Pioneering Solutions for Pain and Limited Mobility

Your impact on the future of orthopedic medicine

2024 Report to Donors

RUSH

Message From the Acting Chairperson

Brian J. Cole, MD, MBA
Acting Chairperson, Department of Orthopaedic Surgery
The Dr. Ralph and Marian C. Falk Professor of Biochemistry

Dear Donor Partner,

Imagine a world without bone and joint pain, where you can enjoy the activities you love with peace of mind. At Rush University Medical Center, we're building it.

Consistently ranked among the top 10 orthopedic programs in the country by *U.S. News & World Report*, Rush has been at the forefront of musculoskeletal research and practice for decades, influencing orthopedic practice and care around the world. **Our more than 50 clinicians and 40 orthopedic scientists work side by side every day to solve painful musculoskeletal conditions and deliver better solutions for patients.**

The research highlights and stories in this report represent some of the most promising paths to groundbreaking treatments for patients. **And they are only possible because of you. Thank you.**

Our donors channel resources to Rush's best and brightest to demystify pain, find better solutions for those living with musculoskeletal conditions, and help all our patients live their best lives.

Donor support enables our diverse teams of scientists and clinician-researchers to investigate some of the most important questions in our field. Our researchers frequently take innovative and creative approaches that lead to new observations — paving the way for breakthroughs. Pilot funding from donors allows our teams to pursue high-risk, high-reward studies that lead to prestigious federal grants to dive even deeper.

Philanthropic investment in our academic endeavors allows us to educate hundreds of trainees who will become tomorrow's thought leaders. Many will return to Rush to establish their own bone and joint practice or lead major scientific investigations because of our reputation for changing the way people think about and practice medicine.

I am proud of our teams' accomplishments and energized by their ongoing projects. I hope you are, too. From all of us involved in Rush's bone and joint programs, thank you for joining us on this path to break boundaries and achieve our vision of a future where everyone can lead active, pain-free lives.

With gratitude,

Brian J. Cole, MD, MBA


EXIT

At Rush, It's Personal

How our drive and commitment advance patient care

Every cell, organ and joint needs to function well for us to live our healthiest lives. In the same ethos, everyone has a role to play in your care at Rush. For many patients, the first person they see when coming to Midwest Orthopaedics at Rush is Ibrahim Benedada, head valet.

"When people first come here, they are in pain," he said. "I tell them, just trust the doctors. They make it personal."

He assures every patient everything is going to be OK. He means it. For nearly 20 years, Benedada has witnessed how clinicians and scientists come together to solve challenges and improve patient care. He has seen how the work of passionate researchers like Catherine Yuh, PhD, junior research faculty member at Rush University, leads to better results.

'Contributing to a greater good'

Dr. Yuh (pictured) remembers how active and fun her grandfather was. He had no trouble keeping up and playing with his grandchildren. She also remembers how drastically things changed when he fell and herniated three discs.

"He became bedridden," she said. "And I saw how difficult it was for my parents to care for him."

The experience became her motivation to find solutions.

For the past decade, Dr. Yuh has been working toward a future unlimited by pain. She started her career as a basic science researcher, working alongside scholars such as Markus Wimmer, PhD, the **Jorge O. Galante, MD, DMSc, Professor of Orthopedic Surgery.**

Now, Dr. Yuh and her team are connecting tissue-level analysis with imaging, motion capture and computer simulation to gain a more comprehensive picture of joint disease — for instance, why the joints of patients with femoroacetabular impingement, or FAI, are shaped the way they are. The hip joints of people with FAI have bony overgrowths that cause abnormal contact of the hip bones leading to pain and tissue damage during movement. Over time, it can result in injuries such as labral tears and, eventually, osteoarthritis.

By looking at more factors together, Dr. Yuh believes the field can determine how they interact and contribute to joint disease and prevent and reduce joint damage and deterioration.

“If we can identify what puts someone at a higher risk of developing severe musculoskeletal diseases like osteoarthritis, we can diagnose them earlier, before those conditions affect your livelihood,” she explained.

“I want to help people regain their ability to move. Even if I never meet them, I will know that something about my work is contributing to a greater good.”

From the lab to global operating suites

Dr. Yuh’s work builds on decades of research pioneered at Rush that have made surgeries like hip and knee replacements less invasive, longer lasting — and more successful. Jeff Levitetz has experienced this shift in orthopedic care firsthand. It's why he has directed his philanthropic support to medical research that’s transforming the field.

Levitetz had his first knee surgery in the 1970s and recalled how painful it was. Between the procedure, the pain and the medications, he remained in the hospital for five days.

Levitetz first came to Rush in the early 2000s. He was not satisfied with a knee replacement he received at a different institution, and techniques for revision surgeries were still evolving. Rush was the only hospital Levitetz found that was willing to work with him. In recent years, he has received same-day procedures at Rush — a stark contrast to the care available in the 1970s.

“I’ve come out better and stronger because of the patient care I’ve received at Rush over the years, and so much of that has to do with research,” he reflected. “I think it speaks for itself.

“Rush did the revision surgery with open arms and gave me a new lease on life. I can’t really describe how appreciative I am of the team at Rush.”

Philanthropy fuels the cycle of research to understand, prevent and treat pain

Benedada and Levitetz give to Rush so our clinicians and scientists can continue finding solutions that preserve joints, reduce pain and restore livelihoods.

“The best part, for me, is when a patient comes out of our doors and says, ‘Ibrahim, I’m done!’” Benedada said. The results patients such as Levitetz see because of research make him proud to be a part of the process.

For his part, Levitetz envisions a future without surgeries like the ones he has had. He believes if anyone is going to achieve it, it will be the surgeons and scientists at Rush.

“I find that the doctors who are really interested in furthering their cause and making their practice better are researchers,” Levitetz said. “And Rush is on the cutting edge. There is no fear in the research they do. Their advancements are driving the future of orthopedic care.”

Scan the QR code to learn more about how research at Rush is transforming orthopedic medicine.

From Microbiology to Health Equity:

Rush Researchers' Trailblazing Studies to Demystify Back Pain

Orthopedic spine specialists at Rush are international experts who have led groundbreaking studies and pioneered techniques to advance our understanding and treatment of spine-related conditions. From examining the relationship between gut health and chronic pain to exploring how where we live influences low back pain, they're continuing to reimagine how we improve spinal health.

Our guts are full of bacteria, fungi, viruses and other microorganisms, good and bad. They interact with each other to perform processes such as digestion and protect us from potentially dangerous organisms. A healthy gut means a healthy you.

Over the last few decades, this complex system — or microbiome — has been of increasing interest to scientists. We've learned that when the healthy, resident bacteria in our gut are compromised, our entire immune system is affected. These changes in healthy bacteria have been associated with common chronic diseases such as asthma, obesity, diabetes and even some neurological conditions.

So, what does gut health have to do with disc degeneration and low back pain?

A multidisciplinary team of Rush scientists and clinicians set out to answer this question to better understand spondylolisthesis, or "slipped vertebrae." Spondylolisthesis occurs when a vertebra — most commonly in the lower back — "slips" forward or backward out of place in relation to the vertebrae above and below it.

Their study included 33 people over age 50, 12 of whom did not have lumbar degenerative spondylolisthesis and 21 who did. The individuals with spondylolisthesis had higher levels of pro-inflammatory bacteria in their gut.

Their findings are direction-setting for the field, which is still exploring the full extent of the relationship between spine and gut health.

"This discovery significantly broadens our understanding of spinal degeneration that can oftentimes be debilitating," said **Dino Samartzis, DSc**, a professor in the Department of Orthopaedic Surgery at Rush and the study's primary investigator. "A healthy gut may translate into a healthy and pain-free spine, and that work opens up new possibilities for new, personalized treatment options."

Identifying and understanding the root causes of low back pain

This study isn't the only one at Rush breaking boundaries. Rush molecular biologist **Ana Chee, PhD**, and geneticist **Chundo Oh, PhD**, were the first to apply "spatial transcriptomics" to spine-related conditions. This genre-bending method uses genetic sequencing and spatial analysis to map different cell types to specific areas of tissues. This data gives scientists a more comprehensive understanding of how cells are situated with each other, their relationships to one another and how they interact.

"I cannot overstate the significance of this achievement," Dr. Oh said. "It opens new avenues for understanding the spatial and molecular dynamics within degenerating discs to better understand, for instance, why a disc may be painful or not or why it responds to certain treatments."

Dr. Chee is expanding on this approach to improve our understanding of how T cells — which help fight infection — contribute to inflammation that

leads to chronic lower back pain.

"We can use spatial transcriptome data to characterize the T cells present in inflamed areas of the tissue and the pathways that lead to inflammation," she explained. "Ultimately, understanding the microenvironment of a patient's diseased disc tissue will allow us to design more personalized approaches to manage back pain and improve spine health."

How social factors affect spine health

Understanding the molecular pathways behind back pain and disc degeneration, among other conditions, is only one part of the equation.

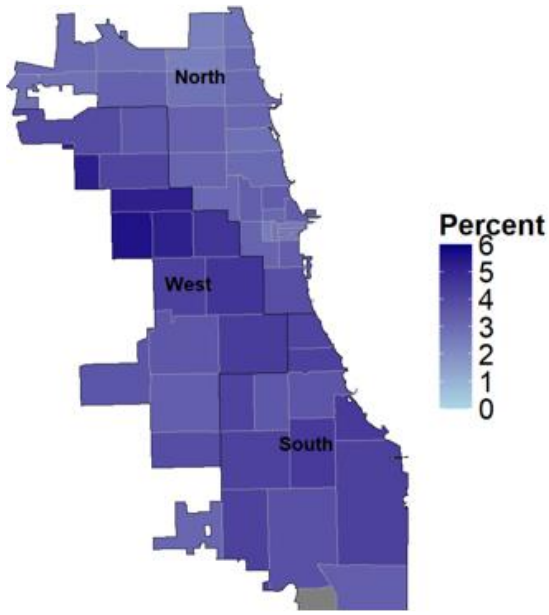
Rush researchers are also examining how social factors and where we live might predict chronic pain, and what we can do to improve health equity. Health equity is the principle that everyone should have a just opportunity to be as healthy as possible.

Assistant Professor John T. Martin, PhD, has directed several studies looking at what factors influence spine disease. Their results are just scratching the surface.

"Our research suggests lower back pain is higher on the South and West Sides of Chicago," he said. "Place clearly affects your risk."

The research team also found that socioeconomic status, mental health, nutrition and pain intensity were more influential than traditional factors like age, sex and body mass index.

Understanding the factors that predispose someone to chronic low back pain can help policymakers and health care leaders deploy resources to areas disproportionally affected by musculoskeletal conditions. This can improve access to pain management, mobility and overall quality of life.



The map above shows the prevalence of low back pain by ZIP code in Chicago. John T. Martin's research suggests that neighborhoods with a higher proportion of white residents and higher levels of education have a lower prevalence of back pain. Areas with higher rates of heart disease and opioid-related ED visits are associated with more pain.

The role of mental health in pain and healing

Rush researchers and clinicians have also discovered there may be a link between anxiety and post-operative outcomes after a cervical disc replacement, or CDR.

Previous research looked at mental health *before* these surgeries, but Kern Singh, MD, and his research team wanted to know more about patients' mental health *after* surgery. They learned that mental health, especially anxiety, may play a significant role in healing from CDR.

"Patients with higher anxiety levels may experience more pronounced limitations in physical function and increased pain and disability," Dr. Singh explained. "These results show the importance of addressing mental health throughout the care journey of patients undergoing CDR."

2024 Rush Orthopaedics Journal

*Every year, the Department of Orthopaedic Surgery publishes the **Rush Orthopaedics Journal**, which offers a glimpse into the exceptional care and groundbreaking research being done at Rush. Below are selected highlights from the journal. You can learn more about these and other studies from our faculty by scanning the QR code to the right.*

Repeat Shoulder Dislocations Associated With Revision Labral Repair

Brian Forsythe, MD
Associate Professor of Orthopaedic Surgery, Rush University

Shoulder dislocations in young athletes are common, but many patients put off surgery, even though early surgical intervention reduces the risk of future dislocations and joint damage. A study led by Dr. Forsythe found that patients with multiple shoulder dislocations were more than twice as likely to require revision labral repair. His team's work will help surgeons provide better advice to young athletes so they can maintain their active lifestyles.

Tibial Tubercle Osteotomy Accuracy: How Can We Improve?

Adam Yanke, MD, PhD
Co-Director, Cartilage Restoration Center at Rush
Associate Professor of Orthopaedic Surgery, Rush University

Tibial tubercle osteotomy is an important surgical procedure to treat patella-femoral pain and dysfunction and arthritis. While they are successful, surgeons are not always as accurate with their incisions as they plan to be. Using a cadaveric model, Dr. Yanke and his colleagues are testing how 3D guides that match each patient's unique anatomy could improve the accuracy of their incisions, which would translate to reduced operative times and fewer complications.

In Total Knee Arthroplasty, Surgical Technique Matters More than Implant Choice

Vasili Karas, MD, MS
Assistant Professor of Orthopaedic Surgery, Rush University

One in 10 people who undergo a knee replacement aren't satisfied with their outcomes, usually because of decreased range of motion. Dr. Karas and his team wanted to know how implant design and robotics-assisted techniques affect this outcome. Based on their analysis, the implant doesn't make a difference. Rather, their results suggest the techniques used can improve patients' ability to be active and have improved outcomes across the board.

Protecting and Preserving Our Joints

Spotlight on Osteoarthritis and Joint Reconstruction Research

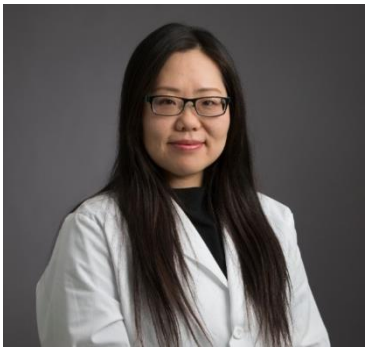
Research holds the key to unlocking the secrets of joint pain. Rush physician-researchers are using a gene-editing tool to identify new treatments for osteoarthritis, testing an antibody that could prevent and treat a rare but devastating post-surgical infection, and investigating safer alternatives to opioids. Our long history of discovery is only possible because of your support.

"At Rush, we've been able to start with smaller philanthropic funds and turn them into large federal grants," said Lan Zhao, PhD. "That's always our goal: Get that return on investment, so we can really advance projects and patient care."

Craig Della Valle, MD

Associate Professor, Department of Orthopaedic Surgery

Physician-researchers at Rush have pioneered studies in recent years to apply scientific evidence to the search for alternatives to opioids in orthopedic care. Dr. Della Valle and his team, led by Anne DeBenedetti, MSc, director of research, are assessing the efficacy of the antidepressant medication duloxetine in reducing patients' pain, improving sleep and minimizing the need for opioids after total knee replacement. So far, their results suggest duloxetine makes people feel more comfortable. Participants also reported greater knee function six weeks after surgery. These findings continue to create momentum in their work to reduce opioid use in orthopedic medicine.



Lan Zhao, PhD

Assistant Professor, Department of Orthopaedic Surgery

Osteoarthritis, a painful and debilitating joint disease, affects about 33 million adults in the U.S. Research led by Dr. Zhao underscores the potential of the gene-editing tool CRISPR to modify patients' stem cells, which can be transformed into different types of cells such as cartilage. Using CRISPR, Rush researchers discovered that inhibiting certain genes has the potential to reduce joint pain and improve joint structure in osteoarthritis. The team's findings also suggest stem cells can be modified to protect cartilage, reduce inflammation and decrease pain. The research holds promise for the development of innovative treatments and offers hope for the future of arthritis care.

Markus Wimmer, PhD

Jorge O. Galante, MD, DMSc, Professor of Orthopedic Surgery

Periprosthetic joint infection, or PJI, is a rare but devastating complication for 1-2% of the approximately 1 million people who undergo hip and knee replacement surgery each year. Current treatment methods, including surgery and long-term antibiotic use, can have high failure rates. Potential outcomes include amputation and death. The formation of a bacterial biofilm in PJI makes it highly resistant to antibiotics. Building on research that has shown promise in the treatment of other infections, Dr. Wimmer and his team are testing a biofilm-disrupting antibody, which — when combined with antibiotic treatment — could prevent and more effectively treat PJI.

Honoring the Career of Howard S. An, MD

2023 Wiltse Lifetime Achievement Award Recipient

Last year, **Howard D. An, MD,** The **Morton International Professor of Orthopaedic Surgery** and **director of the Spine Fellowship Program,** was recognized by his peers with one of the most prestigious awards in the spinal field. The Wiltse Lifetime Achievement Award celebrates clinicians and scientists who have made significant contributions to the field and advanced our understanding and care of spine diseases.

Dr. An is a fitting recipient. A renowned spine surgeon and prolific researcher, his findings have led to better diagnostics, surgical techniques and treatments for spinal stenosis, scoliosis, intervertebral disc degeneration, low back pain and other spinal issues.

For instance, his innovative studies advanced our understanding of the role cytokines, the proteins that control inflammation in our bodies, play in disc degeneration.

An educator and mentor

While retired from clinical practice, Dr. An's legacy is underscored by the fellows, students and research mentees who have had an impact in the field, too. Dr. An has directed several spine surgery fellowship programs and trained more than 90 spine fellows and 50 visiting researchers. He has mentored over 200 early-career researchers.

Expanding on his passion to train the next generation of spine experts, Dr. An cofounded and codirected the Rush International Spine Education program, the world's first international blended learning program recognized by an academic institution. The program fills an important gap in orthopedic training, educating aspiring and current spine specialists in underrepresented regions of the world. To date, the program has reached specialists in more than 40 countries.

The path to Rush

Dr. An completed his medical studies at what was formerly known as Medical College of Ohio. He pursued his orthopedic surgery residency at the same institution. Afterward, he relocated to Philadelphia, where he completed one of the most prestigious spine surgery fellowships in the United States at the Rothman Orthopaedic Institute at Thomas Jefferson University.

After a stint at the Medical College of Wisconsin, Dr. An joined the faculty at Rush in 1997. Additionally, Dr. An serves as the spine specialist for the Chicago Bulls, Chicago White Sox, Joffrey Ballet and other sports teams.

To honor the life and career of Dr. An, Rush has launched the **Dr. Howard An Fund for Spine Research.** The fund will support and advance orthopedic spine research.

Bone and Joint Briefs

Celebrating Successes in the Field

A Record-Breaking Chicago Sports Summit

Leaders from professional and college sports organizations and experts in the business of athletics and sports medicine, gathered on Oct. 8, 2024, for the eighth annual Chicago Sports Summit, led by **Brian Cole, MD, MBA**, and hosted by Midwest Orthopaedics at Rush.

With more than 350 attendees and two dozen sponsors, the event raised a record-breaking $125,000 for research.

Rush Leadership in Research and Education on Full Display at Academic Conferences

Rush faculty and students and their research have been well-represented on the national stage this year. At the American Academy of Orthopaedic Surgeons' Annual Meeting, Rush won best research for the ongoing duloxetine study mentioned on page 9.

Meanwhile, joint preservation and cartilage restoration researchers released 115 publications that are helping optimize cartilage transplantation as an alternative to joint replacement. The department finished its busy year at the American Association of Hip and Knee Surgeons Meeting, where 10 studies were presented.

Joshua J. Jacobs, MD, Receives Multiple Awards

Joshua J. Jacobs, MD, Grainger Director of the Rush Arthritis and Orthopaedics Institute and chair emeritus of the Department of Orthopaedic Surgery, has been recognized by his peers as a globally influential figure in orthopedic research, care, leadership and education.

This past year, Dr. Jacobs was awarded the American Academy of Orthopaedic Surgeons' Leadership Award as well as the 2024 Association of Bone and Joint Surgeons' Nicolas Andry Lifetime Achievement Award.

Over the past 40 years, Dr. Jacobs' contributions have improved the performance of hip and knee replacements and the diversity of the field. He has served in multiple leadership roles at Rush to build the institution's research enterprise and train the next generation of orthopedic surgeons.

"During his tenure as chairman, the number of research faculty doubled, and federal funding for joint research ranks No. 2 in the nation," said **Hannah J. Lundberg, PhD**, associate professor in the Department of Orthopaedic Surgery. "Dr. Jacobs is a true clinician-scientist and advocate for both clinical and basic science research."

Joshua J. Jacobs, right, receives the 2024 Association of Bone and Joint Surgeons' Nicolas Andry Lifetime Achievement Award from Matthew Dobbs, MD, immediate past president of the association. Dr. Jacobs has been a dedicated leader and passionate practitioner for over 40 years.

To make a gift, arrange a tour of Rush's bone and joint laboratories, or learn more about how you can support research that transforms orthopedic care around the world, contact:

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Without Boundaries

The **RUSH** Campaign

Rush University System for Health aims to eliminate the boundaries in health care preventing you from living your healthiest life. As a supporter of bone and joint research at Rush, you are a critical partner in achieving our broader philanthropic vision.

Learn how your gift helps transcend boundaries by scanning the QR code: