Welcome to the first edition of Orthopedic Innovations, a newsletter from the University of Wisconsin Department of Orthopedics and Rehabilitation.

This newsletter includes innovative research and new clinical treatment options that are occurring at the University of Wisconsin in the field of orthopedics and rehabilitation. It is important to our faculty and staff to let you know what we've been learning, teaching, and practicing. We hope you find this newsletter to be a valuable and informative resource. But even more important, we want to connect with you. Our deep commitment to the Wisconsin Idea means that we touch lives across the state and beyond.

So as you care for your patients, we invite you to stay in contact with us. Visit us online at uwhealth.org/ortho, and subscribe to this publication to receive updates. We also encourage you to contact the OrthoAccess triage service at (888) 978-4611 or by e-mail at orthoaccess@uwhealth.org.

Tom Zdeblick, MD
Professor and Chairman
University of Wisconsin Department of Orthopedics

A MESSAGE FROM THE CHAIR

Research is the key to discovering new treatment methods for millions who suffer from debilitating musculoskeletal disorders. This issue features the Department’s investigation into the biomechanical behaviors of pathological and damaged musculoskeletal tissues and the strategies for restoring them to normal function.

Transferring critical research findings from the laboratory to clinical application requires significant funding. To provide continued support for the Department’s talented researchers, we have launched the Freedom of Movement Fund. Contributors to the fund help dramatically accelerate the translation of laboratory experiments through clinical trials to patient applications.

Our deep commitment to the Wisconsin Idea means that we touch lives across the state and beyond. We hope you find this newsletter to be a valuable and informative summary of some of the Department’s work. Visit uwhealth.org/ortho and ortho.wisc.edu to learn more about our program.

Thomas Zdeblick, MD
A.A. McBeath Professor and Chairman
Department of Orthopedics and Rehabilitation

Histology images are of rat ligaments stained with picosirius red and viewed through a polarizing lens to emphasize collagen.

A. Normal tissue has aligned collagen with some waviness.
B. Untreated healing ruptured ligament creates disorganized scar tissue.
C. Mesenchymal stem cell (MSC) treatment creates more aligned collagen fibers as ligament heals.

Realizing the promise of regenerative medicine in orthopedics has long been the goal of UW researcher Ray Vanderby, and his current research is edging him closer to that reality than ever before.

Dr. Vanderby's research focuses on the biomechanical behaviors of pathological and damaged musculoskeletal tissues and the strategies for restoring them to normal function. His work is highly interdisciplinary, ranging from purely mechanical descriptions to new methods for functional imaging to tissue engineering and regenerative approaches to wound healing. Among his primary research goals are to:

- Modulate the healing process in ligaments, tendons and muscle so as to entirely regenerate the original native tissue. Techniques include controlled local release of biofactors to mediate the local immune response as well as stem cell therapy approaches.
- Use nanofiber scaffolds and tissue engineering approaches to regenerate ligaments and tendons.
- Develop new ultrasound-based methods to noninvasively explore biomechanical behaviors of tissues for diagnosis, functional assessment and interoperative evaluations.
New Clinic Helps Running Moms Get Back in Stride

Many pregnant women with a passion for running plan to continue logging the miles after the birth of their children. Regardless of how much time has elapsed between having a baby and returning to running, it is common for women to experience musculoskeletal symptoms they never felt before having children.

“A main concern is they may try to run the way they used to run,” says UW Health Sports Medicine Runners Clinic Director Bryan Heiderscheit, PT, PhD.

Dr. Heiderscheit is also a UW School of Medicine and Public Health department of orthopedics and rehabilitation professor. “A normal running pattern prior to childbirth may be too demanding when a mom returns after pregnancy, especially if certain muscles are not firing in the proper manner. This can translate into hip, knee and lower back problems.”

To ease the return to running, the Runners Clinic offers a program that identifies and strengthens muscles critical to running and assesses running form to correct flaws that may be causing symptoms. Patients also have access to other services including sports medicine, nutrition and sports psychology.

The program usually starts with a musculoskeletal evaluation by a physical therapist to identify strength, alignment and flexibility concerns, especially as it relates to the lumbopelvic region.

“There are four layers of abdominal muscles,” says Dr. Heiderscheit. “The deepest ones tend to turn off during pregnancy. We help retrain women on how to use those deepest muscles so they’re not overly dependent on muscles that aren’t in good position to support the spine and pelvis.”

Also included in the rehabilitation program is an evaluation to assess running form and correct flaws that may be causing pain. A video evaluation system provides direct feedback regarding running mechanics.

Many moms who participate in the program are able to quickly return to running and experience reduced or no pain during training.
Sports Rehabilitation Concussion Clinic: New Options for Treatment

In the next few months, thousands of school-aged athletes will gear up for spring and summer sports, and with that comes the potential for head injuries. While the majority of concussion patients recover quickly with rest, as many as 33 percent may develop Post-Concussion Syndrome (PCS).

Symptoms of PCS can include prolonged fatigue, headache, dizziness, irritability, insomnia and difficulty with concentration or memory, as well as intolerance to cardiovascular exercise.

The standard of care for PCS has been to rest, both from physical and cognitive activity, until symptoms are resolved. However, recent research suggests rehabilitation is an effective way to address the potentially life-altering consequences of a concussion.

UW Health Sports Rehabilitation, in collaboration with UW Health Sports Medicine physicians, evaluates and treats athletes with prolonged concussion symptoms. Evaluations include a thorough assessment, with special consideration given to aerobic exercise tolerance, whiplash-like cervical spine dysfunction and problems with vision and balance. Graded exercise testing combined with a systemic examination can help properly identify the specific impairments underlying PCS. Since no two patients are identical, this classification allows for a refined approach to treatment of each patient’s unique deficits.

While treatment is specific to each athlete, it often includes elements of closely monitored sub-symptom aerobic exercise, manual therapy and therapeutic exercise for spinal dysfunction, as well as visuomotor and balance retraining. Progressive aerobic exercise has been shown to be safe and effective in improving function in patients with PCS.

Most athletes are prescribed an exercise program to be performed five to six days per week, with close monitoring of exercise intensity using a heart-rate monitor. Exercise intensity is determined during the evaluation, and maintained at sub-symptom levels. Cervical range-of-motion, eye movement and balance exercises may be prescribed as well.

As patients make progress, rehabilitation programs are fine-tuned to meet the demands of returning to full function in daily life and sports. Additionally, elements of injury prevention are incorporated as individuals return to pre-injury activities.

For more information on head injuries and concussions:
Visit uwhealth.org/concussion or call (608) 263-4765 to request an evaluation.

Teri Larson Jones, 45, is a world champion barefoot water skier, but the physical pounding of practice and competition led to a degenerative cervical disc that had her contemplating quitting the sport. An artificial disc replacement by Dr. Thomas Zdeblick, chairman of the Department of Orthopedics and Rehabilitation, relieved her pain.

Six weeks after surgery, Teri was back on the water and later qualified for the 2012 U.S. Nationals Open Division, competing against athletes half her age. She also secured a spot on the 2014 U.S. team and competed in the World Championships in Australia.

Three UW Health spine surgeons—Drs. Thomas Zdeblick, Paul Anderson and Greg Trost—were key players in the original U.S. FDA trial that tested the efficacy of artificial discs in 2003.

Visit uwhealth.org/spine to view Teri’s story and learn about the UW Health spine program.
WELCOME TO OUR NEW DIRECTOR OF DEVELOPMENT

Dori Falk has been named Director of Development for the Department of Orthopedics and Rehabilitation at the UW School of Medicine and Public Health.

Dori is an accomplished development professional who understands the importance of philanthropy in supporting research and education. She has an extensive fundraising background through her professional and volunteer work experience.

Because federal grants are increasingly limited and departmental funds are not enough to support research, philanthropic support is essential to advance the future of orthopedics and improve the quality of life for people with bone and joint disorders and injuries.

Dori’s primary responsibility is to work with individuals and organizations who are interested in supporting the UW Department of Orthopedics and Rehabilitation Freedom of Movement Fund.

Musculoskeletal issues affect millions of children and adults, and while great progress is being made in preventing and treating orthopedic conditions, there is still much to discover and understand.

With its comprehensive clinical program and strong basic and translational research focus, the Department of Orthopedics and Rehabilitation has an unprecedented opportunity to eliminate orthopedic conditions that prevent people of all ages from living active, healthy lives.

Today, the Department is recognized for its leading-edge orthopedic and rehabilitation research. Exciting advances in surgical techniques such as anterior cruciate ligament repair and artificial disc replacement were pioneered by our faculty. Concussion studies conducted here are not only changing the way school-aged athletes around the country are managed to prevent concussions, but also how they are treated post-concussion.

We have the infrastructure, faculty commitment and history of excellence. The next step is to secure the financial resources to continue the work.

The Freedom of Movement Fund supports:

- **Innovation**—advanced curative treatments, prosthetics and surgical procedures
- **Prevention**—of injury, trauma and disease
- **Restoration**—hope for better functioning for those with musculoskeletal disease and deformity
- **Regeneration**—tissue engineering and the development of protein growth factors harnessing the body’s ability to self-heal
- **Education**—support for the next generation of scientists
- **Compassionate Care**—grants made available to cover hospital costs for patients in need

TO LEARN MORE ABOUT THE FUND OR TO DONATE ONLINE:
Visit [ortho.wisc.edu/giving](http://ortho.wisc.edu/giving), email Dor at dori.falk@supportuw.org or call her at (608) 265-9182.
Advancing the Future of Orthopedics
DR. GEORGE AND NANCY VOGT PROFESSORSHIPS

Longtime Madison orthopedic surgeon Dr. George Vogt loved to take the long view. When as a young man he knew he wanted to travel, he learned how to fly. When his regular pilot’s license didn’t allow him access to enough sky, he earned an instrument rating and the ability to fly above the clouds. And shortly after retiring in 1990, he longed for something more than just the next tee time, so George went back to school and learned how to build his own airplane.

“George simply loved life and never gave up on anything,” Dr. Vogt’s wife, Nancy, says about her late husband. “He was my in-house encyclopedia because he was so interested in learning new things. Even after retirement he kept up with all the latest scientific discoveries, not just in orthopedics, but other sciences, too.”

Nancy recalls two of the topics that most interested George from a professional perspective were academic medicine and the field of stem cell research—the latter of which he became fascinated with after learning about the revolutionary work being done at the University of Wisconsin. Nancy says her husband was especially interested in how regenerative medicine could one day help the body self-heal, potentially helping thousands of people avoid painful musculoskeletal conditions like osteoarthritis.

Knowing her husband’s passion, Nancy decided to include the Department of Orthopedics and Rehabilitation in their estate plans. The Vogts’ generosity and foresight will fund two orthopedic professorships in their name: one in orthopedics and the other in stem cell and regenerative medicine.

“The possibility of developing therapies that could relieve the suffering of others was of great interest to both of us,” she says. “I know this gift honors the kind of person George was.”

THANK YOU TO OUR DONORS

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Orthopedic Traumatologists: Acute Care and Beyond

The UW Health orthopedic trauma team is available 24 hours a day to provide care for people who experience a traumatic accident or injury.

As a Level One Trauma Center, UW Hospital and Clinics provides a high level of emergency care with state-of-the-art facilities and services. Orthopedic surgeons are fellowship trained and experts in orthopedic trauma surgery, so patients receive highly specialized emergency and follow-up care.

The musculoskeletal trauma team works with the rest of the UW Health trauma team to provide comprehensive care to acutely injured patients. This multidisciplinary team includes general surgery trauma surgeons, nursing staff, mid-level providers and therapists.

Clinical Highlights

- Acute and subacute fractures
- Complicated fractures including pelvic and acetabular fractures, inter- or peri-articular fractures, multiple extremity fractures and fracture dislocations
- Non-healing fractures of extremities, including malunion, delayed union and nonunion
- Complex orthopedic reconstruction for patients who have suffered severe trauma or osteomyelitis of the extremities or pelvis
- Less invasive plating techniques featuring percutaneous techniques to insert and anchor plates, which can result in less scarring, faster healing and fewer complications
- Patients with multiple injuries, who require the services provided by a Level One trauma team
**Tissue Engineering and Regenerative Approaches to Wound Healing** (continued from page 1)

- Better define the fundamental behaviors of normal, pathological, damaged and healing tissues, relating elastic and viscoelastic descriptions to composition, microstructure and cellular interactions.

To achieve these goals, he develops multiple approaches for experimental and applied mechanics, including histology, cellular and molecular biology, biochemistry and various other methodologies.

Dr. Vanderby is currently studying the effect of mesenchymal stem cells (MSCs) on the healing process in simple tendons and ligaments, including rotator cuffs, medial cruciate ligaments and Achilles tendons. His main goal is to identify the growth factors within those MSCs that control the healing process. Stem cell therapy, as it is practiced today, can be beneficial in healing musculoskeletal injuries, but Dr. Vanderby says nobody knows enough about the processes to know how or when it will work, if at all.

“Stem cell therapy can be helpful, but it can also have no effect at all, depending on the timing of the cell implantation and the number of cells used,” says Dr. Vanderby. “There are a lot of confounding factors involved, and we simply don’t know enough about it yet to make it work consistently. That’s what my research is addressing: understanding the details of how it works, when it works, so that it will work every time.”

Dr. Vanderby says that stem cell therapy is only a means to an end, and that the real clinical benefit will come when the effective biofactors can be isolated and harnessed for repair.

“We’d like to get to a place where we don’t need to use cell therapy at all,” Dr. Vanderby says. “It would be a lot easier, and clinically more useful, if we could simply identify the proteins in the stem cells that are managing the entire healing cascade and then just inject those and be done with it.”

Once Dr. Vanderby identifies the factors, he will then work with Bill Murphy, UW professor of biomedical engineering and orthopedics and rehabilitation, on ways to most effectively deliver those factors to a patient. Delivery methods can include putting the proteins onto microspheres, which can then be injected directly into areas that need healing, or they can be put onto sutures that will “time-release” the factors in predetermined and controlled concentrations.

The concept of regeneration in ligaments and tendons is a small step, Dr. Vanderby says, but a very nice first step down a path toward solving some of the more vexing problems in orthopedics. He believes that once we understand how the regenerative process works in these simple models, researchers will be that much closer to solving issues of healing in more challenging environments, such as a synovial joint capsule.

“When that happens,” Dr. Vanderby says, “it will signal one of the most profound advancements in orthopedics research.”

TO LEARN MORE ABOUT ORTHOPEDIC RESEARCH:
Visit ortho.wisc.edu
Welcome to Our New Orthopedic and Rehabilitation Providers

WARREN DUNN, MD, MPH
Chief, Division of Sports Medicine
Board-certified Orthopedic Surgeon

Clinical Interests
- Rotator cuff repair
- Shoulder replacement
- Anterior cruciate ligament reconstruction and revisions

Research Interests
- Outcomes following ACL reconstruction
- Meniscus repair and the effectiveness of rehabilitation for rotator cuff tears

NORANN RICHARD, PhD
Clinical Psychologist, Pain Clinic

Clinical Interests
- Pain and headache management
- Adjustment to chronic medical conditions
- Mood and anxiety disorders
- Meditation and mindfulness-based stress management
- Relaxation and imagery training
- Individual and group psychotherapy

SETH WILLIAMS, MD
Board-certified Minimally Invasive Spine Surgeon and Orthopedic Traumatologist

Clinical Interests
- Minimally invasive spine surgery techniques
- CT-navigated surgical techniques
- Complex cervical and lumbar spine surgery
- Extremity fractures due to trauma

Research Interests
- Minimally invasive spine surgery techniques
- Posterior lumbar interbody fusion rates
- Minimally invasive percutaneous and open techniques for iliac screw placement with CT confirmation

KATHRYN WILLIAMS, MD
Board-certified Foot and Ankle Orthopedic Surgeon

Clinical Interests
- Adult foot and ankle surgery including reconstructive procedures
- Foot and ankle trauma
- Sports injuries
- Ankle joint replacement
- Treatment of foot and ankle arthritis

Visit uwhealth.org/americancenter for more information.