolution of probiotic research

Lawson scientist Dr. Gregor Reid was once ridiculed for claiming that healthy bacteria inhabit our bodies. The idea that we could consume bacteria to improve health was even more ludicrous.

Today, probiotics is a multimillion dollar industry and research is rapidly accelerating our knowledge of healthy bacteria.

Dr. Reid is respected worldwide for his expertise and leadership in this field.

The first probiotic for women

Trillions of micro-organisms, including healthy bacteria, inhabit the human body. This collection of micro-organisms is called the human microbiome.

For over 30 years, Dr. Reid has studied the vaginal microbiome. In the 1980s, Dr. Reid and his mentor, Dr. Andrew Bruce, were the first to propose that healthy bacteria, called lactobacilli, provide health benefits to the vagina and bladder.

Through further research, Dr. Reid found that lactobacilli were critical in preventing vaginal and bladder infections.

"Lactobacilli naturally inhabit the urethra and vagina," explains Dr. Reid. "But when they are reduced, harmful bacteria invade more easily and increase the risk of infection."

Antibiotics, while effective in removing harmful bacteria, also kill beneficial bacteria like lactobacilli. A study led by Dr. Reid showed that one week of antibiotics disrupts the vaginal microbiome for at least six weeks. This is why bladder infections can return so frequently.

After many studies, Dr. Reid and his colleagues isolated two strains of lactobacilli – lactobacillus GR-1 and RC-14 – that are especially important to women's health.

They began clinical trials in 1987 to test the ability to reintroduce these strains to the microbiome. In the early 2000s, they conducted three clinical trials that proved lactobacilli could be taken orally and still provide benefits to the urogenital tract.

After years of hard work, the two strains of lactobacilli were licensed in 2004 and sold around the world as the first probiotic to improve women's health.

"Hearing from women about how probiotics have helped them is what has made this research so rewarding," says Dr. Reid.

Discovering the breast tissue microbiome

Dr. Reid and his PhD student, Camilla Urbaniak, were the first to prove the existence of a breast tissue microbiome. They also confirmed the existence of beneficial bacteria in human milk.

"Research has shown that breastfeeding decreases a woman's risk of breast cancer," says Dr. Reid. "We wondered if beneficial bacteria in the milk might be playing a role and whether other types of bacteria could be influencing cancer development."

Comparing breast tissues from healthy women to those with breast cancer, they discovered bacteria in both, but it differed significantly. The bacteria from women with cancer were causing significant DNA damage, which can lead to the development of cancer. Meanwhile, the breast tissues from healthy women contained bacteria known to promote health and prevent cancer.

"Other studies have shown that probiotics can be ingested by women and reach the mammary gland," explains Dr. Reid. "This raises the question of whether women, especially those at risk for breast cancer, should take probiotics to increase beneficial bacteria in the breast. With further research, this could create new options for patient care."

Dr. Gregor Reid partnered with Western University's "Western Heads East" program and Yoba-for-Life to set up community kitchens in Tanzania, where local women produce probiotic yogurt.

Beyond women's health

In 2001, Dr. Reid helped establish the Canadian Centre for Human Microbiome and Probiotic Research at St. Joseph's Health Care London.

At the Centre, Dr. Jeremy Burton and his team study how the human microbiome influences urological health in men and women. In one of their largest studies, they are looking at the role of the microbiome in the formation of kidney stones. They are also investigating the microbiome's effect on bladder and prostate cancer, as well as kidney transplants.

Meanwhile, Dr. Greg Gloor is further analyzing the human microbiome through next-generation DNA sequencing.

Known for its expertise, researchers from across health disciplines are partnering with the Centre to study the role of the microbiome on human health and disease.

Drs. Gregor Reid, Jeremy Burton and Greg Gloor are part of the Human Microbiome and Probiotics research program at Lawson. Drs. Reid and Gloor are Professors at Western University's Schulich School of Medicine & Dentistry. Dr. Burton holds the Miriam Burnett Chair in Urological Sciences and is an Assistant Professor at Western University's Schulich School of Medicine & Dentistry.

Defining probiotics

In 2001, Dr. Reid was invited to chair the United Nations/World Health Organization Expert Panel on Probiotics. He developed the global definition for probiotics that is still used today: "live micro-organisms that, when administered in adequate amounts, confer a health benefit on the host."

Probiotics for healthy pregnancy and birth

- Research has shown that lactobacilli are crucial to healthy conception and pregnancy.
- With the human fetus exposed to bacteria in the womb and during vaginal birthing, a mother's lactobacilli may be contributing to the baby's healthy development.
- Recent studies show that daily use of probiotics significantly reduces group B streptococci in the vagina, an organism that can be lethal to the baby.

"With a dramatic rise in C-sections and a drop in breastfeeding, newborns are not being fully exposed to beneficial bacteria from Mom," says Dr. Reid. "Other bacteria can take their place, sometimes harmful ones that may contribute to long-term health problems. It's important that we continue exploring probiotics as a potential solution."

Bringing probiotics to those in need

Dr. Reid has partnered with Western University's "Western Heads East" program and Yoba-for-Life to set up community kitchens in Tanzania, where local women produce probiotic yogurt.

- Probiotic yogurt helps to boost energy, increase immunity and prevent diarrhea.
- The goal is to reach one million Africans within five years.

westernheadseast.ca

TARGETING CANCER AT EVERY STAGE

"You have cancer."
It's one of the most feared sentences.

Charles Ishak, PhD candidate, working in Dr. Fred Dick's lab. Charles was first author on a study that showed the Retinoblastoma protein (pRB) helps to silence junk DNA.

A cancer diagnosis can send a person – and their family – on a long and difficult journey. At Lawson Health Research Institute, researchers are committed to improving every stage.

Discoveries are happening in the lab, in the clinic and in collaboration with other research areas. Some researchers focus on basic science while others are also physicians who treat patients.

Their goal is the same: advance our knowledge of the disease in order to develop new treatment and detection strategies.

THE POWER OF JUNK DNA

Dr. Fred Dick is improving this understanding with a new breakthrough in cancer genetics.

A Lawson scientist at London Health Sciences Centre (LHSC)'s London Regional Cancer Program, Dr. Dick specializes in the study of the Retinoblastoma protein (pRB).

This protein is traditionally known to control the growth of individual cells and prevent the development of cancer.

Dr. Dick and his team discovered that pRB actually has another, more important role. It works with another protein, EZH2, to silence 'junk DNA'.

"Most of the DNA in the human genome is junk DNA, also called repetitive sequences," explains Dr. Dick. "They are leftover pieces of ancient infections that are no longer in existence."

Junk DNA is believed to have no positive contribution to the human body. It's kept silent and not expressed by our cells. If it is expressed, junk DNA can be reinserted into the human genome where it damages our genes and contributes to diseases like cancer.

The discovery shows that pRB helps EZH2 find its way to a cell's junk DNA. EZH2 then adds a tag which tells the cell not to express the junk DNA.

The study predicts that EZH2 inhibitors, drugs that block EZH2, could be used to help the immune system target cancers. Blocking EZH2 in cancer cells will lead to the expression of junk DNA so that cancer cells appear to the immune system as if they are infected by a virus. The immune system could then target and kill those cells.

"With more knowledge of someone's specific cancer, we can give the right mix of inhibitors and immunotherapy," says Dr. Dick. "This will help target cancer right at the point where cells are expressing junk DNA."

ENHANCED PROSTATE CANCER IMAGING

Dr. Glenn Bauman is collaborating with Lawson Imaging scientists to improve the diagnosis and treatment of prostate cancer.

Dr. Bauman is a radiation oncologist at LHSC and a lead investigator on an Ontario Institutes of Cancer Research project titled SPIRIT, Smarter Prostate Imaging and Interventions. Dr. Bauman and his team were the first in Canada to capture highly specific prostate cancer images using a new molecule known as a prostate-specific membrane antigen (PSMA) probe. The PSMA probe is used in Positron Emissions Tomography (PET) scans to correctly diagnose cancer.

PET probes are injected into a patient where they then spread throughout the body and identify sites of disease. PET scans are often combined with Computed Tomography (CT) or Magnetic Resonance Imaging (MRI). This shows where the probe is concentrated, confirming precisely where the cancer is located.

There are common PET probes to image most cancers, but they have been less accurate in identifying prostate cancer.

> ‘The number of circulating cells predicts if a patient’s disease is progressing and if it might metastasize. A high number suggests that a patient’s cancer is spreading.”
>
> – Dr. Alison Allan

The PSMA probe solves this problem by specifically targeting PSMA molecules, which are found on prostate cancer cells. The resulting images provide exceptional detail about a patient’s cancer, including the precise location and size of a tumour.

“The use of PSMA probes is a tremendous step forward in the management of prostate cancer,” says Dr. Bauman. “With more accurate detection, we can provide better and faster treatment.”

The next step is to work with researchers across Ontario to develop clinical trials to study the PSMA probe. Dr. Bauman believes it can also be used to measure responses to drug treatments and evaluate men whose cancer may have returned.

IDENTIFYING THE SPREAD OF DISEASE

Lawson scientists are also revolutionizing the ability to track the spread of disease.

Dr. Alison Allan specializes in the study of metastasis. Metastasis, the spread of cancer from the original tumour to other sites in the body, is responsible for approximately 80 per cent of cancer deaths.

“Cancer cells can leave a tumour and enter the blood stream,” explains Dr. Allan. “Called circulating tumour cells (CTCs), these cells move throughout the body where they can invade other organs and tissues.”

Her lab has developed unique blood tests to track metastasis for different cancers by measuring the number of CTCs in a patient’s blood stream.

“The number of circulating cells predicts if a patient’s disease is progressing and if it might metastasize. A high number suggests that a patient’s cancer is spreading.”

With studies proving the effectiveness of these blood tests for a number of cancers, LHSC now offers the test to breast, prostate and colorectal cancer patients. LHSC is the only hospital in the country to offer the test.

It is used for patients who have just been diagnosed with metastatic cancer. Measuring the number of CTCs provides a real-time assessment of how a specific treatment is working.

The blood test can also be used for patients who are in remission, when their body no longer shows signs of the cancer. It helps monitor for remaining cancer and gives patients peace of mind.

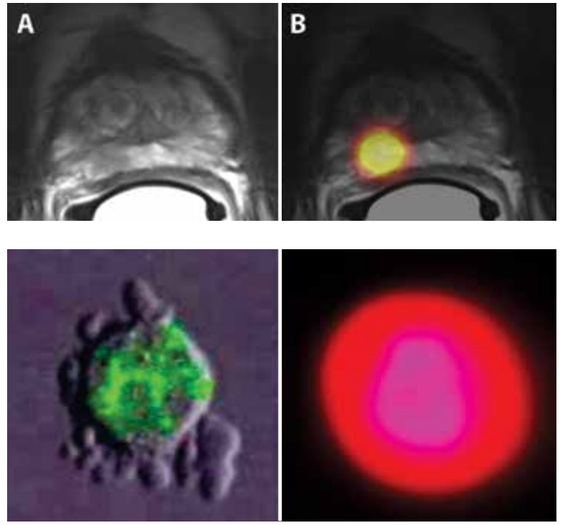
Studies are currently underway for other types of cancer too.

One research team is looking at how the number of CTCs changes before and after standard treatments for esophageal cancer, such as chemotherapy and radiation.

“This is the first time the test has been used in the treatment of patients with early stage esophageal cancer,” says Dr. Richard Malthaner, director of Thoracic Surgery Research at LHSC.

“We anticipate using the results to predict which patients will be cured of their cancer and which patients might need additional treatment,” adds Dr. Edward Yu, radiation oncologist at LHSC. “The blood test could one day replace the multiple x-rays and CT scans that are currently used.”

Dr. Alison Allan specializes in the study of metastasis – the spread of cancer from the original tumour to other sites in the body.



Lawson researchers were the first in Canada to use a PSMA probe to capture highly specific PET/MRI and PET/CT images from a prostate cancer patient. The MRI image (A) demonstrates a dark area in the posterior right side of the prostate (lower left part of the image) that is highly suspicious for prostate cancer. In the PET/MRI image (B), the bright yellow colour indicates where the PSMA probe was taken up in the prostate. This area corresponds to the suspicious area on the MRI scan (A).

Left: Circulating tumor cell (CTC) from a breast cancer patient undergoing chemotherapy. The CTC is stained to show cell death. Right: Breast cancer cell found circulating in the blood stream that was stained with a cancer stem cell marker.

Drs. Fred Dick, Glenn Bauman, Alison Allan, Richard Malthaner and Edward Yu are part of the Cancer research program at Lawson. Drs. Dick and Malthaner are Professors and Drs. Allan and Yu are Associate Professors at Western University’s Schulich School of Medicine & Dentistry. Dr. Bauman is a Professor and Chair of the Department of Oncology, Schulich School of Medicine & Dentistry at Western University and Chief of the Department of Oncology, London Health Sciences Centre.

HEALTH CARE AS UNIQUE AS DNA

How personalized medicine revolutionizes care with treatments tailored to the individual

Imagine you are diagnosed with a disease or other health condition. You need to take medication to manage the illness, or maybe even to stay alive. Testing and analysis is done to study your unique DNA and other factors. Your doctor then prescribes you the exact right medication at the exact right dose, uniquely selected for you.

The Personalized Medicine team in London, Ontario is working to make this a reality.

Located at London Health Sciences Centre (LHSC), they study the genetic differences between individual patients to provide more effective treatments with fewer side effects.

Most medical treatments are designed with a 'one-size-fits-all-approach.' They may be successful for some patients, but not for others. A percentage of people will not process the medication as intended. This can reduce the effect, or worse, cause an adverse reaction.

Personalized medicine is an emerging field that uses an individual's genetic profile, medical history, environment and lifestyle to guide prevention, diagnosis and treatment of disease.

"The focus of our research has been on pharmacogenomics-based personalized medicine. We look at differences in genes to see how an individual will metabolize a drug and the body's response to it," explains Dr. Richard Kim, a Lawson researcher and clinical pharmacologist, and director for the Personalized Medicine Program.

They do this by analyzing the person's genotype. Drug levels are also measured using mass spectrometry, a chemistry technique that identifies the amount and type of chemicals present in the blood.

"We know that everyone harbours unique genetic differences. There can be a lot of variation in how individuals respond to a medication, even if they have a similar genetic makeup. This can put someone at risk for severe toxicity even at a standard dose of a medication," says Dr. Kim. "The most effective drug treatments should work with, not against, a patient's own genetic code."

"We look at differences in genes to see how an individual will metabolize a drug and the body's response to it"

– Dr. Richard Kim

Prescribing methods are often based on how the majority of patients with similar traits respond to the drug.

"Medication dosing is usually carried out in a trial and error fashion. A physician starts with a low dose and incrementally ups the amount to an effective range where they can also avoid an adverse reaction."

While most patients respond well, it's almost impossible to predict the response for those patients whose bodies process the medication differently.

In those cases the drug doesn't work, or worse, causes difficult side effects or a dangerous reaction. It is estimated that adverse drug reactions are the fourth leading cause of death in Canada.

The team has focused on common medications, such as those for lowering blood pressure, anti-cancer drugs, and medications taken following a heart attack, stroke or coronary bypass procedure. They've also addressed some treatments for depression and inflammatory bowel disease, and worked on adverse drug reaction prevention.

They have successfully helped to tailor drug therapies for over 4,000 patients so far.

"There is an increased cost to the health care system when a medication is ineffective or causes an adverse reaction," says Dr. Kim. "As healthcare costs overall increase at an unsustainable rate, we must leverage innovations like personalized medicine to provide quality health care that is affordable."

Until recently, implementing pharmacogenomics into routine clinical care was a challenge. Advances in genomics technology have made it possible to tailor the selection and dose of common medications quickly and more cost-effectively.

"Depending on the clinical situation, we can provide rapid test results and dosing guidance in less than 24 hours." A detailed report analyzes the patient's ability to metabolize the prescribed drug and offers suggestions for alternative treatments where needed.

Current research by Lawson includes a personalized approach for enhancing drug safety for the elderly and a more comprehensive approach for chemotherapy medications for adults and children. They are also looking at how pharmacogenomics testing results can be more seamlessly integrated into electronic medical records and medication order entry.

"We hope to more broadly and systematically introduce our approach to patients at LHSC," adds Dr. Kim. "Gene testing for precise diagnostics improves treatment options and increases patient safety. We have the potential to fundamentally transform the way care is provided in hospitals and the community."

Personalized medicine is having the right dose of the right treatment, at the right time.

Dr. Kim opened the first personalized medicine research clinic in Canada.

In 2006, the team offered dosing guidance for the blood-thinner warfarin, used to prevent clots and embolism. Warfarin interacts with many commonly used medications and chemicals in some foods.

In 2010, testing was studied for tamoxifen, an anti-estrogen used to treat breast cancer. Some women with a genetic defect in a particular metabolizing enzyme, called CYP2D6, have trouble converting the drug to its active form, blocking the desired effects.

The Personalized Medicine team works in a real-world clinical setting to further their research to improve patient care. They range from graduate students, investigators and computer programmers to pharmacists, nurses and physicians.

"We leverage the unique knowledge of our researchers and medical experts, leading to better patient care and reduced cost to the health care system. The support of LHSC and Lawson has been essential in advancing this model of translational research."

– Dr. Richard Kim

Dr. Richard Kim leads the Personalized Medicine research program at Lawson. He holds the Wolfe Medical Research Chair in Pharmacogenomics and is a Professor in the Departments of Medicine, Physiology and Pharmacology, and Oncology, Schulich School of Medicine & Dentistry at Western University.

Our Partners

London Health Sciences Centre

London Health Sciences Centre (LHSC) has been at the forefront of medicine in Canada for 142 years and offers the broadest range of specialized clinical services in Ontario. Building on the traditions of its founding hospitals to provide compassionate care in an academic teaching setting, LHSC is home to Children's Hospital, University Hospital, Victoria Hospital, the Kidney Care Centre, two family medical centres, and two research institutes – Children's Health Research Institute and Lawson Health Research Institute. As a leader in medical discovery and health research, LHSC has a history of over 65 international and national firsts and attracts top clinicians and researchers from around the world. As a regional referral centre, LHSC cares for the most medically complex patients including critically injured adults and children in southwestern Ontario and beyond. The hospital's nearly 15,000 staff, physicians, students and volunteers provide care for more than one million patient visits a year.

For more information, visit **www.lhsc.on.ca**

London Health Sciences Foundation

London Health Sciences Foundation (LHSF) is a Canada Revenue Agency registered charity accredited by both Imagine Canada and the Better Business Bureau, linking our community and health care experts – including physicians, allied professionals, researchers, staff and educators – together in pursuit of medical excellence at LHSC and Lawson Health Research Institute. Established to strengthen LHSC's ability to provide the highest quality health care for patients in southwestern Ontario and beyond, LHSF offers opportunities to support enhanced patient care, education, healthcare innovation and research.

For more information, visit **www.lhsf.ca**

Children's Health Foundation

Children's Health Foundation is dedicated to raising and granting funds to support Children's Hospital at LHSC, Thames Valley Children's Centre and Children's Health Research Institute. Since 1922, funds raised have helped deliver exceptional care and support for children and their families by providing specialized paediatric care, equipment, education programs, therapy, rehabilitation services and research.

For more information, visit **www.childhealth.ca**

St. Joseph's Health Care London

Renowned for compassionate care, St. Joseph's Health Care London (St. Joseph's) is a leading academic health care centre in Canada dedicated to helping people live to their fullest by minimizing the effects of injury, disease and disability through excellence in care, teaching and research. Through partnership with Lawson Health Research Institute and our collaborative engagement with other health care and academic partners, St. Joseph's has become an international leader in the areas of: chronic disease management; medical imaging; specialized mental health care; rehabilitation; specialized geriatrics; and surgery. St. Joseph's operates through a wide range of hospital, clinic and long-term and community-based settings, including: St. Joseph's Hospital; Parkwood Institute; Mount Hope Centre for Long-Term Care; and Southwest Centre for Forensic Mental Health Care.

For more information, visit **www.sjhc.london.on.ca**

St. Joseph's Health Care Foundation

St. Joseph's Health Care Foundation gathers, grows and grants philanthropic funds to enable St. Joseph's Health Care London to pursue excellence in care, teaching and research. Through donor support, the foundation contributes to advances in the delivery of patient care, specialized equipment, research initiatives and capital funds at St. Joseph's Hospital, Parkwood Institute, Mount Hope Centre for Long-Term Care, Southwest Centre for Forensic Mental Health Care and Lawson Health Research Institute. As one of the largest charitable organizations in Southwestern Ontario, St. Joseph's Health Care Foundation is an accredited member of Imagine Canada's Standards Program, which recognizes the foundation's commitment to ethical fundraising and donor accountability.

For more information, visit **www.sjhcfoundation.org**

Western University

Western University delivers an academic experience second to none. Since 1878, The Western Experience has combined academic excellence with life-long opportunities for intellectual, social and cultural growth in order to better serve our communities. Our research excellence expands knowledge and drives discovery with real-world application. Western attracts individuals with a broad worldview, seeking to study, influence and lead in the international community.

For more information, visit **www.uwo.ca**

LAWSON EXPERTISE

CLINICAL RESEARCH

Lawson has clinical research experience in all medical disciplines from prenatal and paediatric care to aging and geriatric care. Opportunities exist for Phase I – IV Trials, sponsored, peer-reviewed or investigator-initiated clinical research.

lawsonresearch.ca/capabilities

Lawson Clinical Research Services (LCRS)

LCRS is a versatile, fully-staffed facility that provides increased clinical trials capacity to investigators from London Health Sciences Centre (LHSC) and St. Joseph's Health Care London (St. Joseph's), as well as community physicians and dentists. LCRS provides the expertise and facilities to manage the clinical, technical and administrative aspects of both investigator and industry-sponsored research. The facility offers clients the opportunity to contract services, in whole or in part, required to successfully conduct clinical research.

Centre for Clinical Investigations and Therapeutics (CCIT)

CCIT is a state-of-the-art clinical research facility located at the Lindros Legacy Research building at LHSC's University Hospital. The goal of the CCIT is to enable pioneering discoveries in the area of translational clinical research that improve care and treatment for patients. As the first of its kind in Canada, this centre functions as a dedicated and centralized hub of the intellectual and physical resources needed by clinician researchers. It also retains the capability and capacity for industry-sponsored clinical trials.

Gerald C. Baines Centre for Translational Cancer Research

Located at LHSC's Victoria Hospital, the Gerald C. Baines Centre was established as a partnership between Lawson, LHSC's London Regional Cancer Program, the Schulich School of Medicine & Dentistry and Western University. The centre supports citywide translational cancer research by linking researchers from multiple disciplines with academic clinicians and facilitating knowledge transfer between teams.

Lilibeth Caberto Kidney Clinical Research Unit (KCRU)

The KCRU is dedicated to clinical research in the areas of kidney health, kidney disease and treatments of dialysis and kidney transplantation. There are over 70 active clinical research studies being coordinated through the KCRU, a 4,000 square-foot facility located at LHSC's Victoria Hospital. The KCRU also fosters strong ongoing collaboration with the ICES Kidney Dialysis and Transplant Program which are sited adjacent to the KCRU facility.

LAWSON IMAGING

Lawson Imaging is a world leader in non-invasive biomedical imaging. New developments in hybrid imaging platforms such as PET/MRI , PET/CT and SPECT/CT are currently being applied to the areas of cardiology, neurology, mental health, metabolic disease, cancer and more.

Using state-of-the-art imaging technology, research is focused on the development of non-invasive capabilities and diagnostic imaging so that we can better understand the fundamental mechanisms of human biology and enhance the diagnosis, prevention and treatment of disease. Lawson Imaging scientists have the expertise and creativity to discover and innovate through basic research, translational research, clinical trials and commercialization.

The first Canadian human magnetic resonance images (MRI) were taken at St. Joseph's in 1982, and Lawson was eventually the first in Canada to receive a PET/CT scanner and whole body PET/MRI scanner. CT Perfusion to measure blood flow in the body was developed here and has transformed the way stroke is assessed around the globe. Also at the forefront are the emerging technologies of photoacoustic and optical imaging and optical spectroscopy, and investigation and therapeutic application of bioelectromagnetics.

lawsonimaging.ca

Whole Body PET/MRI

MRI produces detailed anatomical images of body structures, while PET technology can track changes in a variety of disease conditions at the cellular metabolic level before structural or anatomic changes are seen on CT or MRI. The PET/MRI combines the metabolic imaging capabilities of PET with the structural imaging of MRI. The simultaneous capture of PET and MRI images has many advantages over sequential capture of PET and MRI, including improved co-registration of PET and MRI images, shorter overall imaging times and the ability to observe rapidly changing physiological processes simultaneously. The scanner is used by researchers to help improve diagnosis and treatment of Canada's major health challenges, such as cardiovascular disease, neurological diseases, mental illness and cancer.

Cyclotron & PET Radiochemistry

The Nordal Cyclotron & PET Radiochemistry Facility produces positron-emitting radiopharmaceuticals (PERs) which are used when patients undergo a positron emission tomography (PET) scan. The half-life of the radioactive isotopes in PERs is short and so they must be generated with a cyclotron that is close to the clinic where they are used. The facility produces short-lived PERs for St. Joseph's and is becoming the centre of a regional distribution network. In combination with PET/CT, PET/MRI and preclinical PET imaging scanners, the facility supports a wide range of research projects including imaging applied to oncology, cardiology, neurology, psychology, bioelectromagnetics and other areas.

FACILITIES & TECHNOLOGY

At Lawson, we have joined with our partner research and clinical institutions to provide core research facilities and expertise for highly technical areas in a cost effective manner.

ICES Western

ICES Western is a satellite site of the Institute for Clinical Evaluative Sciences, a not-for-profit research institute encompassing a community of research, data and clinical experts, and a secure and accessible array of Ontario's health-related data. ICES researchers use this data to produce unique scientific insights that improve understanding of health care issues, guide decision-making and inform changes in care delivery in Ontario.

London Tumour Biobank

The London Tumour Biobank is a biorepository with tumour tissue, blood and urine samples from patients following breast and prostate biopsy. Researchers in London can access the samples, complete with comprehensive clinical data, for cancer research. The facility includes a cryogenic freezer with capacity to store over 41,000 patient samples at -196 degrees Celsius.

LAWSON
HEALTH RESEARCH INSTITUTE

The Research Institute of London Health Sciences Centre
and St. Joseph's Health Care London.

lawsonresearch.ca