

Department Briefs

Department of Orthopaedic Surgery Excels in Scholarship

In the area of orthopaedics, rehabilitation, and sports medicine, the University of Pittsburgh ranked fourth on a list of the top 100 most frequently cited universities that receive federal funds and published at least 75 articles in high-level scientific journals. (http://in-cites.com/research/2006/june_26_2006-2.html) From 2001 to 2005, the University of Pittsburgh published 396 articles related to orthopaedics, rehabilitation, and sports medicine, and each of these articles was cited an average of 4.04 times in other publications. The ranking of high-impact universities in orthopaedics, rehabilitation, and sports medicine was compiled by Essential Science Indicators. The citation frequency measure enables researchers to conduct quantitative analyses of research performance and trends in science.

Staff Notes

Constance R. Chu, MD, assistant professor of orthopaedic surgery, has been selected to receive the 2007 Kappa Delta Young Investigator's Award for her research project entitled, "Integrating Bench to Operating Room: Journey of a Clinician-Scientist." The Kappa Delta Orthopaedic Research Awards are considered by the American Academy of Orthopaedic Surgeons (AAOS) to be the highest recognition of excellence and promise in orthopaedic research, and are fondly referred to as the "Nobel Prizes" of orthopaedics. Dr. Chu will receive her award at the annual meeting of the AAOS in February, 2007. Other recent UPMC recipients of the Kappa Delta award include **Johnny Huard, PhD**, in 2004 and **Paul Robbins, PhD**, in 2005.

Anthony M. DiGioia III, MD, clinical associate professor, chaired a successful symposium in Scottsdale in October, attended by 400, entitled, "MIS Meets CAOS: Less and Minimally Invasive Surgery for Joint Arthroplasty — Fact and Fiction." Dr. Freddie Fu was the symposium co-chair.

Freddie H. Fu, MD, professor and department chairman, has been selected by the Senator John Heinz Pittsburgh Regional History Center to receive its 2007 History Makers Award in the field of medicine and health. The award presentation is scheduled for April 27, 2007. The award, which recognizes Dr. Fu's lifetime of outstanding accomplishments, honors individuals who have made regional, national, and international contributions judged to be of lasting importance to the history of Western Pennsylvania. Dr. Albert Ferguson, former department chairman, was a previous recipient of this award. Dr. Fu also was named an honorary member of the German Arthroscopy Association (AGA) at the 23rd German Arthroscopy Association Congress in Salzburg, Austria. Dr. Fu is the first non-German to be given an honorary AGA membership.

Christopher D. Harner, MD, medical director, UPMC Center for Sports Medicine, has received the Pennsylvania Athletic Trainers Society Team Physician Award. The award recognizes Dr. Harner's 15 years of dedicated service to Pennsylvania athletes. Dr. Harner also has been named the 2009 program chair for the American Orthopaedic Society for Sports Medicine (AOSSM). The AOSSM is a national organization of orthopaedic surgeons dedicated to sports medicine who lead in education, research, communication,

and fellowship. **James Bradley, MD**, clinical associate professor, is the AOSSM program chair for 2007, and **Brian Cole, MD**, a graduate of the UPMC Sports Medicine Fellowship Program, will be the program chair in 2008.

Aimee Kimball, PhD, director of mental training, UPMC Center for Sports Medicine, was named to the 2006 "Forty Under Forty" list of prominent western Pennsylvanians by *Pittsburgh* magazine. The list honors talented people under age 40 in a wide variety of fields who are making important contributions to the development of Pittsburgh.

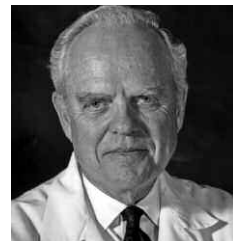
Michael Pagnotto, MD, third-year resident, recently won the award for the best basic science paper at the 21st Annual Smith and Nephew Resident Research Competition. His paper, "Genetically Enhanced Human Bone Marrow Stem Cells for Cartilage Regeneration," is the culmination of work that he completed in the Cartilage Restoration Laboratory under the direction of Dr. Constance Chu.

Dane K. Wukich, MD, chief, Division of Foot and Ankle Surgery, spoke at the 12th annual hands-on course of the Association Internationale pour L'Osteosynthese Dynamique: Focus on Complex Foot and Ankle Trauma, in Strasbourg, France. Dr. Wukich's presentations were "Wound Healing Risk Factors Following Open Reduction Internal Fixation of Calcaneal Fractures" and "Conventional Arthrodesis of the Ankle."

In Memorium

William F. Donaldson, MD May 21, 1921 – November 22, 2006

The department notes with sadness the passing of Dr. Donaldson, who in 2003 was awarded the honorary rank of Distinguished Clinical Professor of Orthopaedic Surgery. Dr. Donaldson served as a clinical professor in the department and as the medical director at Children's Hospital of Pittsburgh for 12 years. He served on the board of trustees of Children's Hospital, on the board's executive committee, and on the board of the Children's Hospital Foundation.



Dr. Donaldson made significant contributions as a clinical faculty member, teaching medical students and training more than 200 orthopaedic residents. He was the protégé of Dr. Edmund R. McCluskey, and in 1953 established himself as the first person in the region to subspecialize in pediatric spine deformity and pediatric orthopaedics. During his years in practice he was instrumental in organizing one of the first coordinated programs in the nation for total care of children with myelomeningocele. Dr. Donaldson authored or co-authored many articles for professional journals and chapters in medical textbooks, served as editor for several professional journals, as chairman of the Board of Trustees of the *Journal of Bone and Joint Surgery*, and as president of the American Academy of Orthopaedic Surgeons. He retired from practice in 1986. In recognition of his achievements in research and his national reputation in the field of orthopaedic surgery, an endowed chair at the University of Pittsburgh School of Medicine was established in 1991 honoring Dr. Donaldson and his wife, Jean.



News from the University of Pittsburgh Department of Orthopaedic Surgery

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This Issue

RESEARCH

Toward Improving Understanding of Carpal Tunnel Syndrome
Page 2

DEPARTMENT BRIEFS

Page 4



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 - Regenerative Medicine
 - Stem Cell
- Spinal Surgery
- Sports Medicine and Shoulder Surgery

How Fast Do We Age? A New Focus on Healthy Musculoskeletal Aging

Healthy, vital, active, and joyful — these are not adjectives normally associated with aging. Yet today, new generations of healthy, vital, active, and joyful seniors are changing the paradigm of aging. They are not satisfied with maintaining a mere veneer of youth, but are remaining youthful on the inside by aging actively. Masters and senior athletes — those who push themselves to the next level through competition — describe themselves as more mentally and physically healthy than their sedentary counterparts. These sports enthusiasts exhibit persistently high levels of functional capacity as well as a high quality of life. They are not waiting for age to overtake them, but are taking the steps necessary for aging well.

Recognizing the growing number of people in their 40s, 50s, and senior years who are remaining physically active,

and their unique health care needs, the UPMC Center for Sports Medicine has added an orthopaedic surgeon with a unique specialty in sports medicine for the aging recreational or elite athlete. As Vonda Wright, MD, observes, "The field of sports medicine has done a tremendous job of focusing on the needs of many populations, including adolescent, female, collegiate, and professional athletes, but little attention has been focused on the largest and fastest growing group of recreational and elite athletes in this country: athletes in



Vonda Wright, MD

Continued on Page 3



Toward Improving Understanding of Carpal Tunnel Syndrome

Carpal tunnel syndrome is the most common peripheral entrapment neuropathy, and has an immense impact on quality of life, individual productivity, and national health care. This syndrome results from the compression of the median nerve in the carpal tunnel, which causes symptoms of pain, paraesthesia, numbness, weakness, and clumsiness. If left untreated, carpal tunnel syndrome can lead to total dysfunction of the hand. Epidemiological studies indicate that this disorder occurs in more than three percent of the general American population. Almost half a million patients undergo surgical treatments for carpal tunnel every year, with medical costs exceeding \$2 billion, and the number of syndrome cases and their costs continue to rise as modern technology places increasing demands on our hands. Motivated by the prevalence of this syndrome and its staggering public health cost, Zong-Ming Li, PhD, director of the Hand Research Laboratory, leads a research team in studying carpal tunnel syndrome through a bioengineering approach, supported by attending hand surgeons Robert Goitz, MD, and Robert Kaufmann, MD.

In several recent clinical projects, the motor manifestations of carpal tunnel syndrome were examined by monitoring the complex motion patterns of the thumb using a camera motion analysis system (figure 1). The results support the hypothesis that carpal tunnel syndrome preferentially impairs abduction and pronation at the



Figure 1. Hand function evaluation by motion analysis system.

carpometacarpal joint. The functional consequences of median neuropathy during precision grip, precision pinch movements, and thumb force production were also studied using simulated neuropathy achieved by blocking the lower median nerve. To further understand the underlying muscular mechanisms for the observed motion abnormalities, cadaveric hands were used to elucidate thumb kinematics generated by individual thumb muscles.

Carpal tunnel syndrome patients usually experience tightness in the intrinsic hand muscles. The Hand Research Laboratory developed a robot-assisted methodology to investigate the regulation of the intrinsic muscles on the stiffness of the proximal interphalangeal joint of the index finger (figure 2). Torque-angle data of the proximal interphalangeal joint with the metacarpophalangeal joint at 0 and 60 degrees were obtained from human subjects. The results of the study showed that the torque-angle curve shifted with the varying position of the metacarpophalangeal joint. As the metacarpophalangeal joint flexion angle changed from 60 to 0 degrees, the

equilibrium of the proximal interphalangeal joint increased more than 20 degrees, and joint stiffness increased more than 50 percent. That the stiffness of the proximal interphalangeal joint is dependent upon the position of the metacarpophalangeal joint supports the regulatory role of the intrinsic muscles on finger joint mechanics. This regulatory mechanism is likely amplified in hands with intrinsic muscle tightness, justifying the commonly used Bunnell Intrinsic Tightness Test.

Dr. Li's research team is studying the expandability of the carpal tunnel by stretching the transverse carpal ligament as a mechanism to release carpal tunnel. This work is inspired by balloon carpal tunnel plasty, a minimally invasive surgical procedure invented by Lee Berger, MD, as an alternative treatment for carpal tunnel syndrome. In a recent experiment, cadaveric hands were dissected to expose the transverse carpal ligament with the carpal tunnel emptied. The transverse carpal ligament was stretched by force, using a custom lever system, directed towards the palm from within the carpal tunnel. The surfaces of the transverse carpal ligament and the carpal tunnel were digitized for the quantification of carpal tunnel expansion under stretching forces. The results of the measurements demonstrated that the carpal tunnel was expanded by more than 50 percent under a 200 N stretching force. Potentially, the mechanical properties of the transverse carpal ligament may be used to develop alternative procedures to release carpal tunnel pressure.

Despite much progress, many research questions about the carpal tunnel await investigation. What are the biological causes and mechanisms of the thickening of the transverse carpal ligament, and how can we prevent this process through biological intervention or ergonomic optimization? Can we design alternative surgical treatment protocols to restore optimal mechanical properties of the carpal ligament? Is there a gender difference in carpal tunnel mechanics? How do carpal tunnel mechanics evolve with age, and why are middle-aged individuals most susceptible? Exploring these and other questions will point the way to improved strategies for diagnosis, prevention, and treatment of carpal tunnel syndrome.

In addition to its focus on carpal tunnel syndrome, the Hand Research Laboratory is conducting research to improve knowledge, understanding, and management of various hand disorders. The research team, together with its collaborators, possesses a wide spectrum of expertise in engineering, kinesiology, biomechanics, motor control, orthopaedics, occupational therapy, biology, and neurology, as well as cutting-edge engineering equipment and



Figure 2. Robot-assisted evaluation of finger biomechanics.

clinical facilities to optimize hand research. The Hand Research Laboratory strives to achieve excellence through dedicated effort, innovative research, multidisciplinary collaboration, educational activities, and professional service. ■

How Fast Do We Age? A New Focus on Healthy Musculoskeletal Aging

(Continued from Page 1)

their 40s, 50s, 60s, and beyond. As clinicians, we need to recognize that the needs of an aging musculoskeletal system are unique. Older people are not simply bad sequels to their 20-year-old bodies."

Much of the available information on musculoskeletal aging was gathered from largely sedentary subjects. This data does not reveal the true potential of an aging musculoskeletal system when aging is active.

In order to study the aging of the musculoskeletal system and understand the needs of aging athletes, researchers at the UPMC Center for Sports Medicine are taking a leading role in promoting healthy lifestyles for masters and senior athletes through sports, research, fitness, and education. More than 4,500 athletes participated in several research studies at the 2001 and 2005 Senior Olympics designed to examine senior athlete injury patterns and the musculoskeletal changes that occur with active aging.

Most of these athletes exhibited a lifelong pattern of physical activity, with 95 percent engaging in sports as teenagers and 85 percent as young adults. Research shows, however, that people can make significant improvements in their physical and mental health by increasing their activity at any age. It is not uncommon for Senior Olympians to run, swim, or throw faster than sedentary people 20 to 30 years younger.

The 2001 survey found that in general, Senior Olympians are physically in better health than their sedentary peers, and their vitality and emotional mental health are much better. Despite their remarkable athletic achievements, however, older athletes are not completely immune to chronic illness; they are simply better at handling it. Evaluation of bone mineral density showed that even senior athletes in their 80s can maintain strong bones.

An important aspect of caring for masters and senior athletes is preventing injury while maximizing performance. Between 1991 and 1998, the rate of musculoskeletal injuries among this age group increased by more than 30 percent. Injury is the number one reason people stop being active while aging. Among Senior Olympians we studied, 89 percent reported more than one musculoskeletal injury after age 50. The injuries occurred secondary to overuse (60 percent) and falls (23 percent). They most frequently involved the foot and ankle, knee, shoulder, and lower back, and were characterized as muscle pulls, ligament tears, and tendonitis. Interestingly, athletes with osteoarthritis of the knee had a greater incidence of injury after age 50 than athletes without osteoarthritis. They were twice as likely to report more than five injuries and three times more likely to have injuries around the knees. This finding may reflect the significant changes in lower extremity muscle strength and proprioception that occur with aging and osteoarthritis.

There is good news and bad news on active aging. The good news is that 78 percent of people surveyed by the *National Public Health Weekly* named exercise as the most important factor in healthy aging, and exercise participation among people over 55 is growing at three times the rate among people from 34 to 54. Engaging in physical activity results in lower medication needs, fewer hospitalizations, and fewer physician visits.



Health Partners estimates that a 50-year-old exercising only 90 minutes per week can realize a health cost savings of more than \$2,200 per year.

The bad news is that too few older people exercise daily – fewer than 30 percent, according to the AARP. Maintaining an active lifestyle is important, not only for individuals but for the country. The direct health care costs associated with inactivity are estimated at 76.6 billion dollars per year, with the cost of caring for people with chronic diseases expected to double by 2011.

There are many reasons that people choose inactivity over a healthy active lifestyle. Of the top four reasons for remaining inactive, lack of guidance from physicians and fear of injury rank one and two. As experts in the musculoskeletal system, orthopaedic surgeons must take the lead in providing the motivation and guidance to the active older people who fill the clinics. As patients experience the physiologic changes of aging, their training and injury recovery strategies must be tailored to maximize their performance.

"With Dr. Wright's leadership and passion for helping aging athletes at all ability levels stay physically active and injury free, we are now working to develop a unique and comprehensive research program and clinical service aimed at maximizing the physical and mental performance of both elite and recreational athletes over 40," says Freddie H. Fu, MD, professor and chairman of orthopaedic surgery at UPMC. ■