



Western  
Bone and Joint Institute

# ANNUAL REPORT 2023

NEW  
PERSPECTIVES  
IN MSK HEALTH

# BREAKING BOUNDARIES

## Tackling Society's Greatest Challenges Through Interdisciplinary Collaboration

The challenges we face today, such as climate change, public health crises, an aging population or technological advancements, are incredibly complex and interconnected. Addressing them requires an approach that mobilizes knowledge and expertise from various fields and beyond the boundaries of academia. Only if we can break down disciplinary boundaries and foster collaboration and inclusivity, will we have a chance at tackling society's biggest challenges effectively.

Western's research institutes are designed for this exact purpose: they are hubs of interdisciplinary activity and innovation dedicated to addressing the world's greatest challenges. They create a welcoming space for researchers, where novel approaches to stubborn problems can thrive, and provide leadership to advance interdisciplinary excellence at Western and beyond.

# BONE & JOINT INSTITUTE

## From the director

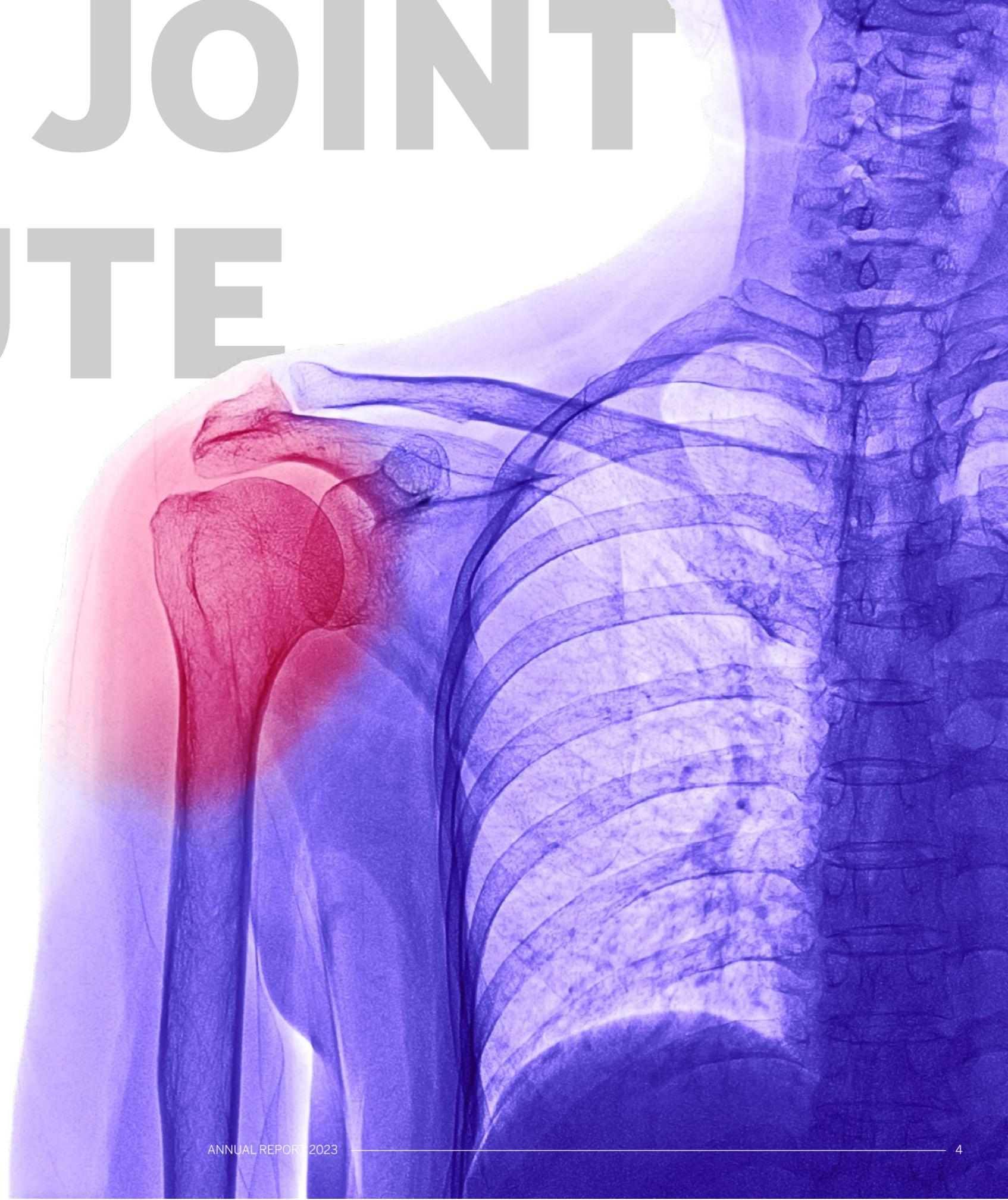
[The Bone and Joint Institute](#) is a catalyst for interdisciplinary research to support the vision of lifelong mobility through musculoskeletal health. We serve our members and partners through activities that promote innovative research ideas, train the next generation of musculoskeletal health researchers, and ensure translation of research across the research community and into patient treatment.

2023 saw the start of several exciting think tanks. BJI think tanks are designed to increase knowledge, enhance research and expand interdisciplinary collaborations. They often lead to submissions of large team grants. This year's think tanks explore four grand MSK challenges: what role do gut microbes play in MSK health? What causes bone health to deteriorate across a person's life? How can we unlock the vast potential of ICES data to improve MSK patient care? How can we lower the global burden of spinal disorders?

Ensuring lifelong mobility requires a broad approach across disciplines. The stories in this year's report are only a small example of the work our members are undertaking. What stands out across these stories are themes of teamwork and the support of new ideas that make a meaningful difference to patients and their communities.

### **Matthew Teeter**

Interim director, Bone and Joint Institute



■ 60

prestigious awards, including 25 Research Chairs, 4 Fellows of the Royal Society of Canada, 5 Distinguished University Professors, and 11 Faculty Scholars

■ 5

faculties are represented through members: Engineering, Health Sciences, Schulich, Science and Social Science

■ 31

technology submissions, plus 6 patents filed and 15 patents issued by BJI members since fiscal year 2019

■ 332

members total, including 140 faculty, 116 trainees, and 76 other members (partners, collaborators and staff)

■ 82\*

new external grants secured totaling nearly \$15M

including 27 new Tri-council grants totaling roughly \$5M; represents 8.7% of total Tri-council funding awarded at Western in 2023

■ 175

publications were co-authored with one or more international scholars across 60 countries/regions with an average category normalized citation impact above the world average at 1.73

■ 396

publications associated with the institute

382 captured in InCites with an average category normalized citation impact of 1.29 times the world average benchmark and citation counts higher than or equal to 34% of the publications in the Web of Science

105 (27.5%) were co-authored by 2 or more BJI members; 212 (55.5%) were open access

■ 769\*

grants held by members (317 internal grants, 452 external grants)

■ 124M\*

in multi-year funding

\*This data does not include grants located at or shared with other institutions or institutes.

## CHALLENGE #1

# HOW CAN WE LOWER THE GLOBAL BURDEN OF SPINAL DISORDERS?



## Empowering research through SPINA, the world's first international database for spine rehabilitation

**To lower the global burden of spinal pain, a team of BJI researchers developed the world's first international spinal rehabilitation registry.**

Diagnosing and treating musculoskeletal (MSK) spinal pain is an international challenge and comes at a great cost to patients and society, particularly if problems become chronic.

Nobody knows this better than BJI members [Alison Rushton](#), Director of Western's School of Physical Therapy, and [David Walton](#), both global leaders in spinal pain diagnosis and treatment. To address the global burden of spinal pain and challenge the status quo of spinal pain rehabilitation research, Rushton, Walton and a team of [Bone and Joint Institute \(BJI\)](#) and [CANSpine](#) researchers developed [SPINA](#), the first international registry to focus on rehabilitation for MSK spinal problems, including neck, mid back or lower back pain.

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***“The BJI think tank has become a vehicle to bring people from different disciplines together and establish a whole new direction of research in spinal pain. It’s allowed us to think big and think long-term.”***

“There are other international spinal registries, but they are all focused on spinal surgery. There is not really anything that looks at spinal pain from a rehabilitation perspective. And there also was not anything in existence that collected the detail of data we need to understand patients’ experiences of spinal pain and how we can use that to really improve our treatment,” said Rushton.

The idea for a rehabilitation-focused database came to life in a [BJI think tank](#), formed in 2022. Now co-led by Rushton and Walton, the think tank has since grown to

18 members from across Schulich, Health Sciences and Engineering. Beyond SPINA, it has become a catalyst for innovation in spinal research, said Rushton: “The BJI think tank has become a vehicle to bring people from different disciplines together and establish a whole new direction of research in spinal pain. It has allowed us to think big and think long-term.”

Thinking big and long-term is the core concept behind the SPINA registry, which is built to collect data over long periods of time and give other researchers the ability to use its data

to drive spinal research forward. Collaboration and inclusivity are the other key principles that guided the registry’s development. The process of developing SPINA, and deciding what kind of data the registry collects, included extensive involvement of patient partners, clinicians, and researchers.

To add data to SPINA, both patients and physiotherapists are invited to enter information into the registry. Once registered, patients fill out an intake questionnaire documenting their experience with spinal pain. After that, they fill out additional

questionnaires at regular intervals to build up a comprehensive data set that follows a patient's journey over time. Clinicians enter data about their patients as well, allowing for a 360-degree view of each patient's journey and experiences with spinal pain rehabilitation.

Although the SPINA database has been operating for less than a year, 120 patients are already registered, along with 17 physiotherapy clinical sites in Canada. Physiotherapy clinics across five provinces have expressed strong interest in joining SPINA, which is why Rushton anticipates a rapid expansion of the database over the next year. Ethical approval for extending SPINA to the UK and Australia is currently underway.

What's more is that two projects – [STARS](#) and [COMPASS](#) – have started investigating treatment for spinal pain using the SPINA registry, seeking to collect and analyze data on up to 1,000 patients.

"For STARS, we are recruiting through the Rapid Access Clinic at Victoria Hospital. Those patients are entering their data into the registry, and our trainees enter physical data as well. So, we have patient data and physical data all in one place, which really helps us with our predictive modeling to look at what factors predict outcome and what groups we should target for treatment," said Rushton. "This is the whole reason for establishing a registry. We want it to lead to impactful projects. We want it to make a difference." And Walton adds: "Our goal is to

make SPINA accessible to anyone who has the expertise, support, and ethical approvals to conduct small and large-scale research to improve the lives of those living with spinal pain."

Building on SPINA's current success, Rushton and Walton have their sight already set on the next ambitious goal: expanding the SPINA registry by adding biomarker data.

*"Biomarkers have the potential to clearly identify the causes of pain and suggest treatments that are personalized to a patient's individual needs."*

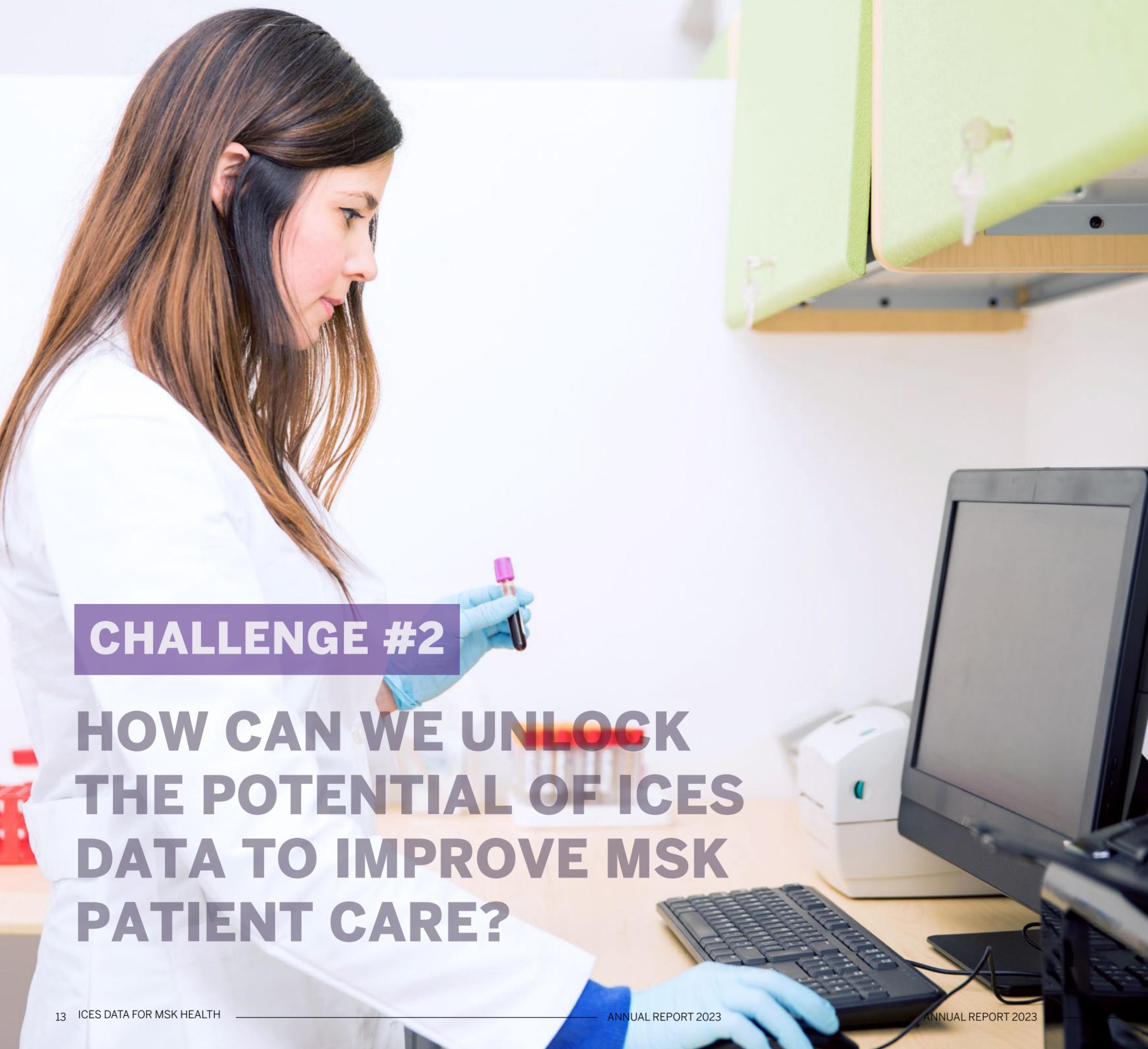
Biomarkers, an umbrella term for objective markers of health, are becoming increasingly important in understanding patient outcomes, pain mechanisms and pain prevention, said Walton: "Pain, whether it's in the spine or elsewhere in the body, often doesn't have a clear marker. Currently, the main way to understand pain is by asking the person about their experience. While self-reporting is crucial for understanding pain and providing patient-centered care, it doesn't give clinicians clear guidance for treatment. Biomarkers have the potential to clearly identify the causes of pain, classify different types of pain more accurately, and

suggest treatments that are personalized to a patient's individual needs."

The BJI think tank is currently looking into funding opportunities that could support storing and collecting biodata of patients in the form of blood, other bodily fluids, tissue samples, or diagnostic images. Western already has several facilities for collecting biomarkers in its various forms, but Rushton and Walton are aiming for a solution that reduces barriers to participation and creates opportunities for collaboration with clinicians and people with lived experiences. "We recognize that only collecting data from participants who are able to travel to campus may not give us a true picture of these markers in the general population," said Walton. "We want to ensure that our research is inclusive and diverse, and that it benefits everyone. One idea we are considering is a 'bio bus' that would bring data collection to different communities. With advances in technology, collecting 'omics' data has become more portable, making this idea feasible."

Walton hopes that biomarker collection could start by the end of this year on a limited scale and ramp up as additional resources become available: "Spinal pain is a major challenge, and it requires an interdisciplinary approach. Our vision for SPINA is to create the world's largest and most comprehensive database of people with spinal pain. This will help researchers from different fields to ask and answer complex questions and reduce the global burden of spinal pain." \*

***"We want to make sure that our research is inclusive and diverse and benefits everyone."***



## CHALLENGE #2

# HOW CAN WE UNLOCK THE POTENTIAL OF ICES DATA TO IMPROVE MSK PATIENT CARE?

## Unraveling ICES health data to improve MSK patient care

**BJI researchers are paving the way for groundbreaking musculoskeletal (MSK) research and improved patient care through data-driven insights.**

The [Institute for Clinical Evaluative Sciences \(ICES\)](#) registry encompasses a vast amount of Ontarians' health data. However, making sense of this data, especially for MSK health issues, poses many challenges. A new strategic [Bone and Joint Institute \(BJI\)](#) initiative, led by an interdisciplinary team of BJI researchers, aims to leverage ICES health data for innovation in MSK research and patient treatment. The initiative includes creating an MSK-focused theme group at ICES, support for new research projects using ICES data and helping researchers learn how to harness its potential.

BJI researcher [Christina Ziebart](#) started working with ICES data during her PhD with her former supervisor [Joy MacDermid](#). She quickly recognized the vast potential large health data sets have for research and innovation in patient care and completed her post-doc to extend her work with ICES data.

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Jamie Fleet is one of the researchers awarded a BJI health data grant.



MSK HEALTH DATA GRANTS COMPETITION

## Exploring challenges in Parkinson’s and osteoporosis treatment through ICES data analysis

To encourage MSK researchers to work on ICES data projects and help them build skills in analyzing ICES data, the BJI launched the Health Data Grants Competition in early 2024.

BJI member and physiatrist [Jamie Fleet](#) was one of the researchers who successfully applied. The grant will pay for her training through the [ICES Faculty Scholar 2.0 Program](#) and provide support for a research project that aims to improve care for people with Parkinson’s disease.

Using ICES data, Fleet and an interdisciplinary team of researchers will look at how patients affected by Parkinson’s and osteoporosis are medicated while keeping an eye on rates of fractures.

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When Western hired her as a professor in Health Sciences’ School of Physical Therapy, she started working with MacDermid and fellow faculty member Jacquelyn Marsh to co-lead a new think tank at the BJI.

“We knew there were people at Western who had used ICES data to put out papers around musculoskeletal health at a health service level. There was some emerging interest, so we decided to bring people together who were working separately on those kinds of issues,” said School of Physical Therapy professor MacDermid. “We started meeting as a think tank to bring forward ideas and we invited ICES staff and leaders to talk to us about ICES health data

– what the data can provide and how that can be useful to MSK research.”

*“To help with all those challenges the BJI launched a competition to encourage people to work with ICES data.”*

[The think tank](#) has meanwhile grown to a group of 22 members from three Western faculties, and one collaborator from the University of Toron-

to. Over the span of only one year, the collaborative work of this BJI think tank has already shown some impressive results.

“Working with ICES data is a very specific type of research and it can be intimidating to dive into it without any training. You need to learn how to ask the right questions to interpret the data, how to fill out data request forms and other paperwork, how to follow privacy policies and regulations, and so on,” said Ziebart. “To help with all those challenges, the BJI launched a competition to specifically encour-

age people to work on research projects that use ICES data and provide help with training.” Since March 2024, BJI’s MSK Health Data Grants have funded interdisciplinary teams with up to \$34,000 over two years to complete new ICES projects on an MSK topic and complete training through the ICES Faculty Scholars 2.0 program.

Another key objective for BJI’s ICES data think tank is to establish an MSK-themed focus group. While there are several research programs within ICES that span a range of topics

“A common medication for osteoporosis is a bisphosphonate. The actual pill is really big, and you have to sit up for half an hour after you take it and drink a lot of water. People with Parkinson’s often have difficulties with swallowing, which means you can’t take those giant pills,” said Fleet.

The goal of the project is to investigate whether people with Parkinson’s and osteoporosis are currently receiving adequate medical treatment. The team will look at ICES data on how often and what kinds of medications these patients use, and how common fractures occur compared to the general population.

*“You don’t have to wait years and years to collect that data and that really speeds up the process of making discoveries that can improve patient care.”*

Having access to the ICES registry is invaluable for this type of research, said Fleet: “If I were to do a smaller study at my hospital, I might get 100 people over a few years, but using ICES, we can look at everyone in Ontario over a twenty-year period very quickly. You don’t have to wait years and years to collect that data and that really speeds up the process of making discoveries that can improve patient care.”

Since March 2024, BJI’s MSK Health Data Grants have funded interdisciplinary teams with up to \$34,000 over two years. Other projects include data analysis on how often people with a spinal cord injury receive screening and treatment for osteoporosis and a study on cost-effectiveness of a healthy lifestyle program. \*

and disciplines, a designated group for MSK health-related issues currently doesn’t exist, said MacDermid: “When you look at ICES, there are different fields or specialty areas, and currently musculoskeletal seems to fall under chronic disease at best. But that’s not a good match because, for example, Tina and I work with fractures, which don’t really fall under chronic disease, but they are musculoskeletal.”

ICES data encompasses health care records for almost 21 million people, but the registry has its limitations.

For example, the registry tracks data connected to a patient’s OHIP ID, such as diagnoses and procedures provided through an Ontario health service. It doesn’t, however, track services outside of the hospital system, such as long-term or rehabilitation through private practices. It also does not have data on patient outcomes like pain, mobility and function.

That said, when combining ICES data with other data outside the registry, such as clinical trial data, that’s when the registry’s superpowers are unleashed, said MacDermid: “Let’s say you are doing a joint replacement clinical trial, and you’re following people for two years. You can ask permission from your patients to integrate their clinical data with their ICES health service data. So, that gives you the ability to see how those patients are faring three to five

***“By taking on this new perspective, we’re unleashing a whole new set of questions that can be answered with a group of people that are now specialized in asking these questions specific to MSK health. And this is...going to help us serve MSK patients better.”***

years down the road, based on their ICES data, and that can lead to really important insights in MSK patient care.”

MacDermid also points out that there is a largely untapped potential to use ICES data to reveal issues around social marginalization, such as gender disparities or the impact of socio-economic status on people’s health. In addition to procedures and diagnoses, the registry also includes data on poverty and social determinants of health that could be leveraged to foster equity in health services.

“When you have that data from everyone coming into the health care system, it allows you to see if there are issues around social differences on a community level,” said MacDermid. “One of my papers looked at the connection between fractures and social marginalization, and it turned out that people who have lower socioeconomic

status tend to have higher rates of fractures. Now, we don’t know why that is. It could be nutrition or social factors, but these kinds of insights can then trigger another study to find out why.”

As for next steps, the team is hoping to secure additional funding to broaden London’s community of ICES specialists with an MSK-focus and increase capacity among Western researchers to work with ICES data.

“By taking on this new perspective, we’re unleashing a whole new set of questions that can be answered with a group of people that are now specialized in asking these questions specific to MSK health,” said Ziebart. “And this is going to improve our knowledge related to MSK concerns in the population, and ultimately it is going to help us serve MSK patients better.” \*

# THE MISSING LINK

## The intriguing connection between gut health and bone strength

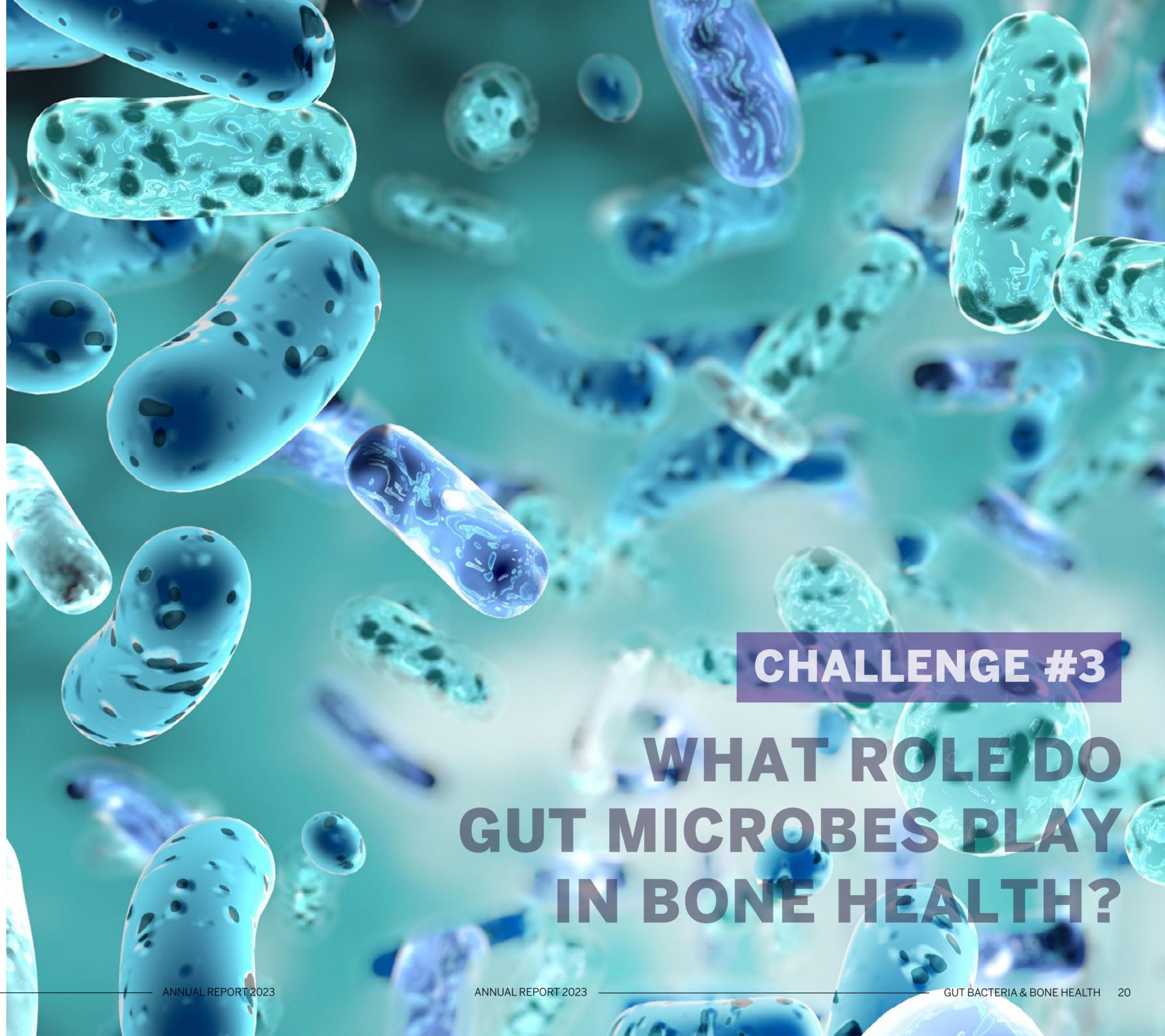
**A new interdisciplinary research initiative aims to investigate the intriguing link between the gut microbiome and musculoskeletal (MSK) conditions and disorders.**

By fostering collaboration across multiple disciplines, a team of BJI researchers aim to unlock the potential of the gut microbiome to improve musculoskeletal health and establish Western University as a global leader in microbiome-MSK research.

“There is currently no cure for MSK conditions,” said [Matthew Teeter](#), interim director of the [Bone and Joint Institute](#). “As the Canadian population grows older, the burden of MSK conditions is expected to increase by 50 per cent by 2050. For those two reasons, it is important that we investigate new avenues to improve management that delays progression of MSK conditions.”

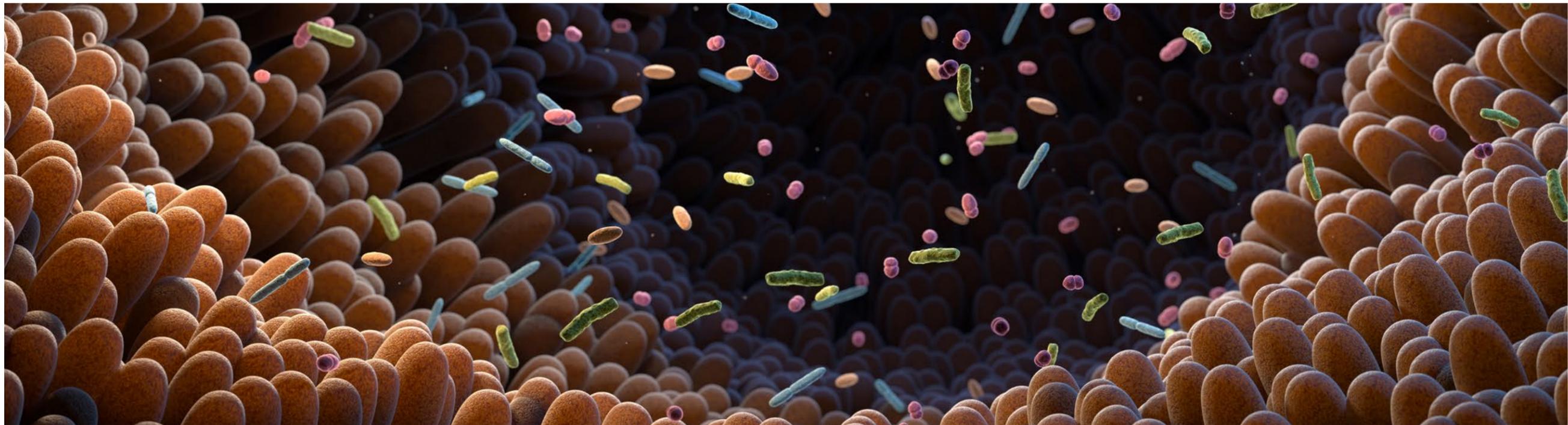
Evidence is mounting that the gut microbiome plays a role in multiple chronic diseases, ranging from irritable bowel syndrome to dementia, and even mental health problems. Recent studies also suggest that the trillions of microbes living in our gut may have a significant impact on bone density and strength.

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## CHALLENGE #3

# WHAT ROLE DO GUT MICROBES PLAY IN BONE HEALTH?



These findings open up new possibilities for understanding and improving preventative and therapeutic strategies against MSK-related disorders. To date, however, this area remains understudied – a fact the Bone and Joint Institute (BJI) would like to change.

“We started discussing this initiative in 2022 as a team focused on orthopaedic infection,” said Schulich’s [Lillian Barra](#), who co-leads the initiative. “We immediately recognized the enormous potential in this area. We have meanwhile held a series of meetings in 2023 and our team has grown to include collabo-

rators from a wide range of disciplines.”

To kick things off, Teeter, Barra and Schulich’s [Jeremy Burton](#) started two new microbiome-MSK clinical trials funded by the [Arthritis Society](#) and the [New Frontiers in Research Fund](#). One trial focuses on fecal microbial transplants and their potential to modulate pathogenic autoimmune responses in rheumatoid arthritis. The other is testing probiotic efficacy on knee replacement outcomes. The trials led to the formation of a diverse team of clinicians, patient partners, industry experts and researchers from across the gamut of

natural, health and social sciences.

Teeter, Barra and Burton are now working on broadening BJI’s gut-bone initiative by facilitating new research collaborations and catalyzing microbiome pilot data related to MSK.

The team’s goals include adding microbiome assessments to MSK studies and initiating new clinical trials testing patient treatments and care that target the gut microbiome. Additional future initiatives could include city-wide symposia, seed funding competitions and a training module on the gut microbiome to in-

crease research capacity in this area.

In addition, the BJI has pledged to prioritize addressing MSK-related equity issues by ensuring that future research projects are inclusive and representative of diverse populations.

Research has shown that social inequities make it more likely for people to be affected by musculoskeletal and metabolic diseases. People facing inequality often don’t have easy access to healthy food and are more likely to suffer from chronic stress. Because of this and other reasons, their gut microbiomes

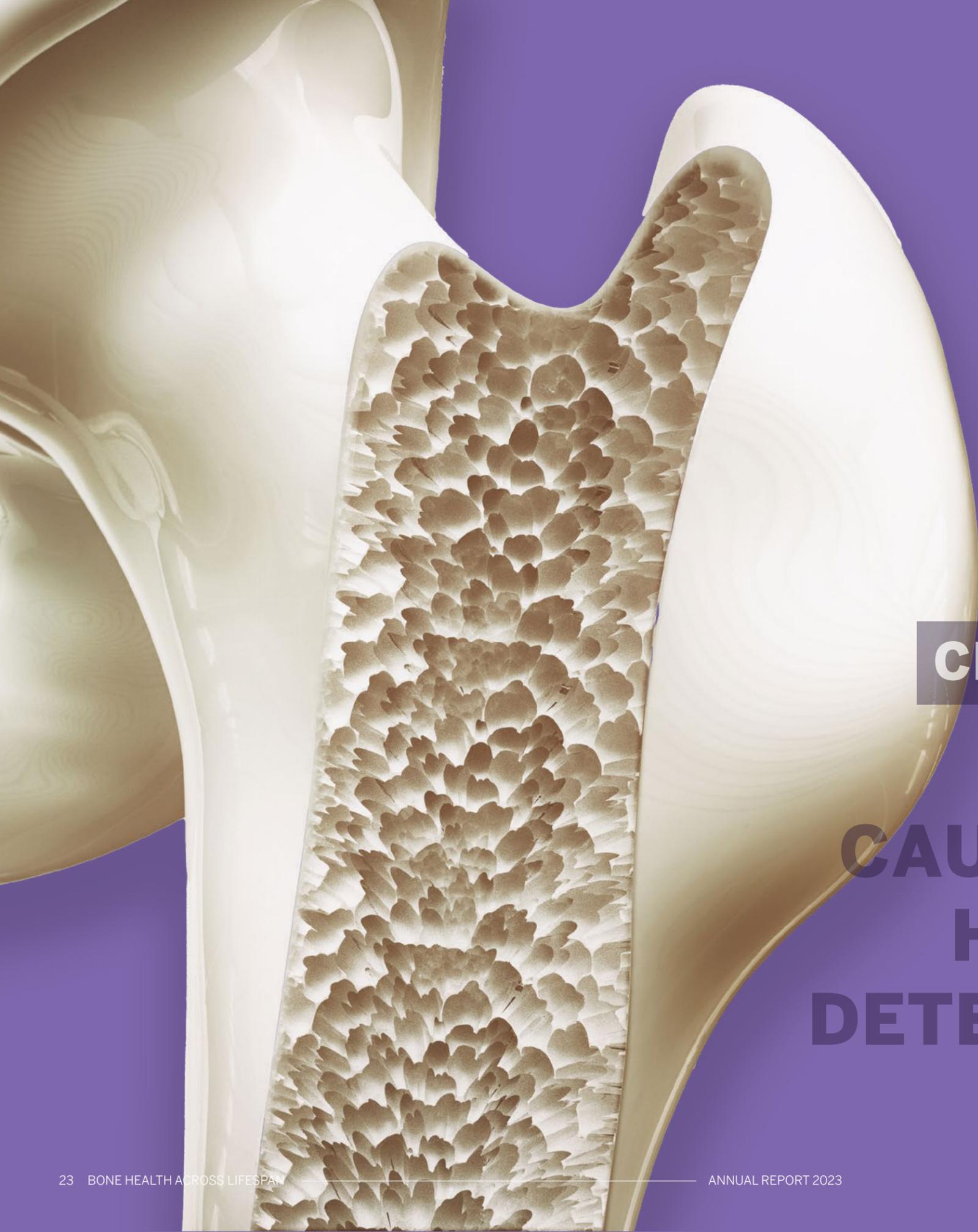
can be less healthy, said Teeter: “Even though we don’t yet know if altering the gut microbiome will affect MSK diseases, we recognize that fairness issues are very important in our work and should guide how we do research.”

*“Western is perfectly positioned to become an international hub for microbial and MSK research.”*

As for next steps, the team is planning to apply for several funding

opportunities to support further research into the mysterious connection between gut and bone health.

“Western is perfectly positioned to become an international hub for microbial and MSK research,” said Teeter. “There is a wealth of local expertise in gut microbiome research and interdisciplinary expertise in MSK-related health here at Western and at our hospital partners. All it takes is for us to find ways to leverage that expertise and we could be on our way to establishing a new way to improve patient outcomes.” ✨



**From cradle  
to grave:  
investigating  
bone health over  
a lifetime**

## **CHALLENGE #4**

# **WHAT CAUSES BONE HEALTH TO DETERIORATE?**

**A new BJI think tank  
is looking into what  
causes bones to  
deteriorate through an  
interdisciplinary lens.**

Late-life bone loss and the risk of fractures from weakened bones affect a large number of Canadians and it comes at a high price. According to research based on the [Canadian Longitudinal Study on Aging](#), bone loss is impacting about 1 in 4 women and 1 in 8 men with an annual cost of over \$4.2 billion Canadian dollars. What's more is that these numbers could be significantly lower, if only we had a firmer understanding of factors and experiences throughout a person's life that lead to brittle bones at a later stage.

That's exactly what the [Bone and Joint Institute's](#) latest [think tank](#) has decided to investigate, taking a highly interdisciplinary approach to what impacts bone health long before it starts to deteriorate.

"The big challenge is that the entire way we deal with this problem in Western biomedicine is backwards. By the time someone clinically presents with low bone mass, it's too late. So, it is something that needs to be considered over an entire lifespan," said biological anthropologist and think tank co-lead [Jay Stock](#). "If we can find some of these key factors, it means earlier intervention that could help people continue to thrive well into their older adult ages."

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Led by Stock and School of Physical Therapy's [Christina Ziebart](#), the think tank has already grown to 28 members since late 2023. Members include researchers from across Western's faculties of health sciences, medicine, engineering and social sciences, as well as clinicians, patient partners and collaborators from two other Ontario universities.

*"We have people in this think tank who specialize in psychosocial stress, poverty or systemic racism. It will be really interesting to see the intersection of those types of lifelong experiences."*

In recent years, there has been a growing realization across the research community that addressing deteriorating bone health requires an interdisciplinary approach and a long-term perspective that extends beyond the typical time frame of research grants, said Stock.

As a first step towards this goal, Ziebart and Stock are planning to compile a list of questions think tank participants would like to explore, diverse views are welcome.

"When you start to bring people together, they will all have their own questions and answers based

on their individual areas of expertise," said Ziebart. "There are so many contributing factors. It truly can go from cradle to grave on these lifestyle influences that we think impact bone health. Starting somewhere is really our big objective on this one." And Stock adds: "I would like to look at lifelong shifts in diets or early life activity and how that impacts bone health. But other members have different questions they are interested in. We have people in this think tank who specialize in psychosocial stress, poverty or systemic racism. It will be really interesting to see the intersection of those types of lifelong experiences."

While the think tank is still in its early stages, Ziebart and Stock already have a long list of ambitious goals. The team has started to apply for grants that could cover access to the [UK Biobank's](#) bone health-related data, designing a social and life history survey, organizing a Southwestern Ontario bone health symposium and a monthly journal club meeting for trainees.

"I like to think of this think tank as an opportunity that comes out of interdisciplinarity. It's an opportunity to have impact with not a lot of effort or funding," said Stock. "Even though the problem itself is of a huge scale, that is beyond the lifetime of any of us, I think just having a broader perspective could lead to some groundbreaking contributions." ✱

**"I like to think of this think tank as an opportunity that comes out of interdisciplinarity. It's an opportunity to have impact with not a lot of effort or funding. Even though the problem itself is of a huge scale, that is beyond the lifetime of any of us, I think just having a broader perspective could lead to some groundbreaking contributions."**



Orthopedic implant infections are often caused by *Staphylococcus* bacteria (pictured here) and are notoriously hard to treat. With the help of a BJI Catalyst Grant, a team of researchers is planning on using CRISPR technology to precisely target and destroy infection-causing bacteria by fighting bacteria with their own weapons.

## In other news

### Celebrating 2023's Grant Winners

## BJI Catalyst Grants

*Our Catalyst Grants spark high-impact interdisciplinary research and empower our members to take an idea and develop it further.*

The BJI Catalyst Grant competition is designed to support interdisciplinary early-stage projects by providing institute members with up to \$30,000 per award in seed funding. The purpose of Catalyst Grants is to foster interdisciplinary collaboration, help members to advance their work and increase the potential for external funding.

In 2019, BJI invested \$260K into nine teams. They went on to secure over \$930K in additional funding, produced at least 5 published papers, 9 papers under development or review, delivered 16 conference presentations, developed one industry partnership and 5 new collaborations with other PIs at Western and beyond.

## Researchers pioneer 3D models of joint lining to advance osteoarthritis research and treatments

**Lauren Flynn**, joint appointed in the Departments of Chemical & Biochemical Engineering and Anatomy & Cell Biology, and Physiology and Pharmacology's **Tom Appleton** are working on a new project that aims to create advanced 3D cell culture models of the synovium, the lining of our joints.

The models will closely resemble real human tissues and can help researchers understand how the synovium changes in osteoarthritis (OA) and ultimately develop new treatments for patients with OA.

"The engineered tissue can help us develop in vitro disease models that we could use to screen potential drugs or small molecule therapeutics that could be applied to prevent or treat osteoarthritis" said Flynn.



*Successfully created engineered tissue using Flynn's cell-assembly approach.*

The 3D models will be created using a patented modular "cell assembly" approach developed in Flynn's lab. The process in-

volves making tiny beads from proteins found in human fat tissue. These beads are then seeded with cells taken from the synovium of patients undergoing joint surgeries. Over the course of eight days, these cells grow and remodel the beads into engineered tissue that looks and acts like real synovium.

The Catalyst Grant funding will help cover the costs of experimenting with building models from human synovium cells and studying how they behave. Flynn and Appleton are also interested in adding macrophages, another type of cell found in the synovium, that plays a role in OA development and progression, to see how they affect the tissue. ✨

## Fighting bacteria with their own weapons

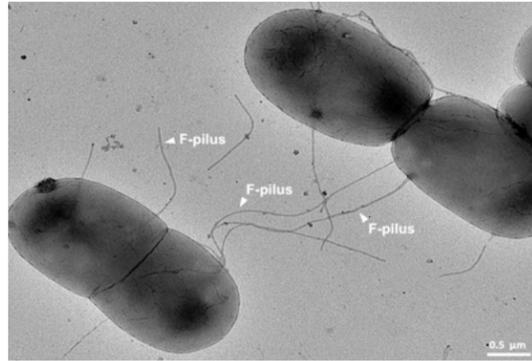
**BJI Catalyst Grant winners Greg Gloor, David Edgell, David Heinrichs, Beth Gillies, David Holdsworth, Matt Teeter and Edward Vasarehelyi** aim to prevent antibiotic-resistant infections by hijacking bacteria's own methods.

Orthopedic implant infections are often caused by *Staphylococcus* bacterial biofilms and are notoriously hard to treat. They are one of the main reasons for implants to fail and result in pain and potentially multiple surgeries for patients.

With the help of the Catalyst Grant, the team is planning on using CRISPR technology to precisely target and destroy infection-causing bacteria. They will do that by leveraging "bacterial conjugation".

Bacterial conjugation, also known as bacterial "sex", is a way by which a bacterial

cell transfers genetic material to another bacterial cell. One of the negative consequences of conjugation is antibiotic resistance: conjugation can spread genes that confer resistance to antibiotics among bacterial populations.



*Escherichia coli* undergoing the process of DNA exchange known as bacterial conjugation.

The team of researchers is planning to turn the tables on harmful bacteria by leveraging this method to achieve the exact opposite: to overcome antimicrobial resistance and ultimately, prevent infections in implant patients.

Using conjugation to manipulate and “improve” bacteria has shown great promise. In biomedical research, conjugation is used to introduce plasmids - small, circular DNA molecule - carrying specific genes into bacterial cells. Its applications range from basic research on gene function and resistance mechanisms to practical uses in drug development, synthetic biology, and vaccine production. \*

## Building a better fall prediction model



Catalyst Grant winners [Janelle Unger](#), [Emily Lalone](#), [Stephen Czarnuch](#), [Jaspreet Bhangu](#) plan to integrate data from wearable technology, clinicians and older adults to develop an AI fall prediction model that surpasses current approaches.

In Canada, falls are the leading cause of injury-related hospitalizations and injury deaths among people aged 65 or older. As the country’s population ages, accurate fall prediction tools become more important to ensure older adults’ quality of life and manage health care costs.

Current fall prediction models are limited and lack input from clinicians and individuals with lived experience. That’s why a team of BJI researchers has set out to develop a better approach that can prevent falls and lead to better care decisions.

The team is planning to use many types of information to develop a fall prediction model that can reliably predict falls in this population. They will leverage new technology, like wearable sensors and artificial intelligence (AI) and gain insights into clinical measures and perspectives from clinicians and older adults at different levels of fall risk. \*

# MSK INNOVATION COMPETITION

## Revolutionizing MSK imaging

**The first prize (\$30,000) in the 2023 MSK Innovation Competition went to three Western students on a mission to improve MSK patients’ quality of life through cutting-edge ultrasound technology.**

*The MSK Innovation Competition is hosted by the BJI and the Morrissette Institute for Entrepreneurship at Western. The competition helps London-based entrepreneurs working in musculoskeletal health to develop their ideas through funding, mentorship and pitch experience.*

Founders of [NovaSonix Healthcare](#) [Carla du Toit](#), [Randa Mudathir](#) and [Megan Hutter](#) developed MSK NovaVue, a revolutionary 3D musculoskeletal ultrasound scanner that is transforming the way we view MSK injuries and diseases.

Conventional ultrasound imaging techniques limit clinicians’ ability to diagnose and monitor MSK-related diseases and their effects. Unlike traditional ultrasound, [MSK NovaVue](#)’s 3-dimensional imaging capabilities allows for intricate visualization of blood flow, inflammation and other soft tissue. A more complete understanding of the affected tissue helps health care providers to visualize and monitor MSK issues and develop treatment plans for patients suffering from MSK issues.

What’s more, NovaVue is compatible with any commercially available ultrasound machine,

and collects 3D and dynamic ultrasound images of any joint, providing clinicians with a comprehensive, inexpensive, and non-invasive tool that fits seamlessly into current workflows to diagnose and monitor musculoskeletal pathologies such as osteoarthritis.

“Winning the MSK Innovation Competition opened many opportunities for us. It allowed us to formally establish and incorporate NovaSonix Healthcare and it funded some of the production for our prototype,” said Du Toit. “We were also provided with amazing advisors who are still helping us to navigate the path of entrepreneurship.”

Building on their success in the MSK Innovation Competition, the team recently won the ORS Business Innovation Competition, further validating the team’s innovative idea. \*



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