



## Annual Fundraising Dinner

by Ted Rudy



*Pat McMahon, MD and Thay Lee, PhD, former colleagues in California, reunite at the dinner in Florida.*

This year's annual fundraising dinner was held at the Ocean Grill restaurant in Orlando, Florida in conjunction with the annual ORS meeting. It was wonderful to see second generation participants come to the dinner. New faces this year included Ali Utkan, MD, a Turkish fellow who worked with Pat McMahon, MD as well as current students of Jeff Weiss, PhD and Glen Livesay, PhD. In addition, Thay Lee, PhD brought his lab members and there was also a large Pittsburgh contingent. As the years go on, more individual alumni are regularly returning, like Marcus Hollis, PhD, Eric Reindel, MS, and Peter Newton, MD.

Out of the 60+ people that attended the dinner, the award for the furthest traveled was a three-way tie that went to Masataka Sakane, MD, Shinro Takai, MD and Nobuyoshi Watanabe, MD who all came from Japan. Shinro was also the most senior former fellow. He also brought a major contribution from his sensai, Yasusuke Hirosawa, MD.

Rich Debski, PhD, President of ORLAC, was the Master of Ceremonies and began the 'formal' portion of the evening by having an individual from each table introduce their table. With such little

notice, this led to some good-natured goofs and memory blanks but contributed to the casual sense of fun and camaraderie. Jamie Pfaeffle, PhD then summarized the aims of the organization and talked about the new research grant for medical students, residents, or fellows for medical research (as opposed to the more usual biomedical engineering uses). The point was made that this award could be named by a new major donor. Rich, assisted by Karen Ohland, MS and Jennifer Wayne, PhD, handed out plaque and certificate awards in honor of donations from the previous year.

Karen provided disposable cameras for each

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## ORLAC Board Update

ORLAC would like to welcome Chris Phillips as the Public Relations Administrator. Following is a message from Chris:

Hello everyone! As the Public Relations Administrator for ORLAC I am pleased to work with such a great group of people and have the opportunity to correspond with all of you. I will be bringing you updates on ORLAC events, funding opportunities and spreading the word about ORLAC and our mission through the web site, mailings, email, networking, the newsletter, etc. Recognition of the ORLAC name will strengthen our numbers and bring in exciting opportunities for all of us.

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# ORLAC Summer Grant Recipients

Compiled by Serena Chan Saw



*John Gardiner, MS, Masayoshi Yagi, MD, and Eric Wong, BS in the midst of testing.*

We are happy to include the following reports from this year's ORLAC Summer Grant Recipients. John Gardiner, MS, a PhD student working with Dr. Jeff Weiss in Utah (although Jeff is now in Arizona) received the 1998 Mrs. Ho-Tung Cheong Research Grant for a graduate student to visit an alumnus' laboratory to perform musculoskeletal research. John traveled to the Musculoskeletal Research Center in Pittsburgh to work with Dr. Woo and others at the MSRC to perform research that was incorporated into his PhD thesis.

Hina Patel, BS is a masters student working with Dr. Glen Livesay at Tulane University. She was awarded the Erin McGurk Research Grant for 1999 which is designated for a female graduate student to perform musculoskeletal research. Her project involved the development of an objective approach for assessing longitudinal variation in both normal ligaments and engineered ligament analogues.

Karen Reisiger was awarded the Mr. & Mrs. Kwok-Chong Woo Research Grant which was designated for an undergraduate student to perform musculoskeletal research during the summer of 1999. Karen spent the summer working with Dr. Rich Debski at the Musculoskeletal Research Center in Pittsburgh. The title of her project was "Development of an Approach to Determine Glenohumeral Capsule Force Distribution with the Arm in the Cocked Position".

*John Gardiner, MS*

Generous financial support from ORLAC in the form of a Mrs. Ho-Tung Cheong research grant enabled me to travel to the Musculoskeletal Research Center (MSRC) at the University of Pittsburgh during the spring of 1999. During my five-week stay in Pittsburgh, I had the opportunity to work under the guidance of Dr. Richard Debski and Dr. Savio L-Y. Woo. I performed research that quantified the force distribution in the human medial collateral ligament (MCL) during valgus and anterior-posterior loading.

My Ph.D. thesis research has been performed at the University of Utah under the supervision of Dr. Jeffrey Weiss. I have utilized a combination of experimental testing and finite element modeling to determine the stress-strain distribution in the human MCL during valgus loading. The experimental testing performed in our laboratory allowed for the measurement of MCL strain and joint kinematics during valgus loading. MCL surface strain was used to validate models on a

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Serena Chan Saw, MS

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# *STUDENTS, RESIDENTS, FELLOWS!!!*



## 2000 ORLAC Summer Research Grants Program



This year, we are able to offer four opportunities for graduate, undergraduate and medical students, residents or fellows, from the United States and abroad, that you won't want to miss! ORLAC continues its Annual Summer Research Grants Program for 2000 to foster young investigators pursuing musculoskeletal research. What a great way to recognize creative endeavors of the very important members of orthopaedic laboratories!

An application consists of the following:

- 1) Name of specific award, your address, and other contact information
- 2) A one page description of the objectives including a description of the project
- 3) Transcript (applicant must be student during award period) - if applicable
- 4) Resumé or CV
- 5) Letter of recommendation from a faculty or industry member
- 6) Budget for the designated amount
- 7) Mail all application materials to:

### **ORLAC**

### **Summer Research Grants Program**

**P.O. Box 7511**

**Pittsburgh, PA 15213**

The application deadline for the awards is **June 2, 2000.**

#### **The Mr. & Mrs. Kwok-Chong Woo Grant**

Designated for an undergraduate student to perform musculoskeletal research during the summer of 2000. Maximum budget of \$3,000.

#### **The Mrs. Ho-Tung Cheong Grant**

Designated for a graduate student to perform musculoskeletal research during the summer of 2000. Maximum budget of \$3,000.

#### **The Erin McGurk Grant**

Designated for a female graduate student to perform musculoskeletal research during the summer of 2000. Maximum budget of \$3,000.

#### **The Unnamed Clinicians Research Grant**

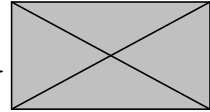
Designated for a medical student, resident or fellow to perform musculoskeletal research during the summer of 2000. Maximum budget of \$3,000. This grant is currently not endowed. We are seeking contributions from clinicians to help endow and name this grant.

The awardees and their mentors will be contacted by phone and mail by June 30. Checks for the designated amount of the specific award will be made out to the laboratory in which the work is to be conducted, with the understanding that the funds are to be used in support of the awardee's research.

That's all there is to it. So, what are you waiting for? - to have a great summer in research!

If you have any questions, please contact Rich Debski at (412) 648-1638 or [genesis1+@pitt.edu](mailto:genesis1+@pitt.edu).

# News from Around the World



Compiled by Caroline Wang, Jennifer Wayne, and Serena Chan Saw

**Maria Apreleva, PhD (MSRC)** graduated from the University of Pittsburgh with a PhD in bioengineering in June 1999. Dr. Woo was her major advisor. She then started working as a post-doc fellow at the Orthopaedic Biomechanics Laboratory at Harvard Medical School in September 1999 conducting patello-femoral and shoulder biomechanics research. Before starting her new job, she went scuba diving on the Cayman Islands. Maria proclaims "Strongly recommend! It was just amazing!"

**Ted Clineff, MS (MSRC)** graduated from the University of Pittsburgh in May 99 and immediately accepted a position as an Analytical Engineer at Orthovita, Inc. in Malvern, PA. As a member of R&D at Orthovita, his responsibilities include analyzing histology of pre-clinical animal studies, initiating a quality control program for raw materials and writing reports of analysis which directly compare their products to previously FDA accepted products. He has professional memberships to ASME, Society of Biomaterials and ORS. Ted and his wife Amy moved to King of Prussia, PA which is conveniently close to all of their family members. They plan to house hunt in the Fall/Winter of 2000.

**Alex Feng, BS (MSRC)** is currently working for Indigo Medical, a Johnson & Johnson company, doing research & development in the area of prostate cancer.

**Robert Hart, MD (UCSD)** is an assistant professor in the Department of Orthopaedics at OHSU

in Portland, OR. He has been there for 1 1/2 years. Things are going well and he looks forward to hearing how everyone is doing. He invites anyone that finds themselves in the Portland area to give him a call.

**Marsie Janaushek, MS (MSRC)** was one of Dr. Woo's students at the MSRC and graduated with her MS last June. Since then, she got a job with a small consulting firm (mainly pharmaceutical) and is living near Princeton, NJ.

**Christian Jantea, MD (MSRC)** invites everyone who is considering a trip to Europe this spring to look up their website on an Elbow Congress. <http://www.uni-duesseldorf.de/WWW/MedFak/Orthopaedie/Elbow2000prog.html>

**Lindsey Johnson, BS (MSRC)** graduated Cum Laude from Duke University and is now a graduate student at the University of Texas at Austin. She is working in biomechanics under Dr. Marcus Pandy and is hoping to do research on modeling of muscle.

**Meena Joshi, MS (UCSD/MSRC)** and her husband Sujay welcomed the birth of their son Arjun Sujay Mehta who was born on September 9, 1999.

**Min Kocher, MD (MSRC)** and his wife Michele Dupre announced the birth of their daughter Isabelle this past summer.

**Deidre MacKenna, PhD (UCSD)** continues her employment with Tanabe Research laboratories in San Diego. She was promoted to Group Leader of the anti-inflammatory drug discovery program. Deidre has traveled 3 times to the parent company in Japan (Tanabe Seiyaku (two sites): Osaka and Tokyo) where she saw **Shinro Takai, MD** in Kyoto, but never managed to hook up with **Shuji Horibe, MD**. She will probably travel to Osaka and Tokyo several more times in the upcoming year and hopes to meet other ORLAC alumni on her travels. On the personal side, she traveled to New Zealand for Christmas and saw the millennium arrive before everyone else! She also visited the boats in the Auckland America's



*Doug Boardman, MD, Kim Doran, BS, and Kevin Armstrong, MD enjoying themselves in Florida.*

cup harbor (of great interest for those who have spent months watching the races on the internet and ESPN2).

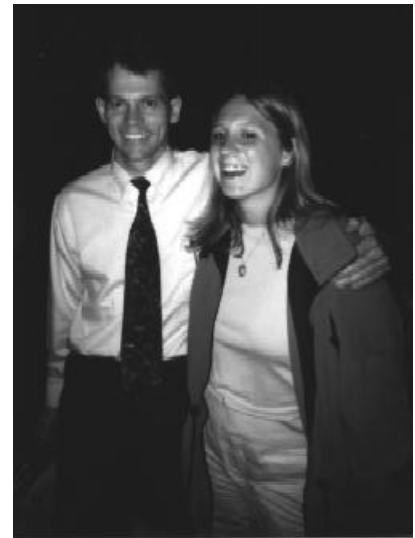
**Ted Manson, MS (MSRC)** is currently in his second year of medical school at Northwestern in Chicago and is also participating in bioengineering related clinical research on scoliosis.

**Karen May-Newman, PhD (UCSD)** is currently in her second year as an Assistant Professor at San Diego State University in the Department of Mechanical Engineering. She is also the Director of the Bioengineering Laboratory there. Karen has research projects in the areas of cardiac perfusion, heart valve mechanics and cell mechanics. She uses both experimental and computational techniques to investigate these areas. Her teaching responsibilities include biomechanics and biomaterials, as well as their foundations in materials science and mechanical design. She is very involved with the San Diego chapter of the Society of Women Engineers, and is currently chairing their industrial outreach program. On a personal note, she is married to Peter Newman and they have one son, Alexander, 2 years old. They live in Encinitas, CA. Her website has a little bit more info, but is still under construction. Karen hopes you are all doing well. Her website is: <http://www.engineering.sdsu.edu/~kmn>

**Shuhei Morifusa, MD (MSRC)** currently is the Chief of Orthopaedic Surgery of Rakuwakai Marutamachi Hospital which is a private general hospital located in the downtown of Kyoto, Japan. His family is well and daughter Miho is a first year student in elementary school, son Ryosuke is attending Kindergarten while son Kohtarō recently began to walk.

**Duane Morrow, MS (MSRC)** is currently working as an Engineer in the Biomechanics Laboratory at Mayo. Much of his effort is spent developing a new method to more objectively quantify cerebellar tremor. Other projects which he lends engineering and/or programming support to include: design and evaluation of a knee brace with a wrapped-spring clutch to decrease energy consumption in patients with chronic leg weakness, modelling of various wheelchair parameters to op-

imize propulsion effort, as well as various aspects of incorporating Motion Analysis to study the course of primary progressive MS, and the effects of exercise programs on osteoarthritis of the knee. On the home front, Duane and his wife Valerie



*Former UConn Huskie student Danyel Tarinelli, MS with current Huskie professor Doug Adams, PhD.*

welcome the birth of their twin boys, Nathaniel Allan and Benjamin Allan. The boys were born on February 9 and are doing well.

**Ephi Most, BS (MSRC)** has been working on her MS degree in Mechanical Engineering at MIT. She hopes to graduate this coming May. Her current research topic is the validation of the robotic system for TKA use and works under the supervision of **Dr. Guoan Li** at the Orthopedic Biomechanics Laboratory in Boston, MA.

**Mark Musolino, MS (MSRC)** wrote that since leaving the MSRC at the end of 1996 with his MS degree, he has had the pleasure of working with Dr. Mark Redfern at the University of Pittsburgh, just downstairs from the MSRC. He has recently re-entered the graduate program in bioengineering and expects to torture himself for the next 3 years in hopes of earning a Ph.D. Most of his work thus far has focused on the biomechanics of quiet standing and gait, but for his dissertation, he plans on utilizing non-linear and stochastic concepts to develop a model of the postural control system. Outside of the lab, he is writing and performing music as much as he can, playing lots of basketball and ultimate frisbee, hiking, snowboarding, and spending time with his girlfriend. He'd also like to announce that his band, *ila* (eye-luh) released its first album last year. For

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News Around the World (cont'd)



Glen Livesay, PhD with his students, Hina Patel, BS and J.B. Raasch, MS

those interested in pop/rock music with a wizard-of-oz type of flair, check out [www.ilamusic.com](http://www.ilamusic.com) for info and free song downloads.

**Peter Newton, MD (UCSD)** remains busy with his clinical practice, but has cut back some to take on new responsibilities this year. The Children's Hospital Orthopedic Biomechanics Lab is up and running and he is coordinating the research program (Clinical Outcomes Center, Biomechanics Lab, Motion Analysis Lab, Spinal Deformity Research Center) as the Chief of Orthopedic Research. On the clinical front, the minimally invasive methods of scoliosis treatment continue to be advancing, and they are now performing corrective anterior spinal roddings completely thoracoscopically.

**Masahiko Noguchi, MD (MSRC)** serves as Assistant Professor and Chief for the Foot and Ankle Service with the Department of Orthopaedic Surgery at Kyoto Prefectural University of Medicine. Recently, he has also been doing research on the Achilles tendon which was presented in two separate abstracts at ORS 2000.

**Christos Papageorgiou, MD (MSRC)** is now Chief of Arthroscopy and Sports Medicine as well as a staff member at the Orthopaedic Sports Medicine Research Center (<http://users.otenet.gr/~grakos/>). He is the winner of the "Albert Trillat" Young Investigator Award at the 1999 ISAKOS Congress. In March/April 2000, he visited Asia and Australia as one of the three traveling Fellows of ESSKA-WPAOSSM. He is very active in knee ligament biology and biomechanics, bone tunnel

healing, as well as meniscus research.

**Moby Parsons, MD (MSRC)** and his wife Yasmine welcomed the birth of their daughter Alexandra Isabelle on March 30, 1999.

**Anthony Petrella, MS (MSRC)** will be defending his doctoral dissertation entitled, "The Effect of Surgical Alignment on Tracking, Load Transfer, and Wear in the Patellofemoral Joint after Total Knee Arthroplast," in April 2000. He is currently finishing research and looking for faculty/post-doc positions. He is also getting married in Pittsburgh in October 2000.

**Jamie Pfaeffle, PhD (MSRC)** defended his PhD in August 1998 and is currently a 4th year medical student. He will be continuing his studies as a resident in Orthopaedic Surgery at the University of Pittsburgh. Two papers from his dissertation work were published (most recently 12/00 in J Biomechanics) and 3 more are in revision. On a personal level, he continues to date his long time girlfriend Tara Beckman with no marriage plans until they are both  $\geq 30$  yrs old.

**Anton Plakseychuk, MD (MSRC)** is finishing his Trauma fellowship in Pittsburgh and will stay to work as a research fellow. He moved to a new house and just finished remodeling the kitchen. His wife Anna has been accepted into the residency program in Anesthesia here at UPMC.

**Christopher Powers, PhD (OBL/VAMC Long Beach)** is currently an Assistant Professor and Director of the Musculoskeletal Biomechanics Research Laboratory in the Department of Biokinesiology and Physical Therapy at the University of Southern California. Their research efforts continue to be dedicated to the biomechanical investigation of locomotion, musculoskeletal disorders, interventions and adaptations. Over the last year, his laboratory has grown considerably as there are now 6 doctoral students, 3 Masters students and one post-doctoral research fellow. They look forward to a productive 2000!

**Eric Reindel, MS (UCSD)** was previously employed at Norian Corporation in Cupertino, CA as a Biomechanical Engineer performing distal radius and tibial plateau fracture and repair re-

search and developing techniques to best utilize SRS, a calcium apatite bone graft substitute. He has since returned to the San Diego area to work at Kinetikos Medical Incorporated (KMI) as Director of Engineering. KMI is an upper and lower extremity small bone implant device manufacturer. His son, Dane Reindel celebrated his 11th birthday in September.

**Dawn Tramaglino Rudd, MD (MSRC)** graduated from Penn State College of Medicine with AOA honors in May 1999. She is currently doing her residency in Internal Medicine at Wilford Hall Medical Center at Lackland AFB in San Antonio, Texas. She is also a Captain in the Air Force.

**Tom Runco, MS (MSRC)** has moved into a historic carriage house in the lovely Main Line area of Philadelphia. He continues to work for Synthese Spine in Paoli, PA and loves it. Mostly, he designs posterior instrumentation systems for the correction of spinal deformity and degeneration. He has also been developing anterior spinal implants for the treatment of fractures, tumor, and spinal deformity. Between traveling to surgeries, he has been going back to Pittsburgh to visit with nieces and nephews (a new little nephew makes 7) and old friends.

**Ryoma Saito, MD (MSRC)** currently works for the Department of Orthopaedics, Maizuru National Hospital, where his responsibilities include care of general orthopaedic cases. However, his specialty is spine, such as disc herniation, spondylotic radiculopathy and myelopathy, infection, and trauma. He and his wife Yoko have a daughter Yuho, "Yu" which means gentle, and "ho" which means walk. She is 2 years 8 months old and loves the snow.

**Masataka Sakane, MD (MSRC)** has been an attending orthopaedic surgeon at Ibaraki Prefectural University Hospital and an Assistant Professor in the Medical Science Institute of the Ibaraki Prefectural University of Health Science since April 1999. His present research projects include tissue engineering, impact biomechanics, and new upper cervical surgeries for disabled children. His wife Michiko and children (Natsumi, Tomoha, and Mafuyu) are doing well. They moved into a new



*A senior with his junior from Tsukuba University, Masataka Sakane, MD and Akihiro Kanamori, MD.*

home in February.

**Matt Sandusky, BS (OBL/VAMC Long Beach)** is currently working for **Chris Powers, PhD** in the Musculoskeletal Biomechanics Research Laboratory at USC.

**Rob Svitek (MSRC)** is now a senior in Bioengineering at the University of Pittsburgh, graduating in May 2000. He is currently working on a senior design project which involves increasing the biocompatibility of biomaterials by attaching a protein to the polymer of interest. He plans on attending graduate school in the fall although he has been job searching as well. Rob also was a previous awardee of the Mr. & Mrs. Kwok-Chong Woo Research Grant.

**David Tung, PhD (UCSD)**, spent three years in a joint postdoctoral fellowship program at Parke-Davis and the University of Michigan, studying inflammation and rheumatoid arthritis. He then went to Axys Pharmaceutical in South San Francisco to do inflammation research and was also the IACUC chair of Axys. About 6 months ago, Chiron Corporation approached him for a position to run their preclinical pharmacology program in osteoarthritis. He took the position and is now in charge of that program as well as other preclinical pharmacology programs in fracture healing, cardiomyopathy, spinal cord injury, traumatic brain injury, stroke and other CNS indications. He is also the pharmacology representative on a committee in charge of evaluating external requests for Chiron compounds (for academic research). Sometimes he feels more like a politician than a scientist and

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## Summer Awardees (cont'd)

subject-specific basis. Unfortunately, we were unable to quantify the force contribution of different MCL regions or even the entire MCL in maintaining valgus stability. These data would be useful for validating the assumptions used in formulating our model (such as the assumption that the MCL-meniscal attachment may be neglected) and as a secondary means of validating our finite element modeling results.

Prior to traveling to Pittsburgh, I formulated a research plan utilizing the infamous MSRC robot to determine the *in situ* force distribution in the human MCL under various loading conditions. During my first couple of weeks at the MSRC, I was able to optimize this research plan as I learned about the capabilities of the robotic/UFS testing system from my discussions with Dr. Debski and my interactions with the MSRC students, fellows, and staff. I am grateful for the support that everyone provided me during this learning period and for the opportunity to participate in the activities of other MSRC groups.

During my last couple of weeks at the MSRC (and one additional week on a return visit in August), we were able to test six human knees using the robotic/UFS testing system. Each knee was tested in force control mode under valgus (10 N-m) and anterior-posterior (134 N) loading at 0, 30, 60, and 90° degrees of flexion to determine the intact knee kinematics. The robot was then used to reproduce the intact knee kinematics after sequential cutting of different regions of the MCL. Using the principle of superposition, the *in situ* force distribution in the medial structures was determined. The cutting of MCL structures was performed by an orthopaedic research fellow, Dr. Masayoshi Yagi. Separation of the MCL and medial meniscus was followed by cutting of the posterior medial complex, the posterior oblique ligament, and finally the remaining portions of the superficial and deep MCL. At the conclusion of all cutting, a final set of force control tests was performed to determine the kinematics of the MCL deficient knee. Results of this work have been analyzed and are being prepared for publication.



*John Gardiner, MS posing by MSRC's robotic/UFS testing system which he utilized in his project.*

Data should help to clarify the relative importance of the medial structures of the knee in maintaining valgus and anterior-posterior joint stability.

I would like to once again thank ORLAC for their financial support that provided me the unique opportunity of working at the MSRC. Working in a different lab provided me with a new perspective on orthopedic research. Also, thanks again to Dr. Debski and Dr. Woo for their guidance and thanks to Eric Wong and Dr. Masayoshi Yagi for their countless hours spent helping to design and perform my experiments. I am grateful for the chance I had to collaborate with the MSRC and encourage other students to take advantage of the ORLAC summer grants program.

### *Hina Patel, BS*

It was a great honor to receive the Erin McGurk Grant from ORLAC for 1999, and enabled me to spend the summer performing research with Dr. Glen Livesay in the Biomechanics Laboratory at Tulane University. My project focused on the development of an objective approach for assessing longitudinal variation in both normal ligaments and engineered ligament analogues. This is an important aspect of understanding normal tissue response under loading, and also represents an emerging challenge in tissue engineering: the assessment of the uniformity and repeatability of scaffold construction.

Before attempting to test and examine normal ligaments or engineered tissues, we sought to create and analyze non-biologic specimens and test them under uniaxial loading to refine our methodology. This was expected to be a relatively brief process, but as you will read, the majority of our efforts were spent on developing the methodology. However, as I have learned in research, the most basic problems often become the most challenging to address - and it has been a very rewarding process.

Given the large deformations characteristically seen in soft tissues such as ligaments, and based on preliminary tensile testing of some engineered analogues, it was evident our non-biologic specimens would need to be capable of large elastic deformation. We therefore sought to create specimens with known longitudinal variation in mechanical properties through controlled mixing of different elastomers (with different mechanical properties). Despite our best efforts, however, it became apparent that creating a known, controlled variation through mixing was actually quite difficult. An alternative solution was to introduce known (apparent) variation in mechanical properties by simply varying the thickness of the specimens and using a single elastomer. With our 2-dimensional view of the specimen during testing, a change in thickness (in and out of the plane of interest) worked very well. The challenge then



Hina Patel, BS, the 1999 recipient of the Erin McGurk Grant

was to introduce a smooth variation in thickness during the molding process. This was achieved by generating single wavelength sinusoidal profiles out of Delrin through CNC machining, and use these to create the variations in thickness during molding. To

explore different types of longitudinal variation, nine molds were machined in all combinations of three different amplitudes and three different wavelengths.

Specimens were subjected to uniaxial loading in an MTS hydraulic testing frame, corresponding to an overall elongation of up to 20%. Surface strains were tracked using mustard seed markers placed longitudinally along the length of each specimen. Beginning with 17 markers, it was possible to investigate the reproduction of the actual strain field for different sets of markers, specifically considering equally-spaced sets of 2, 3, 5, 9 and 17 markers. With our interest in contrast-based imaging of surface strains, we utilized black mustard seeds, which are approximately 0.9 mm in diameter and spherical. Images of the surface markers were collected during testing using a frame grabber (Flashpoint) and stored on a personal computer. These images were analyzed with NIH image, through stacking of a set of images from a single test and using a custom macro to threshold, search for peaks in the images (marker color), and then determine the longitudinal positions of the markers.

Since the longitudinal variations were of known magnitude, we were then able to compare the amount of strain observed experimentally to the expected strain, based on the specific mold used for the specimen. We determined that longitudinal distance over which any strain variation occurs has a greater effect on the number of surface markers required to accurately capture the true behavior than the variation itself. This was true for all three levels of induced variation in the modulus, and was somewhat surprising as we expected there to be a significant interaction between length and magnitude of induced variation.

We have recently begun examining engineered ligament scaffolds and will be exploring improved approaches to represent the strain distribution within soft tissues. While more markers allow better assessment, there is an experimental limit, so we are exploring the interaction between the number of surface markers and the analytical

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## Summer Awardees (cont'd)



*Karen Reisiger, the 1999 recipient of the Mr. & Mrs. Kwok-Chong Woo Grant.*

treatment of the strain.

This work would not have been possible without the support of the Erin McGurk grant from ORLAC, and it has allowed me to explore new areas in research. The lessons I have learned through this experience will continue to benefit me as I complete my Masters degree this summer and seek a position in biomedical industry. This is a great program and if you're a graduate student with some ideas for research - I encourage you to take advantage of the opportunities available through the ORLAC Summer Grant Program.

### *Karen Reisiger*

As an undergraduate student in the Department of Bioengineering at the University of Pittsburgh, I have chosen a biomechanics concentration. This past summer I was fortunate to obtain the Mr. & Mrs. Kwok-Chong Woo ORLAC Summer Research Grant, which allowed me to complete a research project at the Musculoskeletal Research Center. I hope to take knowledge gained during my summer experience into the sports world someday. I have been considering sports biomechanics and sports equipment design as possible career paths. Working at the MSRC was a valuable experience and I learned a great deal about research and biomechanics. I would like to thank Dr. Woo and the rest of the MSRC for all their support this summer.

My summer research project included the de-

velopment of a methodology to examine the function of the glenohumeral joint, which is one of the most commonly dislocated joints in the body. Although the mechanism of joint stability provided by the glenohumeral capsule, ligaments and muscles is not well understood, previous research has shown that stability is dependent on the joint's position. In order to effectively treat injuries associated with a given joint motion, it is important to know the forces that each ligamentous component is subjected to at various arm positions. The cocked arm position of the throwing motion is extremely relevant in sports medicine and orthopaedics. Many shoulder injuries occur in this position during sport activities such as baseball, volleyball, football, and swimming.

The study utilized a previously developed methodology as a foundation and incorporated several improvements to calculate the force in each of the glenohumeral ligaments in a clinically relevant arm position. The advantage of this experiment over past studies includes the use of specimen specific data for each ligament instead of average data. This reduces the error and produces a more accurate analytical model to predict ligament forces.

A coordinate transformation program in Mathematica was written to transform surface geometry between two coordinate systems. For use in this project, points from the Digibot are transformed into the Flock of Birds coordinate system. Then, the entire surface geometry of the scapula and humerus are transformed into the Flock coordinates using the rotation matrix and translation vector found from the program. Shoulder kinematics were then recorded and sample points were digitized. Unfortunately, accuracy problems were encountered using the Flock of Birds Tracking System. Therefore, testing was preformed to determine if the problem was due to the hardware, software, electromagnetic interference or device failure.

An understanding of the forces in the capsule and ligaments directly effects the diagnosis and treatment of shoulder instability. Furthermore, this type of information is important, since surgical

overtightening of the capsule may lead to abnormal joint positions, humeral subluxation and osteoarthritis. The forces present in individual ligaments at different positions are also important in rehabilitation so that safe and effective rehabilitation protocols can be developed.

Once again, I would like to thank Dr. Savio L-Y. Woo for the endowment of my summer research grant, Dr. Richard Debski for his guidance in the project, Al Vangura and Jim Fenwick for their help and humor, Amaury Rolin for his help with those damn birds, Jorge Gil, Jen Zeminski, Maria Apreleva, Lou DeFrate and Damion Shelton. Thanks to everyone at the MSRC!!

**News Around the World (cont'd)**

is still getting used to the new role as a 'scientian'. He and his family moved to a new house on 12/31 - literally just before midnight. Kryztopher is now 12 and Norahlyza is 9. His wife, Aracely, and the children are happy in their new surroundings.

**Al Vangura, BS (MSRC)** and his wife Vicki welcomed the birth of their first daughter, Emily Rose who was born in November. Al also defended his Masters thesis in April 2000. He is currently working for CardiacAssist in Pittsburgh.

**Caroline Wang, MS (UCSD)** is working at home with her kids, Christopher, age 3, and Sasha, age 15 months. She is now the Secretary for ORLAC and is hoping to be in touch more with San Diego friends, as well as the field in general. Her husband Mike has just sold his company, Direct Hit (www.directhit.com) to Ask Jeeves, another search engine, based in Emeryville, CA.

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**Currently, at the Orthopaedic Research Laboratory at Virginia Commonwealth University:**

**Jennifer Wayne, PhD (UCSD)** continues as Associate Professor of Biomedical Engineering and Director of the Orthopaedic Research Laboratory at Virginia Commonwealth University in Richmond. Her research in articular cartilage takes a three-pronged approach, combining mechanics, repair, and imaging. Two new research fellows, **Dr. Cyrus Kump** and **Dr. Timothy Marqueen**, joined the lab in July. A new full-time faculty mem-



*Dr. Jeff Weiss' students John Gardiner, MS, Amy Lai and Stuart Loui*

ber was recently recruited to direct the Molecular Biology/Biochemistry Division of her lab. Jennifer continues to serve on the Bioengineering Division of the ASME, on the Program Committee (after having been the Technical Program Chair for IMECE 1999), as a BED representative to the Operating Board, and as sessions organizer. On the homefront, her two daughters (Stephanie 7 1/2 yo and Nancy almost 5 yo) are growing up at an alarming rate and thoroughly enjoying school, gymnastics, ice skating, etc. Her husband, Forrest Sloan, recently joined Puget Sound Rope, an exciting business out of Seattle, WA.

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**Currently, at the Musculoskeletal Research Center at the University of Pittsburgh:**

One of the most exciting events that occurred at the Musculoskeletal Research Center this past year was the 23<sup>rd</sup> Annual American Society of Biomechanics Meeting held for the first time in Pittsburgh this past October. The local organizing committee was chaired by **Drs. Lars Gilbertson** and **Savio Woo**. The numerous sessions ranged from sports biomechanics and cardiovascular biomechanics to modeling and neural control. A highlight of the opening ceremony was a keynote lecture delivered by Professor Y.C. Fung, the "Father of Modern Biomechanics", at the Carnegie Music Hall. The conference was a great success and established Pittsburgh as a city to remember.

The MSRC also has been successful in gaining extramural funding. Grants were funded from

*(continued on Page 12)*

## News Around the World (cont'd)

a variety of sources. The ACL and MCL groups successfully renewed their grants through the National Institutes of Health, the Muscular Dystrophy Association, and the Pittsburgh Tissue Engineering Initiative. The MCL group was also successful in obtaining funding from the Rockefeller Brothers Fund and was awarded a \$25,000 grant. The PCL group was awarded four new grants this year from various sources totaling \$170,000 from The Aircast Foundation, Johnson & Johnson, The American Orthopaedic Society for Sports Medicine and The Orthopaedic Fellows Foundation.

In November of 1999, graduate students **Jonathan Sakai, BS**, **Ted Clineff, MS**, and **Marsie Janaushek, MS** were three out of the six finalists for the Masters Level Student Paper Competition at the ASME meeting in Nashville, TN. Ted was awarded 2nd place in the competition. **Todd Doehring, MS** was a finalist in the Doctoral Level Student Paper Competition and eventually was awarded 3rd place. **Jonathan Sakai, BS** and the spine group were awarded the Microstrain Award during the American Society of Biomechanics meeting for their work entitled "Basic Science and Clinical Applications of a Magnetic Tracking/Virtual Reality Based System for Assessment of Overall Cervical Spine Kinematics". Both **Jamie Pfaeffle, PhD** and **Steven Abramowitch, BS** were finalists for the Journal of Biomechanics Award presented at the American Society of Biomechanics meeting.

Under the direction of **Drs. Lars Gilbertson** and **James Kang**, the Spine group achieved a trio of awards and deserved much praise. **Dr. Seong-Hwan Moon** and the Spine group were awarded the Outstanding Paper Award by the North American Spine Society for their work entitled "Human Intervertebral Disc Cells are Genetically Modifiable In Vitro" in October as well as the Basic Science Award by the Cervical Spine Research Society in December for the paper entitled "Human Cervical Disc Cells Are Susceptible to Adenovirus-Mediated Gene Therapy". **Dr. Kotaro Nishida** and the Spine group were awarded the Eastern Orthopaedic Association Founders' Award at the An-



*MSRC graduate students  
Jennifer Zeminski, BS and Eric Wong, BS.*

niversary Meeting held in October for work entitled "Intradiscal Gene Therapy: Preclinical Feasibility Studies of Adenovirus-Mediated Gene Transfer for Genetic, Biochemical and Biological Modification of the Intervertebral Disc".

Under the direction of **Drs. Freddie Fu, Rich Debski and Savio Woo**, the ACL group was also successful in their endeavors this year. **Dr. Akihiro Kanamori** was awarded the Arthroscopy Association of North America Research Award at the Annual Meeting in April for work entitled "The Effect of Axial Torque on Grading the Pivot Shift Test: A Biomechanical Analysis".

The MSRC (and ORLAC) sponsored a new addition to the ORS this year. **Drs. Richard Debski, James Wang, and Savio Woo** organized The International Symposium on Ligaments and Tendons (ISL&T) held one day before the ORS at the Grand Floridian Resort in Orlando, Florida. With 106 attendees, this meeting was unique in that there was extra time allotted for discussion to allow students and faculty to receive extensive quality feedback on their research. We have received numerous positive feedback from this endeavor. Many others had heard about the meeting afterwards and were interested in joining next year. The ISL&T will become an annual meeting for years to come.

During this past year, **John Withrow** defended his Masters thesis and is now continuing his education in business at Duke University. **Michael Wentz** and **Nicholas Perrusquia** also completed their Masters program this past summer.

Several new fellows have joined the MSRC. **Gustavo Azcona-Arteaga, MD** arrived from Mexico City, **Feng-Yan Jia, MD** joined us from Xi'an University in China, **Yukihisa Fukuda, MD** joined us from Kyoto Prefectural University of Japan with both a medical and engineering background and **Eiichi Tsuda, MD** arrived from Hirosaki University of Japan. In addition, **Danyel Tarinelli, MS** joined us from the University of Connecticut in July as a staff research engineer. **Ezequiel (Zeke) Cassinelli, MD, Ronald Hall, MD** and **J. Mi Lee, MD** are all Orthopaedic residents spending a year doing research in the MSRC.

This past summer, 10 students participated in the Summer Undergraduate Research Program coordinated by Dr. Lars Gilbertson. Returning students were **Damion Shelton** and **Rob Svitek** of the University of Pittsburgh. Together they joined **Jon Fischer, Karen Reisiger, Beth Kirkpatrick,** and **Ryan Costic** from the University of Pittsburgh, **Thomas Vikoren,** a medical student from the University of Pittsburgh, **Amaury Rolin** and **Shivdev Rao** from Carnegie Mellon University, and **Michael Williams** from Ringgold High School.

The MSRC welcomed several new undergraduate students from the University of Pittsburgh. **Jonita Cutts, Kristina Goodoff, Dan Hubbard, John Jolly,** and **Maribeth Thomas** will complete projects throughout this year under the direction of Dr. Rich Debski.

Families in the MSRC are also expanding. **Serena and Kyi Saw** welcomed the birth of their first son, Jacob Andrew, who was born on January 8. **Rich and Mandy Debski** announced the birth of their first daughter, Riley Jacqueline on April 4. **Ken and Sandie Fischer** are anxiously awaiting the arrival of their third daughter in May.

Wedding bells are also ringing. **Mary Gabriel, BS** married Adam Knudsen in May 1999. **Yukihisa Fukuda, MD** briefly returned to Japan in April 2000 to marry his fiance and bring her to the United States. **Pat McMahan, MD** returned to the MSRC and the Department of Orthopaedic Surgery at the University of Pittsburgh after work with Thay Lee, PhD at UC Irvine. He and his fiance Vitolene McCabe were married on April 8, 2000.

**Steve Abramowitch, BS** announced his engagement to Debra Brandt. They are planning a June 2001 wedding.

**Chris Phillips** left the MSRC in February 2000 to pursue another position, **Kotaro Nishida, MD** returned to Japan after spending almost 3 years at the MSRC and **Seong-Hwan Moon, MD** returned to Korea after his 2 year fellowship.

**Dr. Savio Woo** has been taking a six-month sabbatical leave from the Univ. of Pittsburgh. He and Mrs. Woo have been enjoying the warm winter (although a little rainy) in California at Stanford University. While at Stanford, Dr. Woo is learning more about functional assessment of body motion from his colleagues as well as participating in special courses such as bioengineering research and development as well as tissue engineering. In addition, much effort has been devoted to the understanding of new biotechnology firms as well as dot-com companies. Hopefully upon his return, the MSRC can collaborate and derive funding from some of these companies as well as engage in the entrepreneur spirits of start-ups.

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 • **If you have an address change or exciting news** •  
 • **that you would like to share with ORLAC,** •  
 • **please let Serena know by:** •  
 • **Phone: (412) 648-2023, fax: (412) 648-2001 or** •  
 • **email: chanss+@pitt.edu** •  
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### Fundraising Dinner (cont'd)

table and Todd Doehring, MS took digital-camera candid pictures. Todd's efforts were more computer-compatible and so are posted on the ORLAC website for your enjoyment. How many can you name? We all enjoyed the dinner and socializing.

Meeting like this year after year has led to a continued acquaintance with former strangers -- whether or not one worked directly with them, has met them at previous ORLAC dinners or just recognizes them from the literature. It changes the way one listens to the presentations at ORS (and the pre-ORS International Symposium on Ligaments and Tendons which was sponsored, in part, by ORLAC). Be sure to put us in your plans next year.

# ORLAC in Japan

by Akihiro Kanamori

Dr. Woo was recently invited as a guest speaker for the Japanese Orthopaedic Association (JOA) annual meeting that was held in Kobe, Japan from April 6-9, 2000. ORLAC members that were able to attend the meeting gathered together and had a wonderful dinner (not sushi, but Italian) on April 6. Those in attendance included former fellows that have worked with Dr. Woo (Drs. Shuji Horibe, Shinro Takai, Hiromichi Fujie, Ryoma Saito, Takashi Marui, Yasuyuki Ishibashi, Masataka Deie, Kotaro Nishida and Nobuyoshi Watanabe), fellows currently working at the MSRC (Drs. Akihiro Kanamori, Masayoshi Yagi, Yukihisa Fukuda) and future fellows (Drs. Takatoshi Shimomura from Kobe and Yasuhiko Watanabe from Tsukuba). Some of the members were able to bring their spouse while others brought pictures of their children. Dr. and Mrs. Woo had a wonderful time with

everyone. We would like to thank Dr. Marui who organized this wonderful dinner despite his busy schedule as a committee member for the JOA meeting.

## Board Update (cont'd)

In this new millennium the ORLAC Board of Directors is fully committed to the mission of supporting orthopaedic research by expanding your knowledge and awareness of ORLAC. This is a monumental task well worth the effort. Your support is greatly appreciated. If you have any suggestions or comments, please drop me a line via email or phone! I would love to hear from you. You may reach me at the following:

**Chris Phillips**, PR Administrator, ORLAC  
(724) 258-6773, orlacpr@home.com.

I look forward to hearing from you!

**ORLAC**  
**P.O. Box 7511**  
**Pittsburgh, PA 15213**

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