STEADMAN PHILIPPON RESEARCH INSTITUTE

SUMMER 2025

SPRI NEWS

A MAJOR AWARD, RESEARCH EXPANSION AND NEW EQUIPMENT KICK OFF

AN EXCITING YEAR AT SPRI

DR. MATTHEW T. PROVENCHER AWARDED PRESTIGIOUS 2025 KAPPA DELTA ANN DONER VAUGHN AWARD

Dr. Matthew T. Provencher was presented with the 2025 Kappa Delta Ann Doner Vaughn Award at the AAOS Annual Meeting in March 2025

A LIFETIME ACHIEVEMENT AWARD IN ORTHOPAEDICS, THE KAPPA DELTA ANN DONER VAUGHN AWARD WAS PRESENTED TO MATTHEW T. PROVENCHER, MD, MBA, CAPT MC USNR (RET.), AT THE AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS (AAOS) AND ORTHOPAEDIC RESEARCH SOCIETY (ORS) ANNUAL MEETINGS IN EARLY 2025. THE KAPPA DELTA AWARDS ARE GIVEN TO RESEARCHERS WHO HAVE DEMONSTRATED OUTSTANDING CLINICAL RESEARCH RELATED TO MUSCULOSKELETAL DISEASE OR INJURY.

25 YEARS OF MILITARY CLINICAL RESEARCH FEATURED IN AWARD

Dr. Provencher specializes in complex knee and shoulder surgery at The Steadman Clinic and serves as Co-Director of the prestigious ACGME-accredited SPRI Sports Medicine Fellowship. A retired Captain in the United States Navy, Dr. Provencher and his colleagues from the military began the award-winning research 25 years ago while serving in the military. The goal of the project—"Advancement in Care Through Applied Translational and Clinical Research in Anterior Shoulder Instability: Military Contribution over 25 Years"—which included 10 physician collaborators from the military, was focused on optimizing care for shoulder dislocations and instability, which is prevalent among active-duty military.

In selecting Dr. Provencher and his team for this award, the AAOS commended the research for "its worldwide impact on treatment options, indications and surgical techniques, leading to what is now considered by many to be a gold-standard technique for arthroscopic shoulder stabilization. These contributions have guided clinical and surgical decision-making while enhancing patient care."

> "THIS DISCOVERY ALLOWED SURGEONS TO OFFER AN INNOVATIVE TREATMENT WITH A HIGHER SUCCESS RATE, AND PUBLISHING OUTCOMES HELPED TO CHANGE THE COURSE OF SHOULDER INSTABILITY TREATMENT WORLDWIDE."

The team of investigators includes nine other physicians, all with distinguished service in the military: COL Jon Dickens, MD; Eoghan Hurley, MD, PhD; COL John Tokish, MD; COL Brett Owens, MD; CAPT Lance LeClere, MD; LTC Andrew Sheean, MD; COL Jeanne Patzkowski, MD; CAPT Robert Waltz, MD; and LTC Stephen Parada, MD.

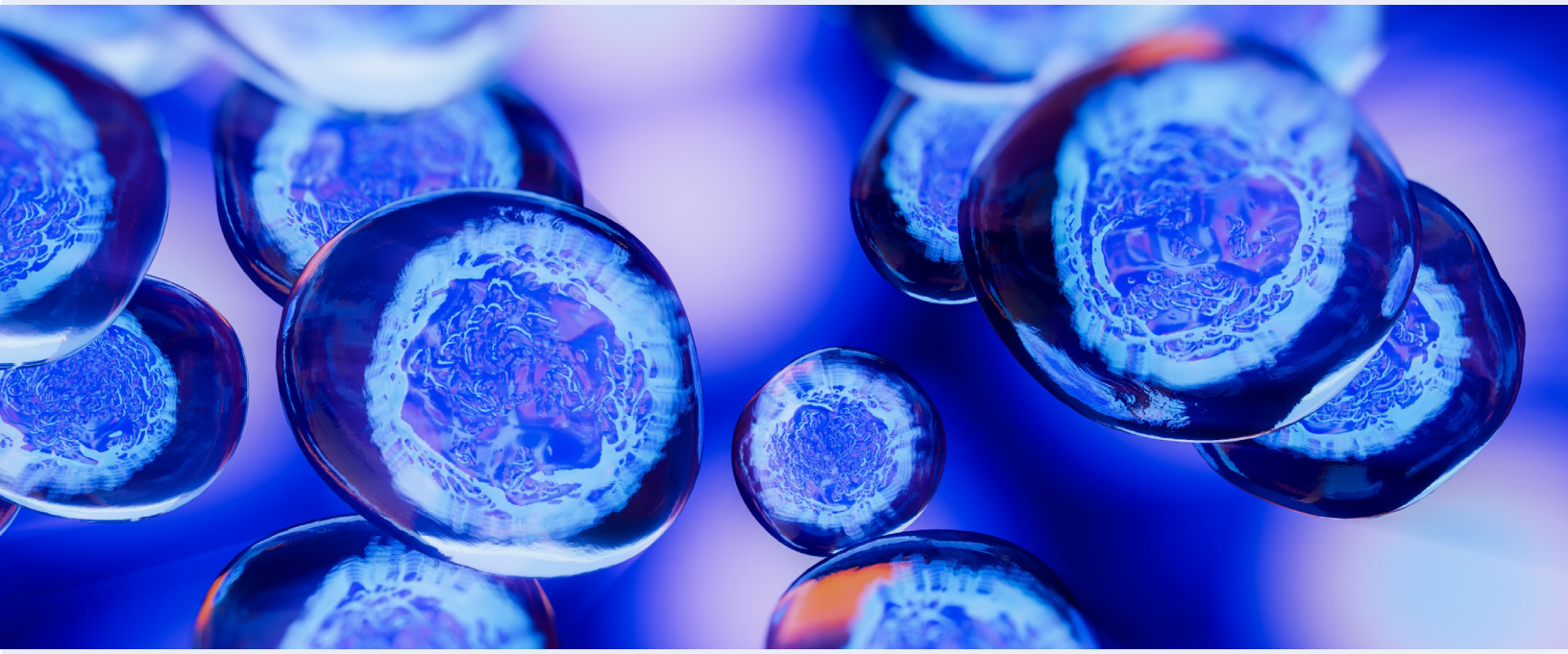
DISCOVERY CHANGES COURSE OF PATIENT CARE

One of the driving factors behind the award-winning research was a previous high-failure rate with shoulder instability—in the early 2000s, shoulder instability procedures had a 20-50% failure rate. Part of this high rate was due to the challenge of obtaining an excellent glenoid allograft (donated cadaveric shoulder tissue). Dr. Provencher and his team began to consider alternatives, ultimately discovering that a distal tibial allograft (DTA) from the ankle—not used in ankle reconstruction—effectively fit into the humeral head in the shoulder and provided stability to the shoulder. This discovery allowed surgeons to offer an innovative treatment with a higher success rate, and publishing outcomes helped to change the course of shoulder instability treatment worldwide.

DR. PROVENCHER JOINS PRESTIGIOUS AWARD WINNERS AT SPRI

The Kappa Delta Awards and Orthopaedic Research and Education Foundation (OREF) Clinical Research Award are considered the most prestigious awards in orthopaedic and musculoskeletal research. Dr. Provencher joins The Steadman Clinic Managing Partner and SPRI Chairman Dr. Marc J. Philippon and Chief Scientific Officer Dr. Johnny Huard in earning these career-defining awards—Dr. Philippon was awarded the OREF Clinical Research Award in 2023; Dr. Huard was awarded the Kappa Delta Ann Doner Vaughn Award in 2018 and Kappa Delta Young Investigator Award in 2004.

Dr. Provencher specializes in complex knee, complex shoulder and sports medicine surgery and serves as Co-Director of the ACGME-accredited SPRI Sports Medicine Fellowship Program



Extracellular Vesicles show tremendous therapeutic potential in regenerative medicine

SPRI BASALT LEADS MAJOR EXTRACELLULAR VESICLE RESEARCH

When The Steadman Clinic planned to expand its operations to Aspen and the Roaring Fork Valley, alongside partners Vail Health, Howard Head Sports Medicine and Aspen Valley Health, integrating a SPRI Regenerative Medicine Laboratory within the new, state-of-the-art orthopaedic center in Basalt was essential. The lab is located within The Steadman Clinic, demonstrating the synergy of research and medicine, and the commitment to translating scientific discoveries into clinical practice.

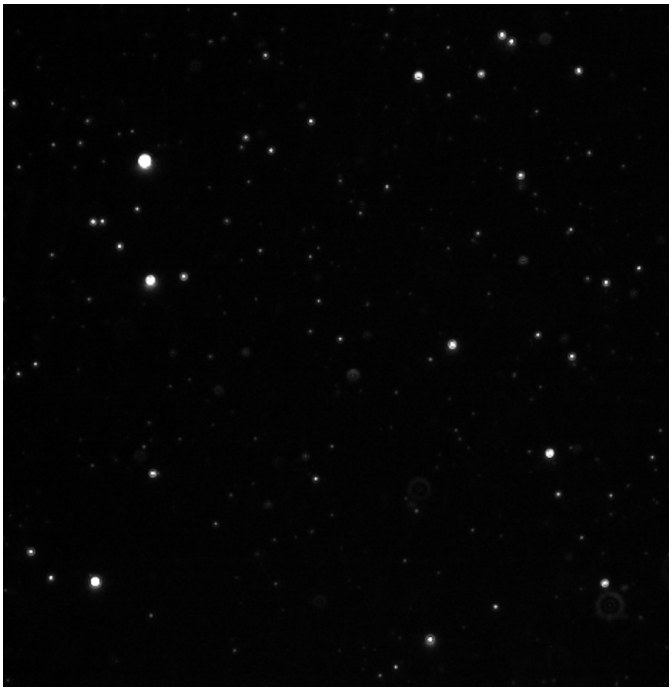
ORTHOBIOLOGICS ARE CENTRAL TO RESEARCH PROGRAM IN BASALT

For years, SPRI's Linda & Mitch Hart Center for Regenerative and Personalized Medicine (CRPM) has focused on both the science and development of orthobiologics—therapies using one's own biologic tissue to aid in healing. The most commonly used orthobiologics are platelet-rich plasma (PRP) and bone marrow concentrate (BMC), and the CRPM team has launched new research into extracellular vesicles (EVs) to further advance its orthobiologics research and therapeutic development. SPRI's regenerative medicine laboratory in Basalt has become a hub for this translational EV program.

WHAT ARE EXTRACELLULAR VESICLES (EVS)?

EVs are unique nanoparticles that deliver specialized bioactive cargo to target cells where they can stimulate or suppress cellular responses. EVs may be used to reduce inflammation, promote regeneration, support tissue repair and more. Where PRP and BMC concentrate the larger cellular portion of blood or bone marrow aspirate—like platelets rich in growth factors for healing and regeneration—EVs are not cells; they're derived from the platelets containing the primary healing message. Moreover, EVs can be concentrated to deliver billions of particles per mL, significantly greater than the volume of platelets in PRP and stem cells in BMC.

SPRI Basalt's Laboratory Operations Coordinator Greta Gohring



Actual EVs depicted by the ZetaView Nanoparticle Tracker Analyzer

Traditionally, EVs have been considered excess product during biologic processing and the fraction of a patient's sample with EVs has been discarded. But, with strong therapeutic potential themselves, could EVs enhance the effect of existing biologic treatments?

When a technician conducts a blood draw to develop PRP for a patient, the patient's body sends a healing message to its cells—the body needs to heal the cut from the blood draw. This means that the patient's sample would likely contain EVs carrying the healing message. So, when the physician injects the EV-derived biologic into the patient, the place of injury would receive that healing message.

The EV operates like a conductor in an orchestra. Without the conductor, a musician may begin to play a song, and nearby musicians may recognize the song and begin to play alongside them. Or, the musician may find themselves playing a solo. But when the conductor takes the podium, they direct all of the other musicians to join the song. They signal when to play, how to perform the song, etc. In an injured tendon, some cells may begin the healing process. But send in EVs, and the cells get a specific message—support tissue repair.

A MUTLI-PRONG RESEARCH PROGRAM BEGINS

The CRPM team in Basalt has begun a clinical study involving EVs. Entitled, "Research to improve biologic treatment approaches in musculoskeletal disorders," the project is led by Principal Investigators Dustin Anderson, MD and Johnny Huard, PhD and Aspen Medical Director Jared Lee, MD. This study aims to investigate platelet-derived EVs (from PRP sample) and bone marrow-derived EVs (from BMC sample) in a series of validation and optimization studies. This includes isolation, storage and characterization testing to establish specific processes and procedures to develop a novel autologous (patient-derived) EV biologic therapeutic treatment.

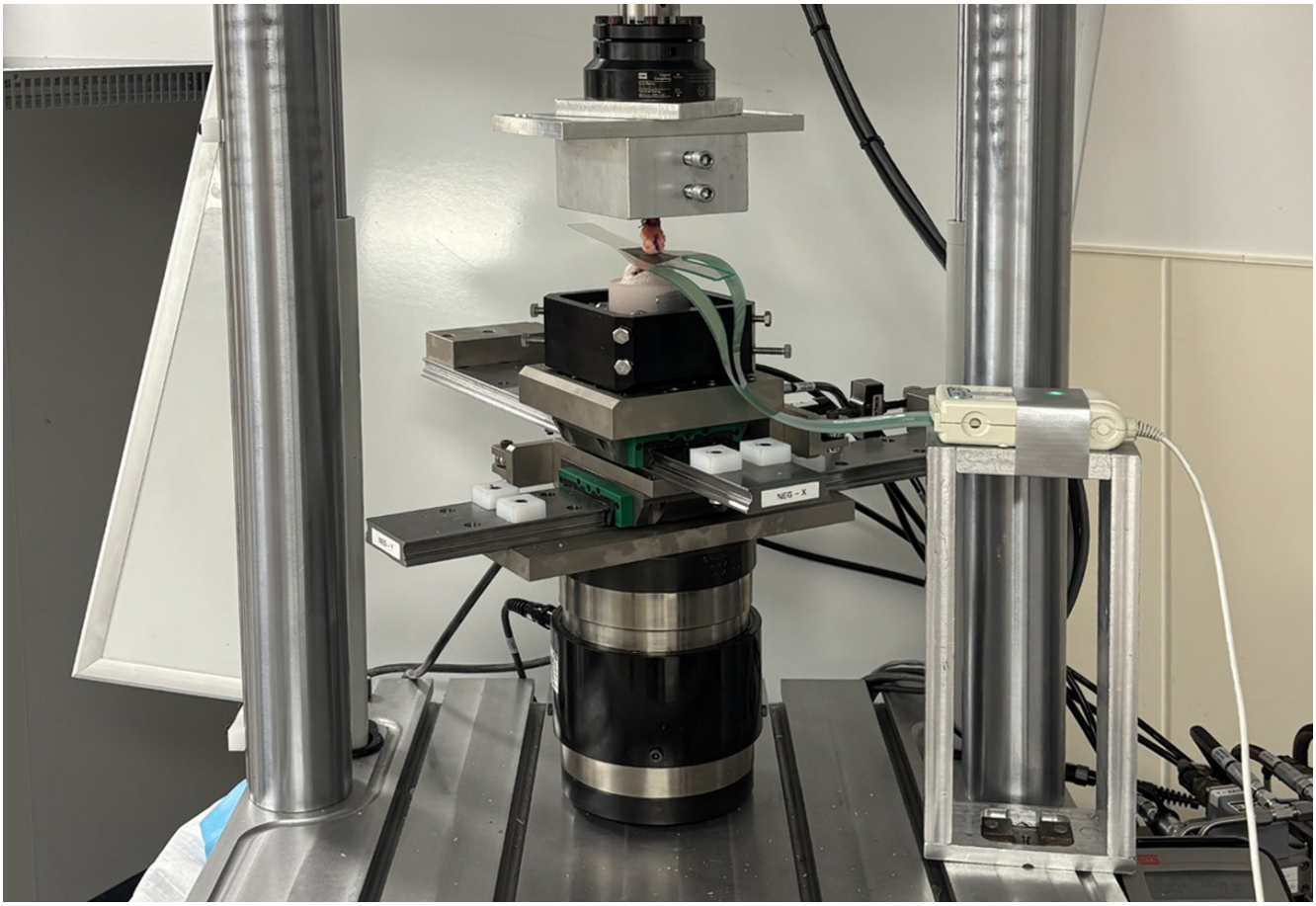
The research team has adopted a multi-prong approach to this research program including basic science, preclinical trials (investigating therapeutics in an animal model) and clinical research. One unique area of the research program not only includes characterizing the EVs derived from the biologic treatments (PRP and BMC), but also investigating EVs derived from other areas of the body, including injured tissue. In conducting this characterization study, the team will create a comprehensive picture of how EVs work and how they can best be optimized for helping patients with musculoskeletal conditions.

NEW CONTRACT EXPANDS EV INVESTIGATION

Recently, SPRI was awarded a Department of Defense (DoD) contract to further analyze biologic samples from a previous clinical trial. The team will examine the EVs present in these samples, including an investigation into the impact of therapeutics from the clinical trial on the microRNA (miRNA) within the EVs. Results from this research will provide brand-new insights into the impact of therapeutics on miRNA and how that can be harnessed for future orthobiologics in clinical care.

HUGE POTENTIAL IN TINY NANOPARTICLES

Although EVs are tiny, they offer huge therapeutic potential for patients. If they can be optimized to promote tissue regeneration, reduce inflammation and accelerate healing from injury or surgical treatment, this novel treatment could make a significant impact on a patient's healing journey. If you're interested in participating in or supporting this clinical study, please contact Study Lead Greta Gohring: ggohring@sprivail.org.



The new MTS machine is significantly stronger than its predecessor and replicates how the human body moves in real life

CUTTING-EDGE EQUIPMENT TAKES ROBOTICS RESEARCH TO NEXT LEVEL

One of the most essential research tools for The Steadman Clinic's surgeons is found in SPRI's Robotics Laboratory. For over 12 years, researchers and engineers have utilized a materials testing machine (MTS) to reach biomechanical answers to clinically meaningful research questions—Dr. Philippon's investigations into cam over-resection or the distractive stability of the hip joint; Dr. Hackett's questions about patellofemoral instability; Dr. Millett's inquiries about posterior shoulder instability; Dr. Provencher's considerations of meniscus allograft transplantation—all of these research questions were answered using this equipment.

But with physical limitations of the existing machine, surgeons were challenged to truly replicate the *in vivo* loading environment to take these clinical questions to the next level. That's when the laboratory team knew that a larger, stronger materials testing machine with more loading axes could help further these important research investigations, and thanks to a generous philanthropic gift from Tina and David Wilson, the lab installed a hydraulic MTS Bionix system with an active XY table.

MACHINE UPGRADE REPLICATES SURGICAL SCENARIOS

The upgrade to the new MTS system has created significant enhancements to the biomechanical research undertaken in the Robotics Lab:

- **The testable space increased from 60 mm to over 100 mm, accommodating larger, multi-joint specimens. This enables a more realistic loading environment to be modeled.**
- **In addition to the testable space, the load capacity of the machine also increased:**
  - **In the Z axis (vertical direction), the new machine can handle 25,000 Newtons (about 5,600 pounds), compared to the original machine's 10,000 Newtons (about 2,250 pounds) of capacity. This new capacity is enough to test the fracture strength of a human femur.**
  - **The torsional capacity (twisting strength) also increased, from 100 Newton-meters of torque to 250 Newton-meters of torque—this allows for more force to be applied to twisting elements—a bone, screw, implant, etc.**
- **The XY table adds a third and fourth axes of load to control the system, allowing the whole system to more closely replicate *in vivo* loading environments.**

SPRI Biomechanical Research Engineer Justin Hollenbeck installing the new MTS machine in the Robotics Laborator

The new MTS machine is much stronger than its predecessor—it can press or pull with more than twice the force and twist materials with more than twice the torque. And with applying more complex forces, the system better simulates how the human body moves in real life.

NEW EQUIPMENT AT HOME IN ROBOTICS LAB

The installation of the new MTS system took two weeks and was completed in March 2025. The team used a manual lift to set the machine in place and installed a hydraulic pump in the surgical skills laboratory closet. Robotics Engineering Manager Alex Brady and Biomechanical Research Engineer Justin Hollenbeck completed training on the new machine to begin utilizing the equipment this spring.

Since installation, the Robotics team has completed or is currently testing for seven projects on the machine across the human body including investigations into the hand and wrist joints and studies involving knee injuries and repair techniques. The lab has six more studies already planned for the new MTS machine, with many more to come.

SPRI SCIENTISTS AND RESEARCHERS PRESENT AT ISAKOS CONGRESS 2025 IN MUNICH

Dr. Joseph Ruzbarsky

COOR Director Grant Dornan

Former SPRI International Scholar Dr. Maximilian Hinz presented his second-place Richard B. Caspari Award paper at the 2025 ISAKOS Congress in Munich, Germany

SPRI Chief Scientific Officer Dr. Johnny Huard

The International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) is a world-leading scientific organization that hosts a biennial congress hosting leading experts, global thought leaders, researchers and surgeons from all over the world. The goal of the event is to connect, share research and connect on the latest advancements in arthroscopic surgery, knee surgery and the field of sports medicine.

SPRI Shares its Research on a Global Stage

The 15th Biennial ISAKOS Congress was held in Munich, Germany June 8-11, 2025. SPRI was well represented at the congress, including five podium presentations and five poster presentations. SPRI scientists, researchers, former clinical fellows and former international scholars presented at the event, including SPRI Chief Scientific Officer Johnny Huard, PhD; Center for Outcomes-Based Research (COOR) Director Grant Dornan, MS; The Steadman Clinic physician and former SPRI Sports Medicine and Hip Preservation & Reconstruction fellow Joseph Ruzbarsky, MD; former SPRI Sports Medicine Fellow Michael Rizzo, MD; former International Scholars Maximilian Hinz, MD; Marco-Christopher Rupp, MD; Phob Ganokroj, MD and former SPRI Research Assistant Yuchia Wang, MD.

Each of SPRI's Scientific Departments were represented at the Congress. COOR presented four podium talks including two presentations featuring artificial intelligence: "Predicting Patient Outcomes in Hip Arthroscopy Using Artificial Intelligence Image Recognition" and "Artificial Intelligence Based MRI-based Volumetric Assessment of Rotator Cuff Musculature Demonstrates Predictive Value for Preoperative and Postoperative Functional Outcomes Following Arthroscopic Rotator Cuff Repair."

Former SPRI International Scholar Maximilian Hinz, MD, was awarded the Richard B. Caspari Award (second place) in recognition of an excellent upper extremity research paper. Dr. Hinz's research was conducted at SPRI and included co-authors Alex Brady, MSc; Wyatt Buchalter, BS; Natalie Cortes, MS; Rony-Orijit Dey Hazra, MD; Marco-Christopher Rupp, MD; Mattew T. Provencher, MD, MBA and Peter J. Millett, MD, MSc.

Congratulations to the SPRI team for its excellent research, highlighted at 2025's ISAKOS Congress.

IF YOU ARE INTERESTED IN LEARNING MORE ABOUT SPRI AND HOW TO SUPPORT OUR RESEARCH, PLEASE CONTACT DIRECTOR OF PHILANTHROPY KRISTIN MORGAN AT KMORGAN@SPRIVAIL.ORG OR 970.401.8739