



## Hand Research Laboratory Zong-Ming Li, PhD



(From left: Dr. Robert Goitz, Dr. Robert Kaufmann, Dr. Nancy Baker, Dr. Zong-Ming Li, Jie Tang, Christopher DeSantis, Rachel Siciliano, Ahmad Fannoon, Kaihua Xiu)

We're happy to report that our Hand Research Laboratory had another productive year in 2007. Under the direction of Zong-Ming Li, PhD, the hand team continues to work diligently to increase our knowledge of the hand and its complexities. As always, we're grateful to the many individuals who contribute to our research progress. Drs. Robert J. Goitz and Robert A. Kaufmann are the attending hand surgeons who provide clinical input. Dr. Nancy Baker and Mr. Norm Gustafson collaborate with us on occupational aspects of the hand. Our staff member, Jie Tang, continues to oversee the day-to-day activities. In the fall of 2007, Kaihua Xiu joined our laboratory as a visiting graduate student from Beihang University in China. Medical students Eric James and Chirag Chauhan finished their scholarly projects in our Hand Lab while completing their medical degrees. Medical students Kraig Graham and Philip McClure are working on a project about finger joint arthritis under the mentorship of Drs. Goitz and Kaufmann. Other students working in the lab include Rachel Siciliano, Christopher DeSanctis, Luke Xie, and Ahmad Fannoon. This April, we will welcome postdoctoral scholar Xin Guo, PhD. Last but not least, our research engine would not run efficiently without the administrative support from Mrs. Lou Duerring and Ms. Diane Fajbik.

Our team currently focuses on two lines of hand research – sensorimotor function and carpal tunnel mechanics. Our laboratory has several ongoing projects related to hand sensorimotor function. In a recent study using cadaveric hands, we investigated the complex motion pattern actuated by individual extrinsic muscles, and gained novel insight into the kinematic role of thumb muscles. In a clinical study for individuals with carpal tunnel syndrome, we looked at pathokinematics of the thumb and found that carpal tunnel syndrome tended to preferentially impair

thumb abduction and pronation. Our research also includes how peripheral neuropathy impairs the precision pinch movement and showed the deterioration of tip-to-tip accuracy and precision as well as alteration of joint kinematics associated with neuropathy. We are developing novel proprioception and pendulum systems to study hand sensorimotor function. It is our hope that this work will lead to a better understanding of the normal and pathological sensory and motor mechanisms of the hand.

Biomechanics of the carpal tunnel is the other main research interest in our laboratory. We have used experimental methods and finite element analysis to study carpal tunnel expansion resulting from force application to the transverse carpal ligament. The results improved our understanding of carpal tunnel expandability and geometrical relationships among carpal tunnel width, ligament length, carpal arch, and cross-sectional area. Using a silicon molding technique, we examined the morphological properties of the transverse carpal ligament and the carpal tunnel, and using ultrasound technology we measured the dimensions of the carpal tunnel structure. In the next few years, our goal is to systematically study the material properties of the transverse carpal ligament, the structural properties of the carpal tunnel, and to establish a computational model of the carpal tunnel.

Our Hand Lab bids farewell to several individuals who have made significant contributions to our research. Corey Pacek, MD, returned to orthopaedic residency after one year of research in our laboratory studying the morphology of the carpal tunnel. After spending one year as a research fellow in our laboratory, Sebastian Gehrmann, MD, returned to Heinrich-Heine University in Germany to continue his orthopaedic practice. Student Matthew Chakan, who worked with us for more than two years providing resourceful assistance, graduated with a BSc degree in bioengineering and has gone on to medical school at Boston University. Nicholas Werner, an undergraduate student who worked diligently on the kinematics of mouse scrolling, graduated and moved on to industrial experiences. We wish them great success in their career pursuits!

Our hand research is made possible by the generous support of many sponsors. We are grateful for the support from the National Institutes of Health (NIH), the Orthopaedic Research and Education Foundation (OREF), the National Fisheries Institute (NFI), the Freddie H. Fu David Silver Professor and Chair Funds, the Department of Orthopaedic Surgery at the University of Pittsburgh, The Pittsburgh Foundation, the UPMC Health System Competitive Medical Research Fund (CMRF), the Orthopaedic Research Laboratories Alumni Council, and Acumed, LLC. These supports enable us to continue exploring the fascinating world of the hand and generating new knowledge that will advance our understanding and management of hand disorders.

In addition, we were honored to welcome many distinguished guests who visited our Hand Lab in 2007. Our research has greatly benefited from their enthusiastic feedback and support.

**Visitors to the Hand Research Laboratory in 2007**

Lee Berger, Seton Hall Graduate School of Medicine, USA  
Murry Berger, Florida, USA  
Harvey Borovetz, University of Pittsburgh, USA  
Gwynne Bragdon, Brown University, USA  
Bambi R. Brewer, University of Pittsburgh, USA  
Thomas Carter, Arizona State University, USA  
Steven Charles, Harvard-MIT, USA  
Charles S. Day, Harvard Medical School, USA  
Ed Domanski, Depuy Orthopaedic, Inc., USA  
Ren G. Dong, NIOSH, USA  
Andrew Evans, University of Washington, USA  
Weppe Florent, Edward Herriot Hospital, France  
Braden C. Fleming, Brown Medical School, USA  
Daniel Fritschiay, Hospital University of Geneva, Geneva  
Julio Cesar Gali, Apice Medicina, Brazil  
Xia Guo, Hong Kong Polytechnic University, China  
Ranjan Gupta, University of California at Irvine, USA  
Wolfgang Huber, Facharzt fur Orthopadic, Germany  
Shepard Hurwia, University of Virginia, USA  
Doug Johns, Depuy Orthopaedic, Inc., USA  
Young-Jo Kim, Harvard Medical School, USA  
Mark L. Latash, The Pennsylvania State University, USA  
Heung-No Lee, University of Pittsburgh, USA  
William N. Levine, Columbia University, USA  
Jiri Lubojacky, Statni Slezska nemocnice, Opava, Czech Republic  
Zhi-Hong Mao, University of Pittsburgh, USA  
G. Elisabeta Marai, Brown University, USA  
Charles T. Meblman, Cincinnati Children's Hospital, USA  
Ayoto Miyamoto, Hiroshima University, Japan  
Larry Moreland, University of Pittsburgh, USA  
Gabriel Ng, Hong Kong Polytechnic University, China  
Norman Otsuka, UCLA, USA  
Uebcacker Peter, University of Hamburg, Germany  
Scott A. Rodeo, Hospital for Special Surgery, NY, USA  
Roy W. Sanders, Florida Orthopaedic Institute, USA  
Weibin Shi, University of Alabama at Birmingham, USA  
Rainer Siebold, Arcus, Sportklinik, Pforzheim, Germany  
Richard Simpson, University of Pittsburgh, USA  
Charrois Slivier, GSH, Paris, France  
Hilmar Stolte, Medical School Hannover, Germany  
Joachim Tenuta, US Army, West Point, NY, USA  
Ray Vanderby, University of Wisconsin-Madison, USA  
Peter Verdand, UZ Gout, Belgium  
Ken Yamaguchi, Washington University in St. Louis, USA

**Hand Research Laboratory Personnel**

Nancy Baker, DSc, OTR/L, Occupational Therapy  
Chirag Chauhan, Medical Student  
Christopher DeSanctis, Undergraduate Student  
Ahmad Fannoon, Graduate Student  
Robert Goitz, MD, Orthopaedic Surgery  
Kraig Graham, Medical Student  
Norm Gustafson, OTR/L, CHT  
Eric James, Medical Student  
Robert Kaufmann, MD, Orthopaedic Surgery  
Zong-Ming Li, PhD, Laboratory Director  
Philip McClure, Medical Student  
Rachel Siciliano, Undergraduate Student  
Jie Tang, Research Staff  
Luke Xie, Graduate Student  
Kaihua Xiu, Graduate Student

*Hand Research Laboratory, Pittsburgh Orthopaedic Journal 2008*



**Hands at Montessori**



**With Dr. Freddie Fu and guests**



**With Drs. Kai-Nan An and Chunfeng Zhao at Mayo Clinic**



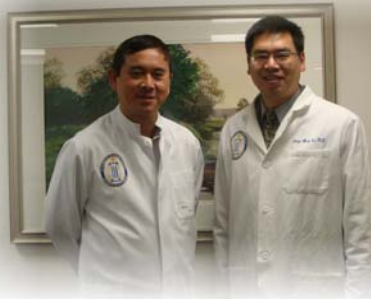
**Dr. Mark Latash visits Hand Lab**



**Dr. Ranjan Gupta visits Hand Lab**



**Dr. Charles Day visits Hand Lab**



**Dr. Fu and Dr. Li**



**Dr. Nancy Baker collaborates in Hand Lab**



**With Dr. Yudong Gu**



**Farewell to Dr. and Mrs. Sebastian Gehrmann**



**Hand morning conference**



**With Dr. PC Ho**



**Dr. Robert Kaufmann in Hand Lab**



**Drs. Morey Moreland and Corey Pacek tour guests in Hand Lab**



**Dr. Lee Berger joins Hand Journal Club**