

2017

# ANNUAL UPDATE



STEADMAN PHILIPPON RESEARCH INSTITUTE

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# THANK YOU

## Defining the future of medicine

**S**taying active isn't just critical to physical health—it also impacts the overall quality of our lives.

With your support, Steadman Philippon Research Institute (SPRI) has been devoted to keeping people active through groundbreaking research. Our scientists are dedicated to understanding the causes of orthopaedic disorders and how to prevent them. In fact, their research in 2017 led to innovative treatments that have the potential to dramatically improve patient care.

Because of you, we've made significant strides in advancing new ideas and discoveries that will help patients heal better and faster.

Thank you for investing in SPRI. Your gifts make a huge difference in the health and well-being of people all over the world.



# YEAR IN REVIEW

## Dear Friends,

On behalf of everyone at Steadman Philippon Research Institute (SPRI), we want to thank you for your continued support. This past year has seen expansive growth for SPRI, and we are excited to share some key highlights from each of our departments in this report.

As you know, the beginning of 2017 marked a tremendous change for both Steadman Philippon Research Institute and The Steadman Clinic in moving into our new, state-of-the-art facilities. A part of SPRI's expansion, the Biomotion Lab is now fully operational, applying the most comprehensive combination of innovative technology to assess musculo-skeletal function. The lab has initiated clinical studies and we're looking forward to seeing the discoveries made by the Biomedical Engineering team.

Building off of 30 years of patient data, the Center for Outcomes-Based Orthopaedic Research (COOR) had its most productive publishing year in SPRI's history in 2017. This includes 59 pubmed-indexed studies, featuring 26 studies from our doctors' outcomes. In addition to this publication record, COOR also published 19 studies in its top target journals, including *The American Journal of Sports Medicine*, which is the highest impact journal for orthopaedic sports medicine. This reinforces SPRI's extensive reach with the work being performed.

*The Journal of Bone and Joint Surgery* published ten-year outcomes for Dr. Philippon's femoroacetabular impingement (FAI) hip arthroscopy patients in 2017, validating his pioneering work in hip arthroscopy. This landmark study reported on patients with excellent outcomes from their treatments, proving that proper patient selection leads to hip arthroscopy success, as stated in a response to the article from Dr. Marc Swiontkowski, *JBJS* Editor-in-Chief.

In 2017, the Center for Regenerative Sports Medicine (CRSM) continued to expand its orthobiologics and anti-aging work, initiating seven philanthropically funded projects and earning six Orthopaedic Research Society awards. The Center launched an industrial partnership to continue important research into the basic biology of stem cells and how they can be used in different applications. CRSM's imperative work in stem cell research and orthobiologics ties closely with the treatments being developed at The Steadman Clinic, an exemplary model of the bench-to-bedside focus of SPRI's research.

We're proud to share that 2017 was a record financial year for SPRI, both in terms of budget and philanthropy. In 2017,

SPRI garnered more support from donors than ever before, invigorating our philanthropic efforts.

Our noble tradition of collaboration was celebrated with our two major events—the Inaugural Injury Prevention Symposium in January (in partnership with the United States Olympic Committee) and Third Annual Vail Scientific Summit in August. These conferences were focused on advancing science, health care and injury prevention, and were well-attended by industry professionals, scientists, clinicians and students.

For the first time since its founding in 1894, the International Olympic Center (IOC) has selected the United States as a research center, joining nine other nations across the world. Amongst all of the research institutes in the United States, SPRI was chosen to join the first U.S. Coalition for the Prevention of Illness and Injury in Sport. We are proud of this great honor for SPRI.

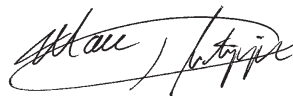
The work that we're doing at SPRI would not be possible without the tremendous support of individuals like you. On behalf of our dedicated trustees and researchers, we wish to thank you for your commitment to Steadman Philippon Research Institute. We appreciate your continued support and look forward to updating you on the innovative advancements happening each day at SPRI.

Thank you for making a difference.

With Gratitude,



J. Richard Steadman, MD, Co-Chairman



Marc J. Philippon, MD, Co-Chairman



Dan Drawbaugh, Chief Executive Officer and President



Johnny Huard, PhD, Chief Scientific Officer



## BEST PREVENTION FOR HIP REPLACEMENT

10-year study shows arthroscopy produces excellent outcomes

*Dr. Marc Philippon, center, performs an arthroscopic procedure on a patient.*

At SPRI, our team strongly believes that in the right patient, joint preservation—not replacement—is the best solution.

### Which is better—labral debridement or repair?

Thanks to benefactor support, we just released a 10-year research project that reaffirms this conviction.

The study involved 145 patients who had arthroscopy to treat femoroacetabular impingement (FAI). FAI is a defect in the hip joint caused by extra bone on the pelvis and thigh bone around the hip joint. This can cause bones to rub, triggering pain and injury.

Half of the test group in the study had hip labral repair. The others had labral debridement—the removal of frayed and loose cartilage in the hip socket. Both arthroscopic procedures are designed to reduce hip pain, improve function and reduce the need for total hip replacement.

For 10 years, staff in our Center for Outcomes-Based Orthopaedic Research (COOR) followed the progress of the study's participants. They collected data regarding patients' symptoms, pain levels and range of motion.

SPRI's 10-year hip study was published in *The Journal of Bone and Joint Surgery*.

### Arthroscopy leads to years of healthy hips

Their findings? Both surgeries produced significant improvements in patient outcomes and satisfaction. In fact, all participants, regardless of which procedure they had, reported excellent hip function and little pain.

Our study also confirmed previous research by identifying patients who may not fare as well after hip arthroscopy, including patients with hip arthritis or patients of advanced age.

“By validating less invasive procedures, our study should help minimize the need for patients to subject themselves to the high costs and recovery times of total hip replacement,” says Marc Philippon, MD, SPRI's co-chair, managing partner of The Steadman Clinic, and pioneer of hip arthroscopy. “It's a great feeling to know we're on the right track and that what we are doing is helping our patients, and that they are happy with their results.”

### Improving FAI treatment worldwide

With 10 years of proof, we're now sharing our findings around the globe. Doctors everywhere can use these evidence-based procedures to make well-informed decisions about treating FAI. This information will also help patients take charge of their health.

## EYE TO THE FUTURE

New tool predicts long-term recovery after shoulder surgery

How long will it take me to recover? How long will my shoulder repair last? These are questions patients commonly ask before having rotator cuff surgery.

But now, people considering this procedure can get a sneak peek into the future—thanks to a first-of-its-kind study. This research enables surgeons to predict patients' probable outcomes after arthroscopy.

Scientists in our Center for Outcomes-Based Orthopaedic Research (COOR) designed the model that makes this possible. They've even converted it into an easy-to-use app.

“Predictive modeling is a powerful tool to translate existing patient data into informed guesses for future patients,” says Peter Millett, MD, Steadman Clinic surgeon and principal investigator of the study. “Data from the large cohort of previous shoulder surgery patients allows us to develop these models.”

### Most comprehensive shoulder research enhances care

COOR scientists analyzed data from over 500 of Dr. Millett's patients who had rotator cuff repair between 2005 and 2014. The group included many types of patients with varied levels of joint damage.

The team gathered pre- and post-op data on 12 variables, including age, injury details and imaging results. Participants were followed for at least two years after surgery, and the vast majority achieved superb outcomes with only a few requiring further surgical care.

### Sharing innovation via app

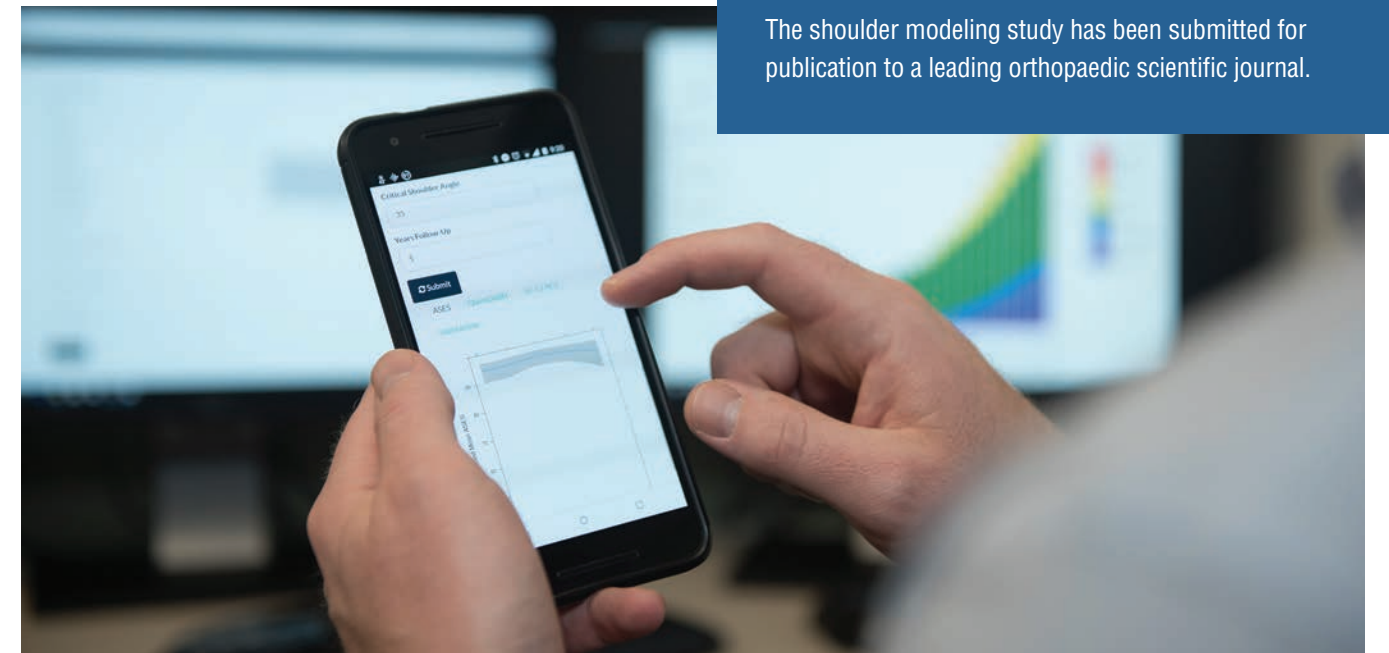
Grant Dornan, COOR director, and his team built the modeling app based on the study's rigorous science.

Clinicians can simply enter key patient data into the model on their cell phone—right in the clinic. In seconds, patients and their doctors will have a preview of the patient's likely recovery. This information should also improve patient selection and education.

The app is now available on the cloud. Physicians anywhere in the world can access it. Over the next 12 months, practitioners will test the app in clinical settings to provide feedback for validating the models and fine-tuning the app.

“This tool will be incredibly helpful because we'll be more able to understand and predict a patient's outcome after surgery,” says Dr. Millett. “It will enhance patient care to levels not previously available.”

The shoulder modeling study has been submitted for publication to a leading orthopaedic scientific journal.



*The custom app uses outcomes data to predict patient recovery after surgery.*

# STANDING THE TEST OF TIME

## Data spanning 20 years proves ACL reconstruction lasts

You know it's quality when something lasts 20 years. Research from the Center for Outcomes-Based Orthopaedic Research (COOR) confirmed Dr. J. Richard Steadman, co-chair of SPRI and founder of The Steadman Clinic, did quality work.

In the 1990s, the prevailing thought was that people over age 40 were too old to have ACL reconstruction. Most doctors simply told them to modify their activity instead. But Dr. Steadman disagreed. He didn't believe a person's age should be a consideration for having ACL repair.

### Two decades of evidence

The purpose of this study was to determine the lasting power of ACL reconstruction in people 40 and older.

The team studied outcomes data for over 20 years from 77 of Dr. Steadman's patients who had ACL reconstruction between 1984 and 1993. The mean age of participants was 44 years at the time of surgery, with some patients as old as 65.

### Data reveals excellent outcomes

Of the 77 people in the study, more than 98 percent reported excellent results 10 years after surgery. At 20 years post-surgery, 84 percent said their ACLs were doing well. These patients also had high function and activity levels, and reported high patient satisfaction. In fact, their median score was 10 on a 10-point scale. Only 19 of the 77 patients had to eventually have a total knee replacement.

The conclusion: People who have ACL reconstruction at age 40 or older can expect to return to activity and have good function in their knees for 20 years. It also showed these patients may have delayed total knee replacement indefinitely.

"Having 20 years of data on one procedure conducted by a single surgeon is unheard of," says Karen Briggs, director of hip research. "This study provides a unique snapshot of what people can expect 20 years after ACL reconstruction."

# BEST GETS EVEN BETTER

## Research shows microspheres advance cartilage repair



Dr. Sudheer Ravuri works in the state-of-the-art Center for Regenerative Sports Medicine laboratory.

### Study yields groundbreaking results

Combining the two group's strengths led to some amazing discoveries. The scientists found the microspheres process can eliminate detrimental factors in the blood that impede healing. This means using microsphere therapy with microfracture surgery should help cartilage heal and repair much faster than with surgery alone.

"This research is leading the scientific community," says Dr. Sudheer Ravuri, deputy director, Center for Regenerative Sports Medicine (CRSM). "It lays the foundation for taking microfracture to the next level."

Dr. J. Richard Steadman, co-chair of Steadman Philippon Research Institute and founder of The Steadman Clinic, introduced microfracture knee surgery over 20 years ago. Since then, it's become the best practice for knee repair.

Today, researchers at SPRI and the University of Wisconsin are building on Dr. Steadman's work with a study using microspheres to aid cartilage growth in knees.

### Collaboration combines unique expertise

Microspheres are small particles made of synthetic polymer that can be filled with proteins or drugs for sustained release. This groundbreaking research involves a new concept called biomimetic microspheres, which are synthetic. Pioneers in microsphere technology, the University of Wisconsin scientists produce the biomimetic microspheres, which contain soft peptides.

After production, the microspheres are sent to SPRI, where our team tests them in a model consisting of muscle-derived stem cells and human umbilical vein cells. As the cells transform and multiply in a petri dish, the microspheres bond to them and regulate cellular changes.

### New perspective enhances approach to care

The CRSM team continues to conduct this vital research on microsphere therapy, both looking ahead toward the potential applications in orthopaedic procedures and looking back at the legacy of techniques pioneered by The Steadman Clinic's physicians and validated through SPRI.



The microsphere study was presented at the 2018 Orthopaedic Research Society meeting.

"Everything we do relates back to the patient," says Dr. Johnny Huard, SPRI chief scientific officer and director of CRSM, "which gives our work in CRSM tremendous purpose. Microsphere therapy can make a remarkable impact, and we're excited to be on the forefront of these discoveries."

With the goal of translating this therapy into patients, SPRI will endeavor to conduct clinical trials and seek FDA approval for the treatment.

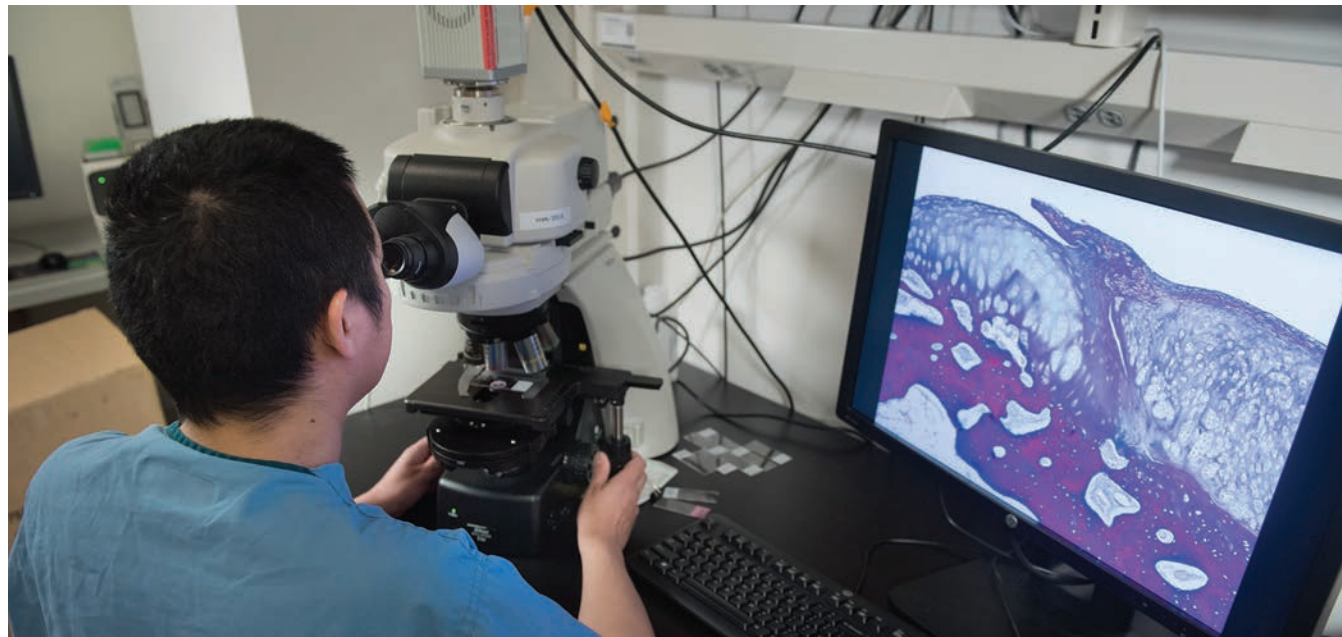
EVEN 20 YEARS  
AFTER ACL REPAIR,

84%

of the study's participants  
REMAINED HIGHLY ACTIVE.



Dr. Steadman, now retired, performing ACL repair in the operating room.



## LOOKING AT THINGS IN A NEW WAY

### Cancer drug restores healthy joints

*International Scholar Dr. Jimmy Utsunomiya examines slides in the Center for Regenerative Sports Medicine laboratory.*

Does something made for one purpose work for something else? That's what researchers in our Center for Regenerative Sports Medicine (CRSM) wanted to find out. They explored whether Avastin, a cancer drug, could promote healing in orthopaedic applications. Guess what? It does.

#### Enhancing cartilage regeneration

Knowing that the FDA-approved cancer drug eliminates growth factors in the tissue repair process—Avastin is used to prevent cancer from returning—Dr. Johnny Huard, SPRI's chief scientific officer and director of CRSM, and his team decided to explore what would happen when the drug is applied to joints. The team was thrilled to discover that the drug blocked the factor that hampers cartilage growth. They validated these findings in animal models with knee defects.

#### Strengthening microfracture technique

After such promising initial research, the team is now looking at whether infusing Avastin with microspheres could produce even better outcomes. To do so, a concentrate would be injected into the injured knees of several animal models to see what would happen.

This technique of using Avastin could promote healing because the microsphere technology employs a sustained drug release. But the team will still need to determine if taking the drug alone or through the microsphere process boosts healing the most.

"Avastin has the potential to create the next generation of microfracture technique," says Dr. Sudheer Ravuri, deputy director, CRSM. In using the drug, physicians could help accelerate healing after a surgical procedure.

#### Looking to the future

Upon discovering that Avastin can effectively heal joints by regulating the blood supply to improve cartilage repair, the team will look to using larger animal models to further test the effects of the new therapy.

In the meantime, Avastin could be translated to the clinic to help patients enhance their healing after a surgery, like microfracture. "We discovered the drug heals different types of tissues," says Dr. Huard. "This finding will enable physicians to select the best treatment for different types of injuries. Everyone wins."

## FREEZING FOR THE FUTURE

What if you were able to freeze your own platelet-rich plasma for future use?

Science has long recognized the healing power of platelet-rich plasma (PRP). But there's a drawback. There is not a storage solution to maintain PRP's biological activity; therefore, patients are treated with PRP within 24 hours.

SPRI's Center for Regenerative Sports Medicine (CRSM) researchers weren't satisfied with the 24-hour limitation.

#### Researchers working to store platelet-rich plasma

"We know that there is a way to store PRP safely for future use," says Dr. Johnny Huard, SPRI's chief scientific officer and director of CRSM. "Freezing PRP just seemed the most logical method."

With benefactor support, the team of researchers at SPRI began by drawing blood samples from 25 healthy donors. From these samples, they prepared two different types of PRP that are used for specific musculoskeletal indications. Leukocyte-rich PRP consists of elevated white blood cells, which have proven to successfully treat damaged soft tissue. Leukocyte-poor PRP contains fewer white blood cells, making it most effective as a treatment for joint injury.

The biological factors in the two PRP preparations were analyzed and the rest of the samples were frozen and stored at -80 degrees Celsius. The frozen PRP samples were tested at various time points to determine whether freezing truly had an impact on the biological factors in the two PRP preparations.

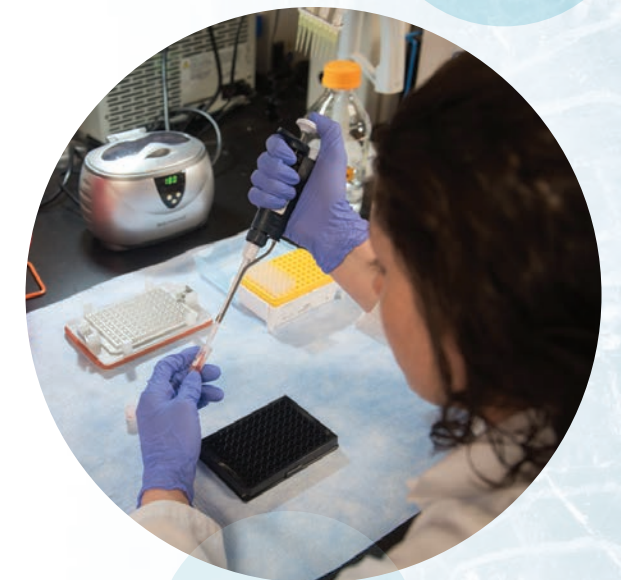
#### Patient benefits

The ability to freeze PRP would allow people to bank their PRP at any age—preferably when they're young and healthy. Science has shown that the younger a person is, the more regenerative their cells are.

The next phase of research is to study the effects of freezing PRP for a longer period of time. Will it strengthen PRP's biological potential even more? Can it be successfully stored for decades? Our team is determined to find out.

"I'm confident freezing PRP will lead to new therapies that will help people heal better and remain active for many more years—regardless of their age," Dr. Huard says.

Invigorated by these initial discoveries, the team has the potential to revolutionize the way people heal with PRP.



*SPRI researchers study the effects of freezing platelet-rich plasma.*

# COMBATING HIP OSTEOARTHRITIS

## Study uncovers benefit of bone marrow treatment

In the United States today, one in four adults over the age of 50 is affected by a progressive joint disease, known as osteoarthritis. Hip osteoarthritis is the second most prevalent joint disease that affects millions of people each year.

The Steadman Clinic (TSC) providers and Steadman Philippon Research Institute (SPRI) researchers are exploring innovative musculoskeletal treatments to combat hip pain and functional limitations caused by this debilitating joint disease. One way TSC and SPRI are combatting hip osteoarthritis is through harnessing the biological potential from an individual's own bone marrow by concentrating the regenerative factors.



Dr. Thos Evans harvests bone marrow from a patient at The Steadman Clinic.

### Research explores bone marrow concentrate for joint treatment

The primary investigator, Dr. Thos A. Evans, is leading this research initiative with his SPRI team. Dr. Evans and his team have conducted a clinical study on 24 patients suffering from hip osteoarthritis who have elected to undergo a single bone marrow concentrate injection. Under a standard clinical procedure, the bone marrow was taken from the patient's own pelvic bone with a needle and syringe. The bone marrow was then processed further using high-quality standard operating procedure in a separate clinical laboratory called ProofPoint Biologics.

The Center for Outcomes-Based Orthopaedic Research (COOR) collected pain scores and hip function data from patients at several time points, including: pre-procedure, one-month, three-month and six-month time points.

### Hip pain significantly decreases with bone marrow therapy

The bone marrow therapy was injected into each patient's hip joint the same day as the bone marrow harvest. The study participants reported a significant reduction in hip pain as early as three weeks after their injection. In addition, the subject's clinical outcomes and function continued to improve up until their six-month follow-up.

"Our work at SPRI is showing us that there is vast potential to harness our individual regenerative factors to treat osteoarthritis and decrease pain," says Dr. Evans. "Our hope is to grow the body of research evidence that supports the use of regenerative medicine in the treatment of musculoskeletal disorders."

This study was featured at the International Combined Orthopaedic Research Society meeting in April. A paper was also submitted for publication in a peer-reviewed journal in May.

This research was exhibited at the 2018 International Combined Orthopaedic Research Society meeting.

# HIPS AT RISK

## Biomotion research targets cause of FAI hip disorder



Biomedical engineering scientists study movement in SPRI's cutting-edge Biomotion Lab.

Many young athletes have severe hip injuries due to a defect called femoroacetabular impingement (FAI). In fact, FAI causes the majority of hip labral tears. And it's linked to cartilage damage and osteoarthritis.

Even though many people have FAI, not all develop symptoms or require treatment. While prior studies mainly focused on bone shape, SPRI researchers believe it's the combination of shape and motion that leads to FAI symptoms.

"This study is really a big, big part of understanding how these injuries happen and how we can correct them," says Dr. Marc Philippon, SPRI co-chairman.

### Research pinpoints cause of hip pain

"Our research is all about injury prevention and developing and validating treatment for FAI injury," says Dr. Scott Tashman, director of Biomedical Engineering. "The first step is to identify the factors that cause symptoms. Then we can develop strategies to avoid FAI and optimal treatments for people with symptoms."

The study includes 120 adult recreational athletes who participate in sports with a high risk for FAI, such as skiing. History shows many of these individuals will have the hip defect associated with FAI. Others will have hip pain.

Our researchers are analyzing these athletes' anatomy, using advanced 3D imaging. They also assess their joint function with dynamic 3D X-Ray technology. The team then creates animated 3D computer models of how each subject's hip joint moves during different activities.

With this data, we can pinpoint the combination of anatomy and motions that cause impingement and can lead to joint damage.

### Plans for new screening tool

Study participants are being followed for three years. The Imaging Research team reviews MRI scans for changes in hip labrum and cartilage while the Center for Outcomes-Based Orthopaedic Research (COOR) collects data on subjects' hip pain and function loss. This follow-up will help identify specific factors causing injury.

Based on the findings, our team plans to design a screening tool to determine who is prone to FAI-related damage. This research will help improve injury prevention, as well as treatment of FAI.

"By understanding the relationship between anatomy and movement, we can help people alter their activities to prevent damage," Dr. Tashman says.

## MOVE THOSE HIPS

Scientists explore cause of hip microinstability with customized robot



Scientists from the Biomedical Engineering team analyze joint movement in the Robotics Lab.

Micro might mean small, but hip microinstability is a big deal. Our Biomedical Engineering team believes it's crucial they understand what causes this defect that can lead to severe pain and crippling arthritis.

While physicians know hip microinstability occurs, there's no evidence-based measure for accurate diagnosis. For this reason, early detection is difficult. Hip microinstability often goes undiagnosed until symptoms are relentless. And there's no treatment.

So, our team started at the core of the issue—literally—with the hip bone. As Dr. Travis Turnbull, deputy director, Biomedical Engineering, says, "You can't fix it if you don't know what it is."

### First step: uncovering the cause

This first-of-its-kind research kicked off with a cadaver robot study of 16 healthy hip specimens.

## Thanks to you

SPRI is one of only a few U.S. research institutes that have a robot to explore the body's mechanics.

Our researchers measured rotation and range of motion of the femur and pelvis in the uninjured hips using the robot.

Next, these scientists injured the soft tissue surrounding the joint in half the hips. They tore tissue in the socket (the labrum) in the other hips. The team repeated the robot tests on each injured hip.

Our Imaging Research staff also plays an important role in this study. They're using MRIs to create 3D models of the hip before and after injury. Once the robot testing is completed, researchers will use the specimens to validate the models.

### Findings crucial to care and prevention

Data analysis isn't complete. But the team is confident the study will show that hip microinstability is caused by tissue damage around the joint.

These findings will help establish objective criteria for diagnosing microinstability and identifying risk factors. And they'll be used to develop treatments and prevention protocols. This is especially important because hip microinstability usually begins in young people.

Our biomechanical experts are committed to understanding how anatomy contributes to hip microinstability.

"Once we know what causes hip microinstability, we'll know how to repair it," Dr. Turnbull says.

## MOVE OVER CT SCANS

MRI could be best diagnostic tool for bone injury

CT scans are the gold standard for diagnosing injured bones in a joint. But they could soon be replaced by MRIs, indicated by a study by Imaging Research.

A CT scan provides clear, sharp images of bones. But it doesn't show soft tissue well. On the flip side, an MRI captures soft tissue, but the bone contrast is lower than a CT scan.

So when physicians suspect bone injury, they typically order a CT scan. If they need information about soft tissue, like cartilage, they order an MRI. This prompted researchers to ask: Can patients with bone and soft-tissue injury skip the CT scan? Will an MRI provide an accurate image of the whole joint?

### CT vs MRI

To answer these questions, our staff took CT scans and MRIs of a cadaver knee with no sign of injury. From these images, they created 3D bone models manually on the computer.

Scientists at the University of Queensland and Commonwealth Scientific and Industrial Research Organisation in Australia contributed to the study. They created computer models automatically.

Our team evaluated both types of computer-generated models. Even though the models were produced differently, they were very similar.

Next, they compared the MRI and CT bone models and saw very similar results. This shows an MRI can provide accurate models for diagnosis and treatment planning. And that means patients could forego a CT scan, even with a bone injury.

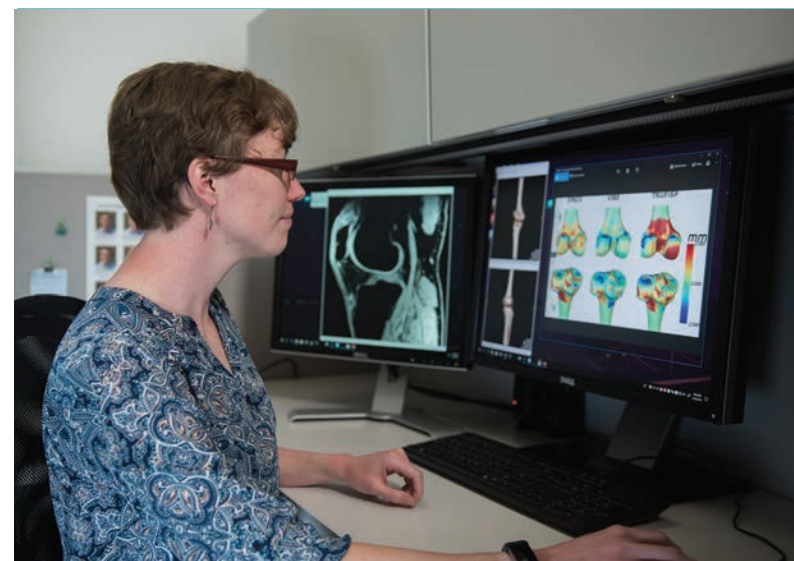
This research produced the first real quantitative and qualitative data about MRI-based bone modeling.

### Huge benefits to patients

Taking just an MRI provides multiple patient benefits. They'll get accurate evaluation of the whole joint with a single image. They'll no longer be exposed to radiation from a CT scan. And they'll avoid the added cost of a scan.

Imaging Research is continuing this work with a shoulder study. So far, the results are already validating the knee study.

"Our research shows MRIs have the potential to provide accurate 3D bone models, in addition to accurate evaluation of soft tissue injury for clinical care," says Dr. Charles Ho, director, Imaging Research. "MRIs will offer many advantages for comprehensive evaluation of joints."



Research engineer Carly Lockard studies bone models from MRI imaging.



The CT and MRI comparison research was published in the *European Journal of Radiology*.



# WHAT'S A HEALTHY ANKLE LOOK LIKE?

Imaging Research develops better measures for evaluating ankle injuries.

Most of us take our ankles for granted. That is until we sprain one or even worse—tear a tendon. On top of that, early and accurate diagnosis is difficult—until now.

“Physicians have been challenged in determining the severity of an ankle injury, such as a tendon injury just short of a complete tear,” says Dr. Charles Ho, director, Imaging Research.

Thanks to his team, now there’s an evidence-based measure for determining the damage in an injured ankle.

### How’d they do it?

These researchers believed that it was necessary to understand the healthy ankle before they could develop tools and techniques for a precise diagnosis.

So the team set out to learn more about the tissue and properties of uninjured ankles, focusing on the peroneal tendon on the outside of the ankle. This tendon is recognized as a common source of ankle pain and disability.

The study involved 24 people with uninjured ankles—ages 23 to 64. MRIs were taken of each person’s ankle in various positions.

The scientists measured MRI-mapping values in each person’s peroneal tendon. The values provided a much better picture of what an uninjured ankle tendon looks like. This morphed into a baseline for comparing tendon injuries.

Researchers expect patient studies to show that the bigger the difference between an injured tendon and the baseline, the greater the damage.

Ankle tendon injuries can be difficult to diagnose using a conventional MRI. This study is significant because it showed quantitative MRIs provide a more accurate evaluation of injuries.

### How do these findings help patients?

With the new baseline, it will be easier for physicians to detect damage earlier. This will be especially important when symptoms are mild.

Knowing what a normal tendon looks like will also help physicians better predict a treatment’s success in injured ankles.

### What’s next?

Researchers are applying similar techniques to measuring the baseline. They’re also measuring tissue in other ankle tendons.

“Our mapping provides an objective tool and information that could lead to a new standard of treatment for injured ankles,” Dr. Ho says. “The baseline gives physicians another tool to enhance patient diagnosis and care.”



Mapping healthy ankles provides a helpful baseline for physicians.

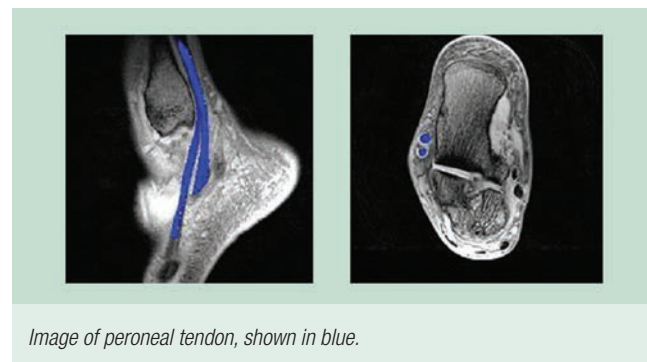


Image of peroneal tendon, shown in blue.



## THE POWER OF EDUCATION

SPRI programs shape next generation of researchers

SPRI researchers work with local students in the high school Science Club program.

SPRI has long been committed to educating tomorrow’s leaders in orthopaedic medicine. Thanks to you, our programs touch students of all ages— from 5th graders to medical fellows.

### Training surgeons from around the world

Orthopaedists from as far away as Greece and Japan came to Vail in 2017 to expand their knowledge and skills through our International Visiting Scholars Program. Preeminent surgeons from the United States participate in our elite Clinical Fellowships. These post-residencies are considered among the world’s best.

This past year, 15 physicians learned from our renowned researchers—the largest cohort ever. Their 12-month stint at SPRI was packed with investigating the causes, prevention and cures of degenerative diseases and joint injuries. They also learned the latest orthopaedic procedures and fine-tuned their surgical skills.

“Working at SPRI has been a life-changing experience,” says Burak Altintas, MD, a 2017-2018 scholar. “The knowledge I gained here will help me advance medicine far beyond what I could have ever imagined.”

### Advancing surgical skills

Skills laboratories have revolutionized surgical training at SPRI. Fellows and scholars, and seasoned surgeons alike, hone their technique and employ emerging best practices. They also do this with computer simulators and virtual-reality technology.



A clinical fellow works alongside Colin Robbins, coordinator of Surgical Skills, in the lab.

“The surgical skills lab sets SPRI’s sports medicine fellowship apart,” says Dr. Jon Godin, SPRI alum. “It’s an invaluable resource for practicing skills and applying them in the OR.”

### Inspiring tomorrow’s scientists

SPRI is also filling the pipeline with young scientists through its Education and Public Outreach Committee (EPOC). This program is aimed at students in grades 5–12. EPOC gives Eagle County youth exposure to our leading-edge research.

Last year’s activities included laboratory tours and school visits by staff. In addition, 10 high schoolers got hands-on research experience through our Science Club. More than 500 students benefited from EPOC during the 2017-2018 school year.

Because of your support, hundreds of SPRI alumni are spreading medical excellence around the world—helping patients remain active longer.

# MORE SPACE, MORE STUDIES, MORE DISCOVERIES

## New SPRI labs further research and patient care

**M**odern labs. The latest technology. Enhanced research. These are just a few of the many benefits of Steadman Philippon Research Institute's new, expanded labs.

SPRI moved out of its basement space to renovated, state-of-the-art labs on the first floor of Vail Health Hospital. SPRI also moved into the new fourth floor atop the hospital's west wing in January 2017, alongside The Steadman Clinic. Together, the research institute and the clinic have 30 percent more square footage than in their previous locations.

In addition, patients, visitors and staff now access SPRI and the clinic through the wing's new main lobby. Only steps from the front doors, an express elevator takes them directly to the fourth floor. All of these changes provide greater convenience for everyone.

SPRI's new space includes:

- Biomotion Lab
- Center for Regenerative Sports Medicine
- Center for Outcomes-Based Orthopaedic Research
- Imaging Research
- Robotic Biomechanics Lab
- Surgical Skills Lab

### Greater collaboration moves research to new level

Another huge benefit of SPRI's new location is its proximity to The Steadman Clinic. With several labs right next door to the clinic, it's easier for SPRI scientists to team up with the clinic's attending physicians on research. As a result, the number of studies conducted in 2017 was three-fold the number in 2016.

"With the surgeons just around the corner, we have greater access and interaction with them. This facilitates more in-depth conversations, better problem solving and greater collaboration," says Dr. Travis Turnbull, deputy director, Biomedical Engineering. "With team members, labs and research departments all together, it's easier to exchange information and share ideas. This is helping us take research to a new level."

SPRI researchers now have more than just a new space. They have the facilities to translate their award-winning research from bench to bedside more efficiently—benefiting patients around the globe.



The Surgical Skills Lab on the fourth floor is located steps away from The Steadman Clinic.

# SHARING KNOWLEDGE

## Injury Prevention Symposium

SPRI and its partner United States Olympic Committee (USOC) hosted the inaugural Injury Prevention Symposium Jan. 28–29, 2017, at the Four Seasons Hotel in Vail.

The event addressed current research and clinical applications for sustaining athlete health across sports and exercise disciplines, through all ages. Attended by more than 60 sports medicine professionals, the symposium centered around the concept of preventing injuries, often focusing discussions about what can be done for adolescent and young adult athletes.

Of the event and its relationship with the USOC, SPRI Co-Chair Dr. Marc Philippon says, "Steadman Philippon Research Institute is proud to have hosted this unique event. Dr. Bill Moreau of the United States Olympic Committee has been a huge proponent of this conference, and we are grateful to him and the USOC for their partnership."

Vice President of the USOC's Sports Medicine Division Dr. Bill Moreau says, "This conference was groundbreaking.

We were happy to see so many come and join the seminar to learn and contribute to the sports medicine community that is focused on preserving and improving the health of athletes."

The Second Annual Injury Prevention Symposium was held May 3–5, 2018.

### Vail Scientific Summit

SPRI hosted its Third Annual Vail Scientific Summit from Aug. 23–26, 2017. Featuring over 60 speakers—including top physicians, scientists, surgeons and researchers—the



Dr. Bill Moreau of the USOC and Dr. Marc Philippon, co-chairman of SPRI welcome guests to the Injury Prevention Symposium.



Dr. Johnny Huard, SPRI chief scientific officer, speaks at the 3rd Annual Vail Scientific Summit.

summit was a forward-looking, collaborative event. SPRI Chief Scientific Officer Dr. Johnny Huard says, "We were so excited to see the response to our event and the growth in numbers of both those presenting and those attending our Vail Scientific Summit. We were able to bring together the very best scientists, researchers and clinicians and put them in the same room as many world-class orthopaedic surgeons."

The summit included a special session dedicated to The Steadman Clinic physicians outlining clinical applications of regenerative medicine, calling to the translational nature of the orthopaedic research being discussed at the summit.

As in the previous Vail Scientific Summits, much of the event was centered around encouraging new collaborations while building on existing ones. The result was a full, cohesive summit that reinforced SPRI's position as an innovative leader in the world of regenerative medicine and orthopaedic research.

The Fourth Annual Vail Scientific Summit was held August 19–21, 2018 at the Vail Marriott Mountain Resort.

### Steadman Philippon Research Institute Golf Classic

Held on September 21, 2017 at Sanctuary Golf Course in Sedalia, Colorado, the Steadman Philippon Research Institute Golf Classic was a huge success. Since 2004, SPRI has raised more than \$1.6 million from the tournament to support its research and education programs.

The 14th Annual Golf Classic was held on September 20, 2018.

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# AWARDS & RECOGNITION

## Center for Outcomes-Based Orthopaedic Research

- Top-cited paper for first quarter, *Journal of Shoulder and Elbow Surgery*
- Third prize poster award, annual meeting, American Orthopaedic Society for Sports Medicine (AOSSM)
- Basic Science Trainee Award finalist, International Society for Hip Arthroscopy (ISHA)
- Richard Villar Award for Excellence in Clinical Research finalist, International Society for Hip Arthroscopy (ISHA)

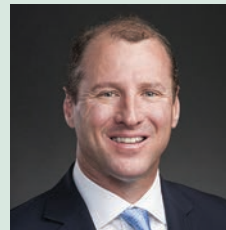
## Biomedical Engineering

- Cabaud Memorial Award, American Orthopaedic Society for Sports Medicine (best paper on hard or soft tissue biology, in-vitro research, laboratory or “bench-type” research or in-vivo animal research)
- Achilles Orthopaedic Sports Medicine Research Award, International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS)
- Best Scientific Exhibit, American Academy of Orthopaedic Surgeons (AAOS)

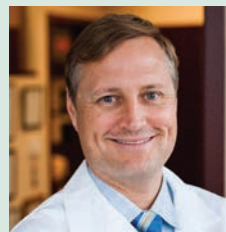
## Center for Regenerative Sports Medicine

- 2,105 citations, 11 articles and book chapters published
- 37 abstracts accepted for Orthopaedic Research Society (ORS) meeting
- New Investigator Award finalist for three studies, Orthopaedic Research Society (ORS)
- Joe and Bettie Ward Award for Excellence in the Biology of Aging Studies, Barshop Symposium on Aging
- Best PCR Award, Best Talk and Best Poster Award, Southwest Regional Symposium, Orthopaedic Research Society (ORS)

## Steadman Clinic Physicians Honored in 2017



**Dr. Peter J. Millett** was presented with an Achievement Award from the American Academy of Orthopaedic Surgeons (AAOS) in 2017, which celebrates his contributions to education, research and advocacy in orthopaedics.



In December 2017, **Dr. Matthew T. Provencher** was recognized with the renowned Col. Brian Allgood Memorial Leadership Award, given to the person who best exemplifies Col. Allgood's attributes of selfless leadership, commitment to excellence in military orthopaedics and loyalty to the ideals of duty, honor and country.



**STEADMAN PHILIPPON RESEARCH INSTITUTE**

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# FINANCIAL SUMMARY

## 2017 OVERVIEW

**total assets**  
\$12,491,859

**total liabilities**  
\$2,534,578

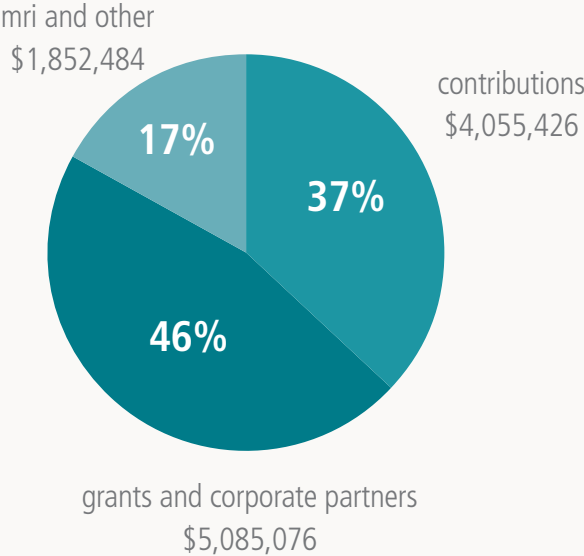
**total unrestricted net assets**  
\$1,462,786

**total change in net assets**  
\$(211,060)

**cash and cash equivalents year-end**  
\$2,334,791

A copy of our latest financial report may be obtained by writing to Steadman Philippon Research Institute, 181 West Meadow Drive, Suite 1000, Vail, CO 81657 or by calling (970) 479-9797.

## 2017 INCOME BY TYPE



## 2017 EXPENDITURES BY FUNCTION

