# American Society of Biomechanics

## 28th Annual Conference

LEGACY Health System

Biomechanics Laboratory

OHSU Oregon Health & Science University

## Program

Portland, Oregon, September 8-11, 2004

www.biomechresearch.org

# Welcome

## FROM THE ASB PRESIDENT

Dear ASB participants,

I would like to welcome you to beautiful Portland on behalf of the American Society of Biomechanics. Like any scientific gathering, the meeting of the American Society of Biomechanics is about the exchange of scientific information. However, it is much more than that. It is about meeting old friends and colleagues. It is about discussing new research ideas in an informal environment, and about exposing students and newcomers to the exciting field of biomechanics. Students have always been an important aspect of this conference. They compete for the New Investigator's Award in a pre-doctoral and post-doctoral category, they are exposed to a student mentoring program, and their attendance is supported by the ASB and local organizers so that costs can be kept at a minimum.

Michael Bottlang, the local organizer, and Steve Robinovitch, the program chair, have put together an exciting conference in a beautiful setting. Let's take full advantage of this meeting and the social program, for interaction, mentoring, advising, and fun.

A special aspect of this year's program will be the Jim Hay Award with a designated session in the area of Sports Biomechanics and Exercise Science. This award was instigated at the suggestion of students and friends of Jim Hay and the ASB executive board. The purpose was to honor the memory of the late Jim Hay, a pioneer in biomechanics, a founding member of the ASB, a dedicated scientist, scholar and educator whose commitment to excellence in science and to student education was unparalleled, but most of all to a friend who we miss very much.

Welcome to Portland! I wish you an enjoyable and exciting conference that you may remember for a long time, and that might give you inspiration and strength for your future research endeavors.

Walter Herzog, President ASB

## FROM THE LOCAL HOST

Welcome to Portland for the 28th meeting of the American Society of Biomechanics! The ASB conference has always been my personal favorite, and it is a great honor and pleasure for us to be your host in Portland. The ASB conference provides a unique blend of science over the wide range of disciplines in biomechanics. Its character is not intimidating but stimulating for students and seasoned scientists alike. It is an ideal place to learn, to get inspired, and to establish collaborations.

You contributed a record 365 abstracts, and Steve Robinovitch assembled an exciting program. Equally impressive has been the diligence and enthusiasm with which the members of the local organizing committee have prepared this conference. All that's left to do is to enjoy the conference, meet old and new friends, and become inspired.

After an exciting scientific program, you can enjoy Portland, the city of roses, bridges, and micro-brews. Access to the ocean and lush green mountains offers a wealth of outdoor opportunities that will entice you to stay an extra day.

Michael Bottlang, Meeting Chair

## Conference Committee:

| | |
|---|---|
| Program Chair: | Steve Robinovitch, Ph.D., Department of Kinesiology, Simon Fraser University, Burnaby, B.C. |
| Conference Chair: | Michael Bottlang, Ph.D., Biomechanics Laboratory, Legacy Research Center, Portland, OR |
| Conference Co-Chair: | Steven M. Madey, M.D., Legacy Health System, Portland, OR |
| Organizing Committee: | Mark Sommers, MS, Biomechanics Laboratory, Legacy Research Center |
| | Larry Ehmke, MS, Biomechanics Laboratory, Legacy Research Center |
| | Marcus Mohr, MS, Biomechanics Laboratory, Legacy Research Center |
| | Tanja Augustin, Biomechanics Laboratory, Legacy Research Center |
| | Marie Shea, MS, Biomechanics Laboratory, Oregon Health & Science University, Portland, OR |
| | Julianne Abendroth-Smith, Exercise Science, Willamette University, Salem, OR |
| | Sean J. Kirkpatrick, OGI School of Science and Engineering, Portland, OR |
| | Brian K. Bay, Mechanical Engineering, Oregon State University, Corvallis, OR |
| | Dan Fitzpatrick, Orthopedic Healthcare Northwest, Eugene, OR |
| | Andy Karduna, Exercise and Movement Science, University of Oregon, Eugene, OR |

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# General Information

## Conference

The 28th Annual Meeting of the American Society of Biomechanics provides a forum for exchange of information among the multiple disciplines in biomechanics, including biomechanical engineering, exercise science, and health sciences. Objectives of this meeting are to promote the exchange of ideas, to encourage interdisciplinary collaboration, and to foster emerging scientists in bioengineering careers.

## Conference Location

The Doubletree Lloyd Center Hotel, 1000 NE Multnomah, Portland, OR 97232 is the designated Conference Hotel. All meeting events, presentations and poster exhibits will take place on the main floor of the hotel. The Doubletree Hotel provides all necessary amenities in one location to ensure an effective Annual Meeting: two restaurants, one bar, an outside swimming pool, and a complimentary fitness center. You will enjoy the convenience of staying at the hotel, meeting your colleagues for breakfast and strolling along the exhibits and posters to the sessions. Next to the hotel is a MAX light-rail stop. Max is free within downtown Portland and provides convenient transportation to many local attractions and to the ASB Banquet at the Chinese Garden.

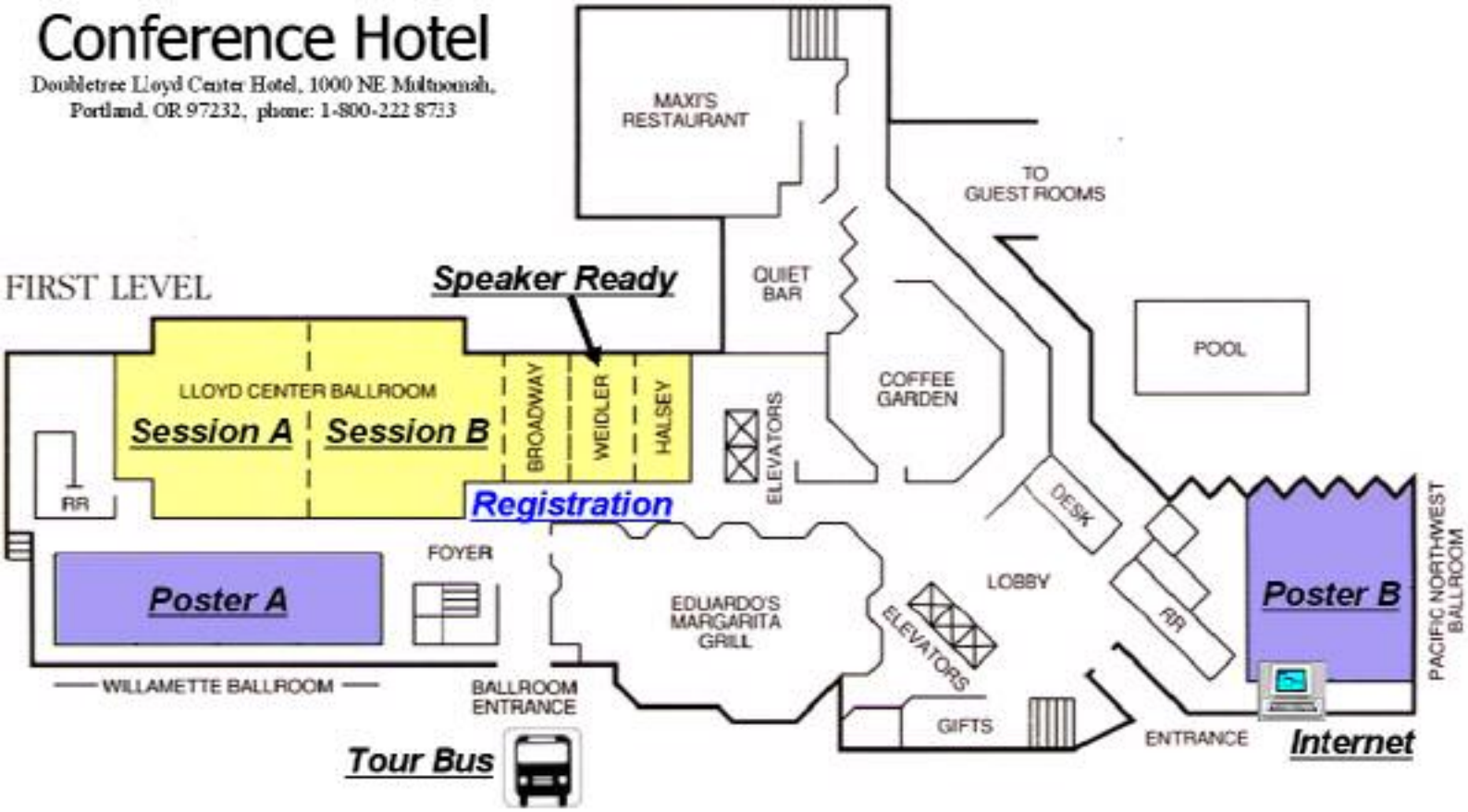
## Program

| | | | |
|---|---|---|---|
| **Lab Tours** | Wednesday, Sept. 8 | 12:30 pm - 3:30 pm | NIKE, Legacy Research Center |
| | Thursday, Friday, Sept. 10, 11 | 12:40 pm - 2:00 pm | NSI, Legacy, other tours upon request |
| **Workshops** | Wednesday, Sept. 8 | 4:00 pm - 5.30 pm | 2 concurrent workshops |
| **Podiums** | Thursday, Sept. 9 | 9:20 am - 12:30 pm | 2 concurrent sessions |
| | Friday, Sept. 10 | 9:20 am - 12:30 pm | 2 concurrent sessions |
| | Saturday, Sept. 11 | 9:20 am - 10:30 pm | 2 concurrent sessions |
| **Posters** | Thursday, Sept. 9 | 3:30 pm - 5:00 pm | Poster Session I |
| | Friday, Sept. 10 | 3.30 pm - 5:00 pm | Poster Session II |
| | *All posters will be displayed Wednesday through Saturday without rotation to allow maximum exposure.* | | |
| **Keynotes** | Thursday, Sept. 9 | 8:00 am - 9:00 am | Steven Vogel |
| | Friday, Sept. 10 | 8:00 am - 9:00 am | Wilson C (Toby) Hayes |
| | Friday, Sept. 10 | 2:00 am - 3:00 am | Andrew Schwartz |
| | Saturday, Sept. 11 | 8:00 am - 9:00 am | Farshid Guilak |
| **Awards** | Thursday, Sept. 9 | 2:00 pm - 3:30 pm | Award Session I |
| | Friday, Sept. 10 | 4:30 pm - 6:00 pm | Award Session II |
| | Saturday, Sept. 11 | 11:00 am - 12:30 pm | Award Session III / Borelli Lecture |
| **Reception** | Wednesday, Sept 8 | 6:30 pm | At outdoor pool area / poster area B |
| **Banquet** | Friday, Sept 10. | 6.30 pm | Classical Chinese Garden |
| **Student Luncheon** (see also page10) | | | |
| | Thursday, Sept. 9 | 12.30 pm - 1.30 pm | Mt St. Helens Room, 2nd floor |
| **ASB General Meeting** | | | |
| | Thursday, Sept. 9 | 5:00 pm - 6:00 pm | Session Rooms A/B |
| **ASB Executive Board** | | | |
| | Wednesday, Sept. 8 | 12:30 pm - 1:30 pm | 1st meeting, Halsey Room |
| | Saturday, Sept. 11 | 12:30 pm - 1:30 pm | 2nd meeting, Halsey Room |

# General Information

## Conference Hotel

Doubletree Lloyd Center Hotel, 1000 NE Multnomah,
Portland, OR 97232, phone: 1-800-222 8733





## ASB Banquet

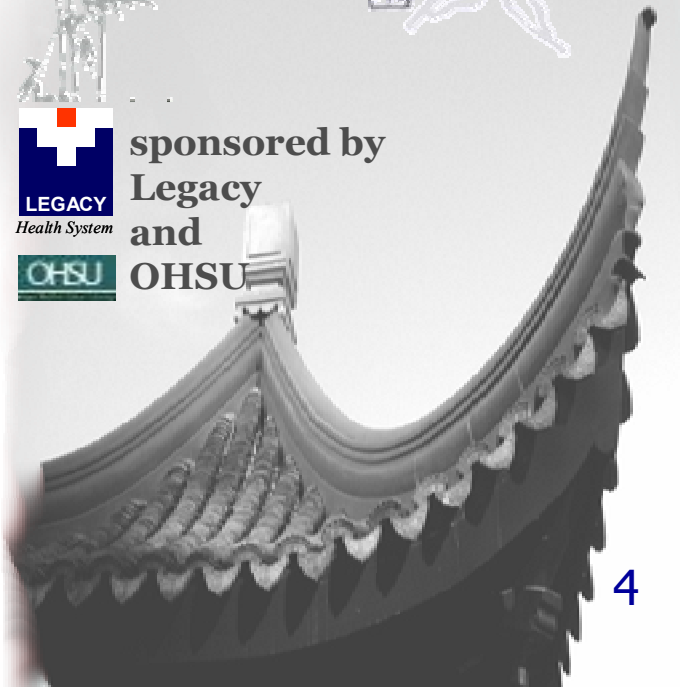
**Friday, Sept 10, 6:30 pm**

Portland Classical CHINESE GARDEN

LEGACY Health System

OHSU

**sponsored by Legacy and OHSU**



# General Information

## Exhibits

Exhibits are conveniently located adjacent to both poster session areas. Over 15 exhibitors will be on display throughout the meeting. Be sure to visit the exhibitor displays. See page 15 for a complete list of exhibitor information.

## Registration

The registration desk will be located in the conference hotel foyer. Registration desk hours are

| | |
|---|---|
| Wednesday, Sept. 8 | 11:00 am - 7:00 pm |
| Thursday, Friday; Sept. 9,10 | 7.00 am - 5:00 pm |
| Saturday, Sept. 11 | 7:00 am - 12:00 pm |

*If you have any questions or require assistance, please drop by the registration desk for help.*

## Information for Presenters

**Podium Presentations** will be 10 minute long PowerPoint presentations followed by a 5 minute question & answer period. A Windows compatible PC, projector, and laser pointer will be provided in each conference room. Speakers must provide PowerPoint presentations on a CD. If movies are embedded, please provide the movie files on the same CD. We will copy the presentations from CD to the presentation computer and re-link all movie files.
*All speakers are required to check into the Speaker Ready Room and turn in their CD the day before their presentation.*
For questions, special requirements, or advance file submission, please contact Marcus Mohr (503 413 5487).

**Speaker Ready Room** is in the Weidler room, and will be open at the same times as the registration desk (see above).

**Poster Presentations** will be displayed throughout the entire conference without rotation to maximize exposure. Posters will be ordered by subjects, as indicated on page 29.

- Poster dimensions must be no larger than 46" x 46".
- Push pins are available at the registration desk.
- Feel free to attach copies of your poster or abstract on your poster board for general distribution.
- *Presenters of odd-numbered posters attend their poster for the first half of each session.*
  (i.e., 3:30 pm – 4:15 pm on Thursday and 3:30 pm - 4:00 pm on Friday)
  *Presenters of the even-numbered posters attend their posters for the second half of each session.*
  (i.e., 4:15 pm – 5:00 pm on Thursday and 4:00 pm - 4:00 pm on Friday).

| | | |
|---|---|---|
| Poster setup: | Wednesday, Sept. 8 | 11:00 am - 6:00 pm |
| Poster dismantle: | Saturday, Sept. 11 | 7:00 am - noon |

**Chairpersons for Podium Presentations** should be at the presentation room at least 15 minutes before the session start to be acquainted with the presenters and the projectionist. Session chairs should introduce the presenters, their affiliation and the titles of the presentations. It is the responsibility of the session chair to keep the presentations on schedule by maintaining presentation start time, end time, and question period.

## ASB Reception

sponsored by SYNTHES USA

On the first night of the ASB meeting, you will be welcomed with a free buffet and Northwest wine to gather with colleagues around the pool and the poster exhibits. This informal reception will be held on Wednesday, September 8, at 6:00 pm at the outdoor pool area of the hotel adjacent to poster area B.

## ASB Banquet

jointly sponsored by Legacy and OHSU

What can be more inspiring than to stroll with your colleagues through pavilions, waterfalls, ponds, bridges, and buffets at the Portland Classical Chinese Garden. Designed and hand-crafted by artists from Suzhou, this authentic Ming Dynasty garden will leave you with a memorable impression of the ASB meeting in Portland. You can enjoy an assortment of delectable food options, including Northwest regional cuisine featuring fresh salmon and Pan-Asian fare with an on-site wokery. A Chinese Lion Dance and live music will complete the cultural experience. The ASB banquet will be on Friday, September 10, starting at 6.30 pm. From the hotel, take the blue or red line MAX west towards Hillsboro or City Center. Exit after three MAX stops at the "Old Town/Chinatown" stop. Walk ½ block back (north) on 1st Avenue to Everett Street. Make a left (west) on Everett and head 2 blocks towards 3rd Avenue. The Classical Chinese Garden is located on the corner of SW 3rd & Everett.

## Housing

The Doubletree Lloyd Center Hotel, 1000 NE Multnomah, Portland, OR 97232 is the designated Conference Hotel. All meeting events, presentations and poster exhibits will take place on the main floor of the hotel. For reservations, call 1-503-281-6111 or 1-800-222 8733 and request the ASB discount rate.

## Transportation

**To Conference Hotel:**

- *From the airport (PDX),* take the MAX light rail (red line) to the Lloyd Center/NE 11th Ave stop, located at the conference hotel. The red line MAX leaves every 15 minutes and costs less than $2. In case you choose to drive from the airport, follow Airport Way to I-205 South, take I-84 West to Portland, go 5 miles and take exit 1 Lloyd Blvd. Go to the second light after the exit and take a right onto NE 13th Ave. Turn left onto NE Multnomah St.
- *From I-5 North*: Take Rose Quarter-City Center exit 302A. Take a left at the second light on Weidler. Go to 9th Avenue and take a right. Go to the second light and the hotel is on the left.
- *From I-5 south*: Take Rose Quarter-City Center exit 302A. At the first light, take a right on Weidler. Go to 9th Avenue and take a right. Go to the second light and the hotel is on the left.

**In Portland:** A MAX light rail stop is located at the hotel (Lloyd Center/NE 11th Ave stop). MAX will take you past many local attractions, including the Classical Chinese Garden, Powell's Book Store and the Oregon Zoo, many of which are within its fare-free zone. It runs every 15 minutes between 6 am and 1 am.

**To Banquet at the Classical Chinese Garden**: Take the blue or red line MAX west towards city center. Exit after three MAX stops at the "Old Town/Chinatown" stop. Walk ½ block back (north) on 1st Avenue to Everett Street. Make a left (west) on Everett and head 2 blocks towards 3rd Avenue. The Classical Chinese Garden is located on the corner of SW 3rd & Everett.

**Rental Cars** can be obtained directly in the hotel lobby at Guest Services (503-281-6111). Cars from Enterprise are available between $32 and $45/day and will be delivered to the hotel.

## Internet Service

Computers with internet access for conference attendees will be located near the Pacific Northwest Ballroom / poster area B.

## Shopping, Events

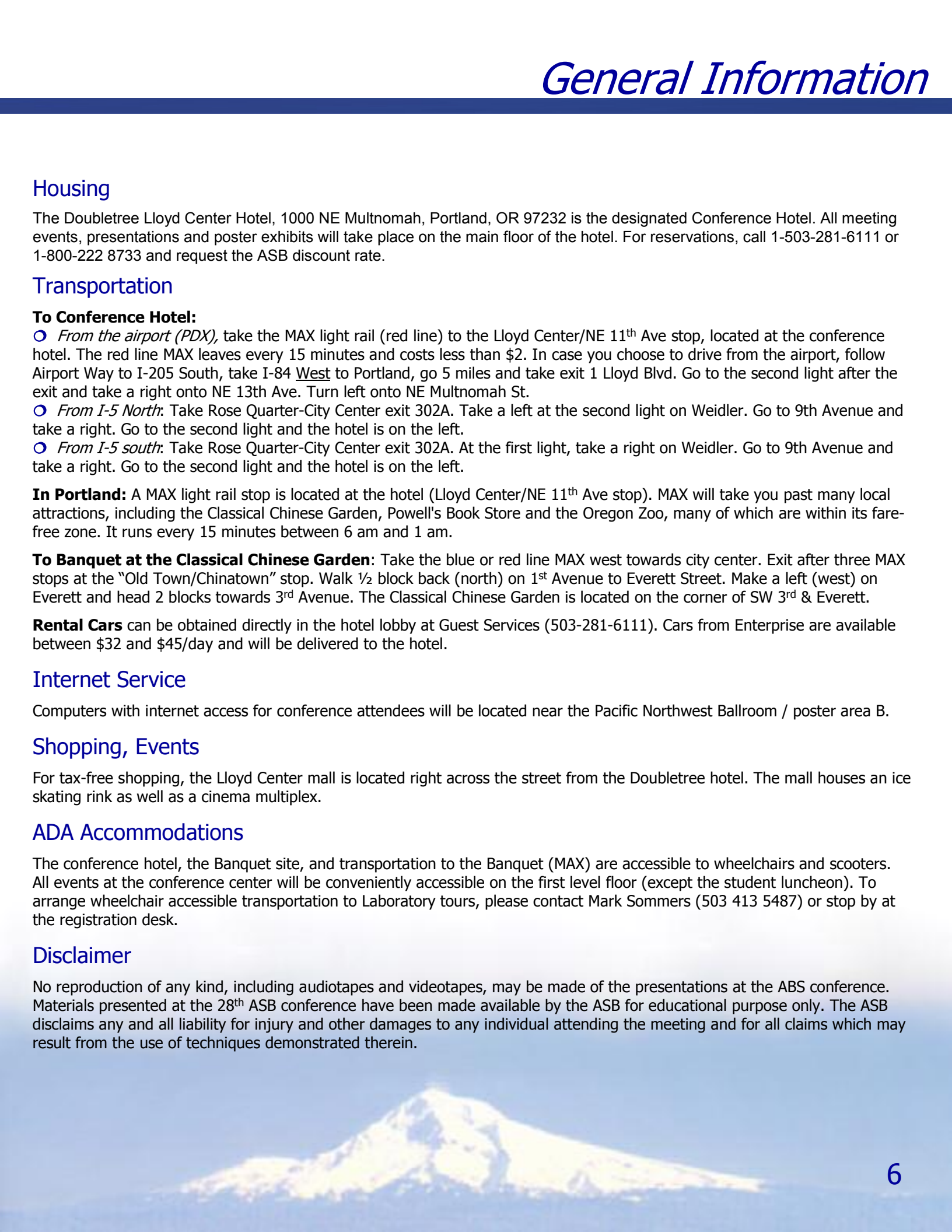
For tax-free shopping, the Lloyd Center mall is located right across the street from the Doubletree hotel. The mall houses an ice skating rink as well as a cinema multiplex.

## ADA Accommodations

The conference hotel, the Banquet site, and transportation to the Banquet (MAX) are accessible to wheelchairs and scooters. All events at the conference center will be conveniently accessible on the first level floor (except the student luncheon). To arrange wheelchair accessible transportation to Laboratory tours, please contact Mark Sommers (503 413 5487) or stop by at the registration desk.

## Disclaimer

No reproduction of any kind, including audiotapes and videotapes, may be made of the presentations at the ABS conference. Materials presented at the 28th ASB conference have been made available by the ASB for educational purpose only. The ASB disclaims any and all liability for injury and other damages to any individual attending the meeting and for all claims which may result from the use of techniques demonstrated therein.



Two concurrent workshops will be offered on Wednesday, September 8, starting at 4:00 pm.

## Workshop A Wednesday, Sept 8 4:00 pm - 5:30 pm Room A

**THE USE OF MOLECULAR BIOLOGY IN BIOMECHANICS**

The scientific community has experienced a virtual explosion in applications of molecular biological methods to the fields of medicine, technology, computing and engineering. All of the highest scientific impact papers from 1996 used molecular biology to understand transduction of information by cells. These papers could justifiably be considered within the purview of biomechanics. In this tutorial, the basic tenets of molecular biology will be presented including basic cell structure and the flow of information from DNA to RNA to proteins. The most common methods used to study cells and tissues will be reviewed including gene cloning, sequencing, blotting methods and the use of reverse transcription (RT) and the polymerase chain reaction (PCR). Finally, application of these methods will be illustrated using examples of vascular, muscle and ligament cell response to mechanical signals provided by applications of exercise, strain fields and temperature. The thesis of this presentation is that molecular biological methods provide powerful tools for studying tissue response, but the careful mechanical characterization of cells, receptors and even isolated proteins remains within the area of expertise we know as biomechanics.

Organizer: Richard L. Lieber, Ph.D.
Professor of Orthopaedics and Bioengineering
UCSD and VA Medical Centers
La Jolla, CA 92093-9151
Phone: (858) 552-8585 x7016
FAX: (858) 552-4381
Laboratory Web page: www.muscle.ucsd.edu
email: rlieber@ucsd.edu

## Workshop B Wednesday, Sept 8 4:00 pm - 5:30 pm Room B

**MUSCLE MECHANICS**

This muscle tutorial will examine recent advances (since the Hill and sliding filament model) in our understanding of muscle contraction. Topics will include:
1. Historical background on the mechanisms of contraction.
2. Hill's experiment on heat production and the Hill model
3. H. Huxley's and AF Huxley's proposal of sliding filaments (1953 and 1954, respectively)
4. The classic cross-bridge model (AF Huxley 1957)
5. The swinging cross-bridge model (H Huxley, 1969)
6. The multiple attachment cross-bridge model (AF Huxley and Simmons, 1971)
7. Cross-bridge structure and proposed interaction with actin (Rayment et al., 1994)
8. Current thinking on cross-bridge mechanics and energetics
9. Applications and transfer of these molecular concepts to whole muscle mechanics
10. Remaining Questions and problems

Organizer: Walter Herzog, Ph.D.
Professor, Faculty of Kinesiology
Canada Research Chair in Molecular and Cellular Biomechanics
Associate Dean Research, Kinesiology
Phone: 403-220-8525
Fax: 403-284-3553
email: walter@kin.ucalgary.ca

## Keynote 1 Thursday, Sept 9 8:00 am - 9:00 am Rooms A,B

**Steven Vogel** is James B. Duke Professor of Biology at Duke University. He is the author of *Vital Circuits, Cats' Paws and Catapults* and *Life in Moving Fluids* and the prize-winning *Life's Devices*.

svogel@duke.edu

MUSCEL POWER: THE BIOMECHANICS BEHIND HISTORY

Until we had combustion engines, electric motors, cheap metals, and synthetics, humans mainly relied on muscle and natural materials. Thus significant historical questions need biomechanical insight. Why did the ancient Egyptians build the great pyramid of two-ton blocks? Why did Greek triremes perform so much better than the later Venetian galleys? Did the arrival of projectile weaponry tilt the balance away from Neanderthals and toward early modern humans? What can we say about the efficacy—relative to both force and power—of the various forms of ancient muscle-powered weaponry? How have we persuaded muscle, a linear engine, to drive rotary machinery? And why have equids only recently joined bovids as effective traction engines? Biomechanics may have driven technology at least as much as technology has driven history.

## Keynote 2 Friday, Sept 10 8:00 am - 9:00 am Rooms A,B

**Wilson C. "Toby" Hayes**, Ph.D. is President of Hayes & Associates, Inc. a consulting firm providing expert testimony in injury biomechanics. Until May 1998, Dr. Hayes was director of the Orthopedic Biomechanics Laboratory at Harvard's Beth Israel Deaconess Medical Center and the Maurice E. Mueller Professor of Biomechanics at Harvard Medical School. Dr. Hayes has received a number of awards, including the Borelli Award.

wch@hayesassoc.com

SO YOU WANT TO BE AN EXPERT? LESSONS FROM FORENSIC INJURY BIOMECHANICS

A construction worker is struck by a falling cement block wall; a child's arm is amputated in a washing machine; an elderly female's neck is broken in a rollover motor vehicle accident; a railroad worker claims work-related wrist injury; a welder is killed in a refinery explosion. The parties are in court seeking compensation, with demands that sometimes seem to outstrip the claimed injuries or to have little prospect of covering the costs of lifetime care. How can a way be found through the often-conflicting stories and competing claims of personal injury, wrongful death and criminal cases to arrive at an understanding of the mechanisms of injury and a determination of who was at fault? How can scientific opinions based on injury biomechanics be used most effectively? To address these questions, this overview introduces: 1) How injury scaling can be used to describe injury severity; 2) How injury risk functions can be used to estimate the probability of injury; and 3) How injury events can be measured against tolerance criteria. Examples are drawn from motor vehicle accidents; slips, trips and falls; occupational and recreational injuries; child abuse, wrongful death and criminal cases. Litigation offers multiple roles to the expert, along with many scientific, ethical and personal challenges. If these are clearly understood and confronted, the effective expert can play a crucial role in the search for truth. In many cases, forensic injury biomechanics can provide the objective evidence that can be the deciding factor in personal injury, products and premises liability, and wrongful death and criminal cases.

## Keynote 3 — Friday, Sept 10 — 2:00 pm - 3:00 pm — Rooms A,B

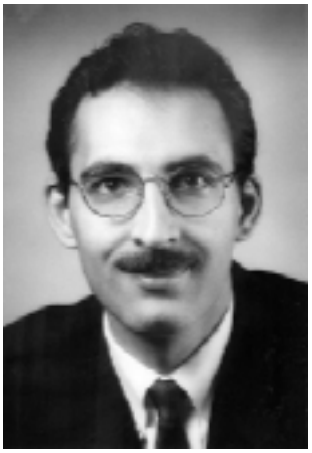
**Andrew B. Schwartz**, Ph.D.
Professor, Neurobiology
University of Pittsburgh

abs21@pitt.edu

USEFUL SIGNALS FROM THE MOTOR CORTEX

Over the years, we have shown that detailed predictive information of the arm's trajectory can be extracted from populations composed of single unit recordings from motor cortex. This high-fidelity extraction can be used to identify different components of the process that underlies volitional movement. By developing techniques to record these populations and process the signal in real-time, we have also been successful in demonstrating the efficacy of these recordings as a control signal for intended movements in 3D space. Having shown that closed-loop control of a cortical prosthesis can produce very good brain-controlled movements in virtual reality, we have been extending this work to robot control. By introducing an anthropomorphic robot arm into our closed-loop system, we have shown that a monkey can easily control the robot's movement with direct brain-control while watching the movement in virtual-reality. The animal learned this rapidly and produced good movements in 3D space. The next step was to have the animal visualize and move the arm directly without the VR display. This was much more difficult for the animal to learn, as it seemed to have difficulty understanding that the robot was to act as a tool. After the animal was trained, it was able to use the robot to reach for hand-held (by the investigator) targets. We are now developing hardware and software, as well as training monkeys to reach out for food targets at different locations in space, to retrieve them so they can be eaten.

## Keynote 4 — Saturday, Sept 11 — 8:00 am - 9:00 am — Rooms A,B



**Farshid Guilak,** Ph.D., is the director of the orthopaedic bioengineering laboratory at Duke University Medical Center. He has received numerous awards, including the William Harris Award, and recently became Editor-in-Chief of the Journal of Biomechanics.

Guilak@Duke.edu

BIOMECHANICS FACTORS IN OSTEOARTHRITIS:
FROM ORGANISM TO ORGANELLE

Osteoarthritis is a painful and debilitating disease of the joints which is characterized by progressive degeneration of the articular cartilage, the tissue that lines the ends of bones. The etiology of osteoarthritis is poorly understood, although it is now well accepted that mechanical factors can play an important role in the onset and progression of this disease. The goal of our studies has been to determine the effects of normal and abnormal mechanical stress on the articular cartilage using in vivo and in vitro model systems, and to characterize specific biomechanical and biochemical signaling pathways involved in chondrocyte mechanotransduction. Our studies have used in vitro explant models of articular cartilage to study the effects of controlled mechanical stress on matrix metabolism and the production of small-molecule mediators of pain and joint degeneration. To investigate the relationship between the stress-strain and fluid-flow environments at the tissue level in relation to that of the cell, multiscale finite element models were developed for single cells within articular cartilage and compared to experimental measures of cellular and subcellular deformation in situ. These models incorporate the physical properties of pericellular, cellular and subcellular structures, which were measured directly using micromechanical testing methods such as micropipette aspiration and nanoindentation. These techniques were also used to probe the physiologic response of cells to controlled mechanical and osmotic stimuli using single-cell fluorescence imaging of ion mobilization and cytoskeletal remodeling. These findings provide new insights on the ability of biophysical to initiate intracellular signaling. The long-term goal of these studies is to better understand the mechanisms through which mechanical factors influence cartilage maintenance and to develop new physical and pharmacologic therapies for the prevention or treatment of joint disease.

# Student Events Program

## Student Luncheon — Thursday, Sept 9 — 12:45 pm - 1:45 pm — Mt St Helens

### Student Business Meeting and Biomechanics Industry Panel Discussion

- **Pick up your lunch box**
- **Go to MT St Helens:** take the stairs across from the registration desk, and St. Helens is to your left.
- **Meet Industry representatives**
- **Discuss career goals**

The purpose of the student luncheon is to inform students about current ASB student related business, vote on current issues and elect the 2004-2005 student representative. This brief meeting will be followed by a panel discussion where scientists will provide their current perspectives on what it takes to succeed in the biomechanics industry. The panel will be composed of established biomechanists from the various industrial disciplines. Questions will be posed to the panel on topics related to what it takes to get a job in the industry, how much education is necessary, are publications essential, where jobs are located, lifestyle in the industry, etc. Additionally, the panel will take questions from ASB students attending the panel discussion. This is a great opportunity for students to see what life is like as a biomechanist in the industry and hear perspectives on how these scientist have succeeded in biomechanics.

For further information, please contact the ASB student representative Max Kurz, mkurz@mail.unomaha.edu

## Women in Science Breakfast — Thursday, Sept 9 — 7:00 am - 7:45 am — Halsey

Creating a new tradition, the "Women in Science Breakfast" will be an integral part of the 2004 ASB program. The breakfast will take place on Thursday, September 9th, from 7-7:45 a.m. in the Halsey Room of the Double Tree Hotel. At this breakfast, experienced female scientists will provide their perspective on how women are making a difference in the biomechanics field. The informal setting will allow female students to extend their professional network and address questions about how to succeed in biomechanics. This breakfast will prove to be an exciting and informative venue for female students.

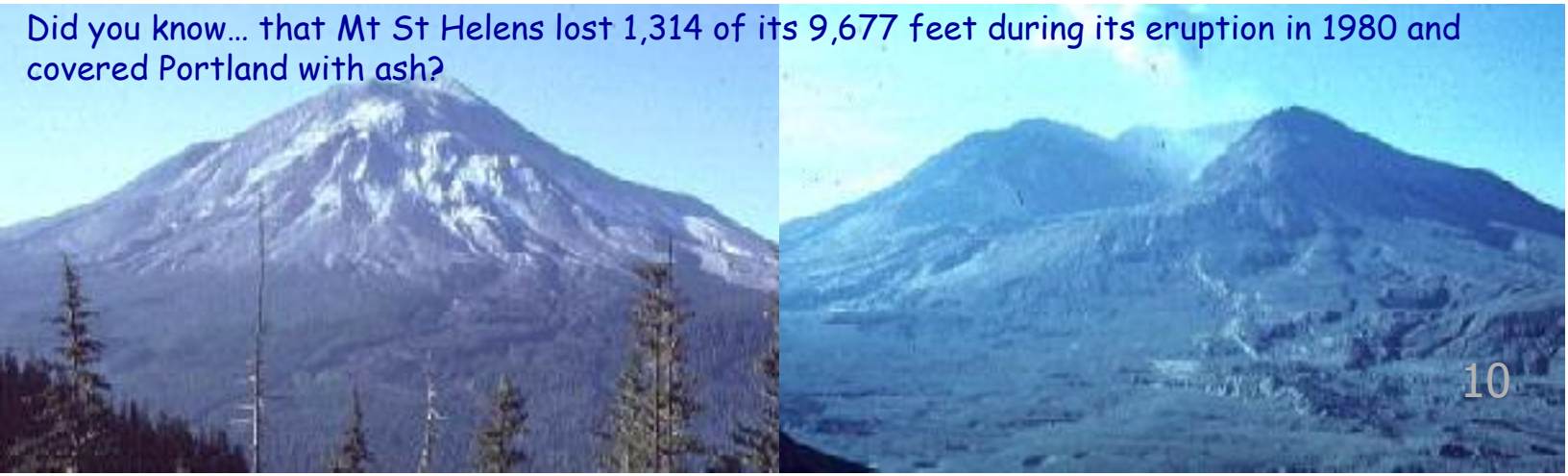
## 1st Annual Mentoring Program

This year we will initiate the first annual ASB Mentoring Program. The goal of the program is to increase the educational and professional experiences of the students attending the conference. How does it work? Any student who will attend the annual meeting can request to be matched with a senior scientist. The ASB executive board will do its best to find a suitable mentor match. Mentoring includes:

1) introducing the student to his/her colleagues to help establish a professional network,
2) spending time with the student discussing research, education and vocational goals,
3) sharing his/her career experiences, and
4) providing constructive feedback on the student's presentation.

Please submit mentoring requests to Max Kurz (mkurz@mail.unomaha.edu), and include your contact information, one paragraph describing your research interest, your career stage and any special requests.

Did you know… that Mt St Helens lost 1,314 of its 9,677 feet during its eruption in 1980 and covered Portland with ash?



Award Session I | Thursday, Sept 9 | 2:00 pm - 3:30 pm | Rooms A/B

## Young Scientist Awards

These awards recognize achievements by promising young scientists. They are awarded annually to one pre-doctoral student and one post-doctoral scientist. Nominees for these awards must be current or pending members of the ASB at the time of submission. Candidates may be self-nominated or nominated by an ASB member. The pre-doctoral award nominee must be a doctoral student at the time of the deadline for abstract submissions to the 2004 ASB meeting. The post-doctoral award nominee must have received his/her doctorate prior to April 1, 2004 and is someone who, at the time of this deadline, is within 5 years of their graduation. These awards consist of an engraved plaque, a check for $500 (USD), and a waiver of the annual meeting registration fees.

**2004 Pre-Doctoral Award:** **Silvia Salinas Blemker**, Stanford University, Stanford, CA

*"Rectus Femoris Fiber Excursions Predicted By A 3D Model Of Muscle"*

**2004 Post-Doctoral Award:** **Seth W. Donahue, Ph.D.,** Dept. of Biomedical Engineering, Michigan Technological University, Houghton, MI

*"Bone Strength Is Not Compromised With Aging In Black Bears (Ursus americanus) Despite Annual Periods of Disuse (Hibernation)"*

## Jim Hay Award Inauguration

This annual award in "Biomechanics of Sports and Exercise Science" will be given for the first time at the 2004 ASB conference in honor of the late Jim Hay and his enormous contributions to the ASB specifically and biomechanics in general. With this award, the ASB will celebrate a great teacher, educator and scientist. Jim was a president and founding member of the ASB, and also served as the president of the International Society of Biomechanics. He has trained numerous students, and is best known for his textbooks on the Biomechanics of Sports Techniques. His approach to science through deterministic modeling was unique, and his love for scientific investigation unparalleled. Aside from honoring Jim in this particular way, the award is intended to stimulate young people in the areas of Biomechanics of Sports and Exercise to attend and contribute to the ASB and its annual meeting. The founding fathers of the ASB came almost exclusively from a sport and exercise background, and for a variety of reasons, this field of scientific investigation is not as strongly represented at the ASB as in previous years. Hopefully, this award will encourage increased participation from researchers in exercise and sport sciences. The Jim Hay award winner will be identified from the submitted abstracts and will receive a plaque and $500.

## Award Session II — Friday, Sept 10 — 4:30 pm - 6:00 pm — Rooms A/B

Award candidates in this session have been selected from the top 20th percentile of submitted abstracts. From this pool, two finalists for each award have been selected by the ASB Awards Committee, and each of these finalists will present their work. The winner of each award will be selected by the ASB Awards Committee after this session.

### Clinical Biomechanics Award

This award recognizes outstanding new biomechanics research targeting a contemporary clinical problem, and is sponsored by Elsevier Science, Ltd., publishers of Clinical Biomechanics. Candidates must be an ASB member and must be first author on an abstract with special relevance for clinical applications submitted to the 2004 ASB meeting. The winner will receive an engraved plaque and US $500.

**2004 Finalists:**

**Allison Arnold, Ph.D.**, Stanford University, Stanford, CA

*Muscle-Tendon Lengths and Velocities of the Hamstrings After Surgical Lengthening to Correct Crouch Gait*

**Dawn C. Mackey, M.S.**, Simon Fraser University, Burnaby, BC, Canada

*Postural Steadiness During Quiet Stance Does Not Associate With Ability to Recover Balance in Older Women*

### Journal of Biomechanics Award

This award, sponsored by Elsevier Science, Ltd., publishers of the Journal of Biomechanics, recognizes substantive and conceptually novel mechanics approaches explaining how biological systems function. Candidates must be ASB members and must be first author of an abstract submitted to the 2004 ASB meeting. The winner will receive an engraved plaque and US $500.

**2004 Finalists:**

**Carina Bender, M.S.**, University of California, Davis

*Quantitative Characterization of Lateral Force Transmission in Passive Skeletal Muscle*

**Marie Shea, M.S.**, Oregon Health & Science University, Portland, OR

*Influence of Sex and Genotype on Skeletal Fragility*

## Award Session III — Saturday, Sept 11 — 11:00 am - 12:30 pm — Rooms A/B

### Borelli Award Lecture

This most prestigious honor given by the ASB, recognizes outstanding career accomplishments and is awarded annually to an investigator who has conducted exemplary research in any area of biomechanics. The award is open to all scientists, including non-ASB members, but excluding ASB officers and members of the Awards Committee. Candidates may be nominated by themselves or by others. Selection is based on originality, quality and depth of the research and its relevance to the field of biomechanics. The award consists of an engraved plaque and US $1,500.

**'04 Borelli Award Recipient:** **Thomas P. Andriacchi, Ph.D.**, Stanford University, Department of Mechanical Engineering

*"Presentation title to be announced"*

### ASB President's Award

This award recognizes meritorious research involving highly innovative use of experimental or theoretical methods in any field of biomechanics that is presented as a poster at the annual ASB meeting. Candidates must be first author. The winner will be selected by the ASB Awards Committee after the final poster session. The award includes an engraved plaque and US $500 .

Laboratory tours will be offered Wednesday afternoon and Thursday, Friday during lunch break. On Wednesday, tour buses to NIKE and Legacy will leave at the 'Ballroom' entrance of the Hotel approximately every 30 minutes, starting at 12:30 pm. The last tour bus will depart at 3:30 pm. Only tours departing before 2:00 pm will return in time for the workshops.

| | | |
|---|---|---|
| Wednesday, Sept. 8 | 12:30 pm - 5:30 pm<br>**(last tour bus departs at 3:30 pm)** | NIKE, Legacy Research Center |
| Thursday, Friday, Sept. 10, 11 | 12:40 pm - 2:00 pm | NSI, Legacy Research Center<br>(additional tours at OHSU, NSI, OGI upon request at the registration desk) |

## NIKE Sport Research Lab

Mario Lafortune, Ph.D., is the research director of the world-renown NIKE Sport Research Laboratory and will offer tours of his state-of-the-art facilities. Its missing is to provide the basic and applied research necessary to create and develop innovative products. Research is conducted in the fields of biomechanics, physiology and sensory/perception to further our understanding of the performance, protection and comfort needs of all active people.

LEGACY
*Health System*

Biomechanics
*Laboratory*

## Legacy Research & Technology Center

Legacy Research & Technology Center is a full service, state-of-the-art 'hybrid' research park. Its research agenda is structured to bring the most advanced health care treatment modalities and cutting edge technologies quickly on-line, where they can be applied to the benefit of patients. The Center opened in July 1997 and contains 65,000 square feet of state-of-the-art laboratories, clinics, and an extensive support matrix, including a 9500 square foot Clinical Research Center dedicated to out-patient studies. Research is supported by Legacy, and by extramural funding sources (NIH, NSF, CDC, and NASA). The Center houses research programs in Biomechanics (Legacy Biomechanics Laboratory), Cancer, Diabetes, Neurobiology, Neurotology, Ophthalmology, Minimally Invasive Surgery, and Organ Transplantation.

## Neurological Sciences Institute / OHSU

The mission of the Neurological Sciences Institute of OHSU is to advance our understanding of the brain and neurological disorders. It houses the *Balance Disorders and Spatial Orientation Laboratories* of long-time collaborators, Dr. Fay Horak and Dr. Robert Peterka.

Dr. Horak's *Balance Disorder's Laboratory* focuses on studies of sensorimotor control of posture and movement. The role of central motor structures such as the basal ganglia and cerebellum and of peripheral sensory information such as the vestibular and somatosensory systems are studied by examining changes in motor control strategies in patients with specific neurological disorders. This understanding is applied to the development of scientifically based approaches to rehabilitation of balance disorders in neurologic patients and the elderly.

Dr. Peterka's *Spatial Orientation Laboratory* is focused on how the brain uses various sources of sensory information to provide an accurate sense of orientation. He studies vestibular related eye movement control and the interaction of vestibular, visual, and proprioceptive system information used for the control of balance and orientation in humans. He is particularly interested in the application of research results to the development of new clinical balance function tests.

## Become a Member

The American Society of Biomechanics (ASB) was founded in October 1977. The purpose of the Society is to provide a forum for the exchange of information and ideas among researchers in biomechanics. The term biomechanics refers to the study of the structure and function of biological systems using the methods of mechanics.

Membership benefits include reduced registration fees at the annual meeting and a subscription to the Journal of Biomechanics. There are two types of Membership in the Society, REGULAR and STUDENT: REGULAR Membership requires 1) expertise in the field of biomechanics (i.e., publication of scientific articles) and 2) contributions to the Society (e.g., attendance at biomechanics conferences). STUDENT applicants must provide a letter from their advisor certifying student status. Attendance at the annual meeting of the American Society of Biomechanics is not required for Student Members. Applications for membership are considered quarterly by the Membership Committee. If you would like to APPLY for membership, please obtain an application form at www.asb-biomech.org or directly from the membership chair:

Julianne Abendroth-Smith
Willamette University
Phone: (503)-370-6423
E-mail: jabendro@willamette.edu

***ASB General Meeting***
*Thursday, Sept. 9*
*5:00 pm - 6:00 pm*
*Session Room A/B*

## ASB Executive Board 2004

| | |
|---|---|
| ***President*** | **Walter Herzog**, University of Calgary, (403) 220-3438, walter@kin.ucalgary.ca |
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| ***Newsletter Editor*** | **Andy Karduna**, University of Oregon, Eugene, OR, (541) 346-0438, karduna@uoregon.edu |
| ***Student Representative*** | **Max Kurz**, University of Nebraska, Omaha, mkurz@mail.unomaha.edu |


The ASB Executive Board is pleased to announce that next year's 29th Annual Meeting of the American Society of Biomechanics will be held August 1-5, 2005, in Cleveland, Ohio. This meeting will be in conjunction with the 20th Congress of the International Society of Biomechanics, organized by Brian Davis and Ton van den Bogert of the Cleveland Clinic. The venue will be Cleveland State University, conveniently located downtown. This combined meeting will attract a much larger number of participants than the usual ASB Annual Meetings, and promises to have an exceptional scientific program.

# Exhibitors

Exhibits are conveniently located adjacent to both poster session areas. Over 15 exhibitors will be present.
Be sure to visit the exhibitor displays. Exhibit hours are:

| | |
|---|---|
| Thursday, Sept. 9 | 8:00 am – 5:00 pm |
| Friday, Sept. 10 | 8:00 am – 5:00 pm |
| Saturday, Sept. 11 | 8:00 am – 11:00 pm |

National Center for Injury Prevention
and Control
4770 Buford Highway NE
Atlanta, GA 30341-3724

www.cdc.gov/ncipc/

ohcinfo@cdc.gov

Kistler Instrument Corp.
75 John Glenn Drive
Amherst, NY 14228-2171, USA

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sales.us@kistler.com

Innovision Systems Corporation
3717 Peters Rd.
Columbiaville, MI 48421-9304, USA

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sales@innovision-systems.com

Motion Analysis Corporation 3617
Westwind Blvd.
Santa Rosa, California 95403

www.motionanalysis.com

biomechanics@motionanalysis.com

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307 West First Street
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RSscan International
Lammerdries 27
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Peak Performance Technologies, Inc.
7388 S. Revere Parkway, Suite 901
Centennial, CO 80112, USA

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info@peakperform.com

Noraxon U.S.A. Inc.
13430 N. Scottsdale Road, Suite 104
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www.noraxon.com

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Vision Research, Inc.
190 Parish Drive
Wayne, New Jersey 07470, USA

www.visiblesolutions.com

phantom@visiblesolutions.com

EnduraTEC
5610 Rowland Road
Minnetonka, MN 55343, USA

www.enduratec.com

electroforce@EnduraTEC.com

zFlo, Inc.
67 Federal Avenue
Quincy, MA 02169, USA

www.zflo.com

info@zflomotion.com

Motion Imaging Corporation
15 McCoy Place
Simi Valley, CA 93065, USA

www.mi-as.com

sales@mi-as.com

Innovative Sports Training, Inc.
3711 North Ravenswood, Suite 150
Chicago, IL 60613, USA

www.innsport.com

sales@innsport.com

Novel, Inc.

964 Grand Avenue
St. Paul, MN, 55105

www.novel.de/

novelinc@novel.de

Vicon Motion Systems Inc - US
9 Spectrum Pointe
Lake Forest, CA 92630

www.vicon.com

moveme@vicon.com

# my schedule

Wednesday, 12:30 pm

Wednesday, 3:30 pm

Wednesday, 4:00 pm

Wednesday, 6:30 pm

Thursday, 7:45 pm

Thursday, 9:20 am

Thursday, 11:00 am

Thursday, 12.30 pm

Thursday, 2:00 pm

Thursday, 3:30 pm

Thursday, 5:00 pm

Friday, 7:45 am

Friday, 9.20 am

Friday, 11:00 am

Friday, 12.30 pm

Friday, 2:00 pm

Friday, 3:30 pm

Friday, 4:30 pm

Friday, 6:30 pm

Saturday, 7:45 am

Saturday, 9:20 am

Saturday, 11.00 am

Saturday, 12.30 pm

# Podium Presentations

| | Session A | Session B |
|---|---|---|
| **Thursday, Sept. 9**<br><br>9:20 am - 10.50 am<br>11:00 am - 12:30 pm | Joint Neuromechanics<br>Sports Biomechanics | Gait & Movement I: Basic Science<br>Orthopaedics I: Basic Science |
| **Friday, Sept. 10**<br><br>9:20 am - 10.50 am<br>11:00 am - 12:30 pm | Cell & Tissue Biomechanics<br>Balance & Falls | Gait & Movement II: Clinical & Methods<br>Orthopaedics II: Clinical |
| **Saturday, Sept. 11**<br><br>9:20 am - 10.50 am | Biomechanics Modeling | Muscle & Reflex |

## 9:20 am - 10:50 am Symposium I: Joint Neuromechanics **Room A**

Chair: Francisco Valero-Cuevas

9:20 - 9:30 **Introduction to Joint Neuromechanics Symposium**
Francisco J. Valero-Cuevas, Neuromuscular Biomechanics Laboratory, Cornell University, Ithaca, NY, USA.

9:30 - 9:50 **THE ROLE OF RECIPROCAL EXCITATION IN THE REGULATION OF STIFFNESS OF THE FELINE ANKLE**
T. Richard Nichols
Department of Physiology, Emory University, Atlanta, GA 30322.

9.50 - 10:10 **ROLE OF SKIN MATERIAL PROPERTIES IN DETERMINING THE SENSITIVITY OF STRETCH-SENSITIVE CUTANEOUS MECHANORECEPTORS**
Peter Grigg
Department of Physiology, University of Massachusetts Medical School, Worcester, MA 01609, USA.

10:10 - 10:30 **NEURO-SENSORY ROLE OF JOINT PERIARTICULAR TISSUE AFFERENTS: A HUMAN KNEE MODEL**
Yasin Dhaher
Sensory Motor Performance Program, The Rehabilitation Institute of Chicago and Department of Physical Medicine and Rehabilitation, Northwestern University, Chicago, IL 60611 USA.

10:30 - 10:50 **ARE NEUROLOGIC FACTORS IMPORTANT IN DEGENERATIVE ARTHRITIS?**
Paul T. Salo
Department of Surgery, University of Calgary, Calgary, AB, Canada

## 9:20 am - 10:50 am Gait and Movement I: Basic Science **Room B**

Chairs: Jonathan Dingwell (University of Texas), Lena Ting (Georgia Tech/Emory University)

9.20 - 9:35 **LOCAL DYNAMIC STABILITY IMPROVES AT SLOWER WALKING SPEEDS**
Laura C. Marin[1,2] and Jonathan B. Dingwell[1,2]
[1]Nonlinear Biodynamics Lab, Dept. of Kinesiology, University of Texas, Austin, TX, USA.
[2]Dept. of Biomedical Engineering, University of Texas, Austin, TX, USA.

9.35 - 9:50 **INDIVIDUAL CONTRIBUTIONS OF WEIGHT AND MASS TO THE METABOLIC COST OF WALKING**
Alena Grabowski, Claire T. Farley, and Rodger Kram
Locomotion Laboratory, Dept. of Integrative Physiology, University of Colorado, Boulder, USA.

9.50 - 10:05 **WHAT CAUSES A CROSS-OVER STEP WHEN WALKING ON UNEVEN GROUND? A STUDY IN HEALTHY YOUNG WOMEN**
Sibylle B. Thies and James A. Ashton-Miller
[1] Biomechanics Research Laboratory, Dept. of Biomedical Engineering, University of Michigan, Ann Arbor, MI, USA.

10:05 - 10:20 **MODULATION OF MUSCLE SYNERGIES OVER TIME DURING POSTURAL RESPONSES**
Gelsy Torres-Oviedo[1], Jane M. Macpherson[2] and Lena H. Ting[1]
[1]Department of Biomedical Engineering, Georgia Tech/Emory University, Atlanta, GA, USA.
[2]Neurological Sciences Institute, Oregon Health & Science University, Beaverton OR, USA.

10.20 - 10:35 **POSTURAL STEADINESS DURING QUIET STANCE DOES NOT ASSOCIATE WITH ABILITY TO RECOVER BALANCE IN OLDER WOMEN**
Dawn C. Mackey and Stephen N. Robinovitch
Injury Prevention and Mobility Laboratory, School of Kinesiology, Simon Fraser University, Burnaby, BC, Canada.

10:35 - 10:50 **POSTURAL SWAY RESPONSES TO PREDICTABLE AND UNPREDICTABLE MOVING VISUAL SCENES**
Mark Musolino[1,2,4], Patrick Loughlin[1,2,3] and Mark Redfern[1,2,4]
[1]Human Movement and Balance Laboratory. [2]Dept. of Bioengineering,
[3]Dept. of Electrical Engineering, and [4]Dept. of Otolaryngology, University of Pittsburgh, Pittsburgh, PA, USA.

## 11:00 am - 12:30 pm Sports Biomechanics **Room A**

Chairs: Mario Lafurtune (Nike Sport Research Laboratory), Darren J. Stefanyshyn (University of Calgary)

11:00-11:15 **FOOTWEAR THAT ALLOWS RELATIVE HORIZONTAL MOVEMENT BETWEEN THE FOOT AND OUTSOLE REDUCES KNEE JOINT MOMENTS DURING RUNNING**
Darren J. Stefanyshyn, Jay T. Worobets and Brady Anderson
Human Performance Laboratory, University of Calgary, Calgary AB, Canada.

11:15-11:30 **KINEMATIC STUDY OF LEFT ARM DURING GOLF SWING**
Koon Kiat Teu[1], Wangdo Kim[1],*, Franz Konstantin Fuss[1] and John Tan[2]
[1]School of Mechanical & Production Engineering, Nanyang Technological University, Singapore;
[2]Physical Education & Sports Science, National Institute of Education, Singapore.

11:30-11:45 **OPTIMAL CONTROL SIMULATIONS OF STANDING LONG JUMPS WITH FREE AND RESTRICTED ARM MOVEMENT**
Blake M. Ashby[1] and Scott L. Delp[1,2]
[1]Neuromuscular Biomechanics Laboratory, Mechanical Engineering Department, Stanford University, Stanford, CA, USA.
[2]Bioengineering Department, Stanford University, Stanford, CA, USA.

11:45 - 12:00 **PREDICTING THE ANTERIOR-POSTERIOR COMPONENT OF GROUND REACTION FORCE FROM WEARABLE INSTRUMENTATION**
Dan C. Billing[1,2], Jason P. Hayes[1,2], John Baker[3], Romesh C. Nagarajah[1]
[1]IRIS, Swinburne University of Technology, Hawthorn, Melbourne, Australia.
[2]CRC for microTechnology, Hawthorn, Melbourne, Australia.
[3]Australian Institute of Sport, Belconnen, Canberra, Australia.

12:00 - 12:15 **PROSPECTIVE STUDY OF STRUCTURAL AND BIOMECHANICAL FACTORS ASSOCIATED WITH THE DEVELOPMENT OF PLANTAR FASCIITIS IN FEMALE RUNNERS**
Irene S. Davis[1,2], Clare E. Milner[1], and Joseph Hamill[3],
[1]Department of Physical Therapy, University of Delaware, Newark, DE.
[2]Joyner Sportsmedicine Institute, Lexington, KY. [3]Department of Exercise Science, University of Massachusetts, Amherst, MA.

12:15 - 12:30 **MEASURING REAL TIME HEAD ACCELERATIONS IN COLLEGIATE FOOTBALL PLAYERS**
Stefan Duma[1], Sarah Manoogian[1], Gunnar Brolinson[2,3], Mike Goforth[3], Jesse Donnenwerth[3], Richard Greenwald[4], Jeffrey Chu[4], Bill Bussone[1], Joel Stitzel[1], Joseph Crisco[5]
[1]Virginia Tech – Wake Forest Center for Injury Biomechanics.
[2]Edward Via Virginia College of Osteopathic Medicine.
[3]Virginia Tech Sports Medicine. [4]Simbex. [5]Brown Medical School.

## 11:00 am - 12:30 pm Orthopaedics I: Basic Science **Room B**

Chairs: Marie Shea (Oregon Health & Science University), Andrew Karduna (University of Oregon)

11:00 - 11:15 **KNEE KINEMATICS DURING ACTIVITY IN ACL DEFICIENT PATIENTS ARE LESS AFFECTED IN THOSE WHO COPE WELL WITH THE INJURY**
Peter J. Barrance[1], Glenn N. Williams[2], Thomas S. Buchanan[1]
[1]Center for Biomedical Engineering Research, University of Delaware, Newark, DE.
[2]Graduate Program in P.T. & Rehabilitation Science, The University of Iowa, Iowa City, IA.

11:15-11:30 **PREDICTION OF RELAXATION FROM CREEP IN LIGAMENTS**
Ashish L. Oza[1], Roderic S. Lakes[2,3] and Ray Vanderby[1,2,3]
[1]Orthopedic Research Laboratories, Department of Orthopedics and Rehabilitation University of Wisconsin, Madison, WI.
[2]Department of Biomedical Engineering, University of Wisconsin, Madison, WI.
[3]Department of Engineering Physics, University of Wisconsin, Madison, WI.

11:30-11:45 **AN MRI IMAGE-BASED METHOD FOR QUANTIFYING MENISCUS STRAINS**
Qunli Sun[1, 2], Robert T. Burks[2], Patrick E. Greis[2], and Jeffrey A. Weiss[1, 2]
[1]Department of Bioengineering, University of Utah, Salt Lake City, UT, USA.
[2]Dept. of Orthopedics, University of Utah, Salt Lake City, UT, USA.

11:45 - 12:00 **CARPAL BONE SCALING IS ISOMETRIC AND NOT GENDER SPECIFIC**
James C. Coburn[1], Joseph J. Crisco[1,2], Douglas C. Moore[1], M. Anwar Upal[2]
[1]Dept. of Orthopaedics, Brown Medical School & Rhode Island Hospital, Providence, RI.
[2]Div. of Engineering, Brown University, Providence, RI.

12:00 - 12:15 **INFLUENCE OF SEX AND GENOTYPE ON SKELETAL FRAGILITY**
Marie Shea[1], Brenden L. Hansen[1], Dawn A. Olson[2], Denise Dinulescu[2], Ben Orwoll[2], John K. Belknap[2], Eric S. Orwoll[2], and Robert F. Klein[2]
[1]Orthopaedic Biomechanics Laboratory, Oregon Health & Science University, Portland, OR, USA.
[2]Bone and Mineral Unit, Oregon Health & Science University, Portland, OR, USA.

12:15 - 12:30 **HETEROGENEOUS ADAPTATION OF THE PATELLOFEMORAL JOINT TO SHORT- AND LONG-TERM ANTERIOR CRUCIATE LIGAMENT DEFICIENCY**
Andrea Clark[1], Walter Herzog[1], John Matyas[2], Leona Barclay[2] and Tim Leonard[1].
[1]The Human Performance Lab, Faculty of Kinesiology, University of Calgary, AB, Canada.
[2]McCaig Centre for Joint Injury and Arthritis Research, University of Calgary, AB, Canada.

## 9:20 am - 10:50 am Symposium II: Cell and Tissue Biomechanics **Room A**

Chair: Walter Herzog (University of Calgary)

9:20 - 9:35 **Introduction to Cell and Tissue Biomechanics Symposium**
Walter Herzog, Faculty of Kinesiology, University of Calgary

9:35 - 10:00 **TITIN AND MUSCLE**
Henk Granzier, Veterinary Comparative Anatomy, Pharmacology & Physiology, Washington State University

10:00 - 10:25 **CELLULAR MECHANOTRANSDUCTION IN BONE**
Christopher Jacobs, Department of Mechanical Engineering and Department of Functional Restoration, Stanford University, and Rehabilitation Research and Development Center, VA Palo Alto Health Care Systems

10:25 - 10:50 **LIGAMENTS AND TENDONS**
Albert J. Banes, Department of Orthopaedics, UNC School of Medicine Chapel Hill, NC

## 9:20 am - 10:50 am Gait and Movement II: Clinical/Methods **Room B**

Chairs: Li-Shan Chou (University of Oregon), Nicholas Stergiou (University of Nebraska at Omaha)

9.20 - 9:35 **IN VIVO SHOULDER KINEMATICS: A COMPARISON OF MEASUREMENT METHODS**
Duane A. Morrow, Diana K. Hansen, Denny J. Padgett, Kai-Nan An, Kenton R. Kaufman
Motion Analysis Laboratory, Division of Orthopedic Research, Mayo College of Medicine, Rochester, MN, USA

9.35 - 9:50 **ESTIMATION OF THE ACCURACY OF A SHAPE-FROM-SILHOUETTE MARKERLESS MOTION CAPTURE SYSTEM**
Lars Mündermann[1], Ajit Chaudhari[1], Gene Alexander[1], Thomas P. Andriacchi[1,2,3]
[1]Division of Biomechanical Engineering, Stanford University, Stanford, CA.
[2]Bone and Joint Center, Palo Alto VA, Palo Alto, CA.
[3]Department of Orthopedic Surgery, Stanford University Medical Center, Stanford, CA.

9.50 - 10:05 **DOES FOOTWEAR INFLUENCE THE STRUCTURE OF CHAOTIC GAIT PATTERNS?**
Max J. Kurz, Nicholas Stergiou and Daniel Blanke
HPER Biomechanics Laboratory, University of Nebraska at Omaha, Omaha, NE.

10:05 - 10:20 **COMPARING MOMENTUM AND STABILITY TRADEOFFS DURING BIDIRECTIONAL GAIT INITIATION IN OLDER ADULTS AND PARKINSONISM**
Chris J. Hass[1,2], Dwight E. Waddell[1], Steve L. Wolf[3], Jorge L. Juncos[2], Robert J.Gregor[1]
[1]Center for Human Movement Studies, Georgia Institute of Technology, Atlanta, GA, USA.
[2]Department of Neurology, Emory University, Atlanta, GA, USA.
[3]Department of Rehabilitation Medicine, Emory University, Atlanta, GA, USA.

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10.20 - 10:35 **MUSCLE-TENDON LENGTHS AND VELOCITIES OF THE HAMSTRINGS AFTER SURGICAL LENGTHENING TO CORRECT CROUCH GAIT**
Allison Arnold[1], May Liu[1], Michael Schwartz[3], Sylvia Õunpuu[4], Luciano Dias[5], Scott Delp[1,2]
[1]Depts. of Mechanical Engineering and [2]Bioengineering, Stanford University, Stanford, CA.
[3]Motion Analysis Laboratory, Gillette Children's Specialty Healthcare, St. Paul, MN.
[4]Center for Motion Analysis, Connecticut Children's Medical Center, Hartford, CT.
[5]Motion Analysis Center, Children's Memorial Medical Center, Chicago, IL.

10:35 - 10:50 **GAIT EFFECIENCY: CENTER OF MASS MOTION, $VO_2$ AND WALKING SPEED**
Michael S. Orendurff, Ava D. Segal, Jocelyn S. Berge, Kevin C. Flick and Glenn K. Klute
Motion Analysis Laboratory, Rehabilitation Research and Development, Seattle, Washington.

## 11:00 am - 12:30 pm Balance and Falls **Room A**

Chairs: Darryl G. Thelen (University of Wisconsin-Madison), Elizabeth T. Hsiao-Wecksler (University of Illinois at Urbana-Champaign)

11:00 - 11:30 **MULTIDIRECTIONAL POSTURAL INSTABILITY IN PARKINSON'S DISEASE**
Fay B. Horak, PhD, PT
Balance Disorders Laboratory, Dept of Neurology, Physiology & Pharmacology and Biomedical Engineering, Neurological Sciences Institute, Oregon Health & Science University.
**INVITED LECTURE**

11:30 - 11:45 **THE EFFECT OF HAND POSITION ON WRIST KINEMATICS AT LANDING FROM A FORWARD FALL FROM A KNEELING POSITION**
Karen L. Troy, Courtney D. Gavin, Mark D. Grabiner
University of Illinois at Chicago, Chicago, IL

11:45 - 12:00 **SAFE LANDING DURING A FALL: EFFECT OF RESPONSE TIME ON ABILITY TO AVOID HIP IMPACT DURING SIDEWAYS FALLS**
Fabio Feldman and Stephen N. Robinovitch
Injury Prevention and Mobility Laboratory, School of Kinesiology, Simon Fraser University, Burnaby, BC, Canada.

12:00 - 12:15 **SIMULATION OF FORWARD FALLS: EFFECT OF LOWER EXTREMITY CONTROL STRATEGY ON INJURY RISK**
Jia-Hsuan Lo and James Ashton-Miller
Biomechanics Research Laboratory, Department of Mechanical Engineering, University of Michigan, Ann Arbor, MI, USA.

12:15 - 12:30 **EFFECTS OF BLURRING VISION ON M/L BALANCE DURING STEPPING UP OR DOWN TO A NEW LEVEL IN THE ELDERLY**
[1]John G Buckley, [1]Karen Heasley, [2]Andy Scally and [1]David B Elliott.
[1]Vision and Mobility Research Laboratory, Department of Optometry.
[2]Institute of Health Research, School of Health, University of Bradford, Bradford, UK.

## 11:00 am - 12:30 pm Orthopaedics II: Clinical **Room B**

Chairs: Steven M. Madey (Legacy Health System), Sean S. Kohles (Kohles Bioengineering)

11:00-11:15 **OPTIMIZATION OF BONE ALIGNMENT TO REPRODUCE PLANTAR PRESSURES IN A SUBJECT-SPECIFIC FINITE ELEMENT FOOT MODEL**

Ahmet Erdemir[1], Marc Petre[1,2], Sachin Budhabhatti[1,3] and Peter R. Cavanagh[1]
[1]Dept. of Biomedical Engineering, Cleveland Clinic Foundation, Cleveland, OH, USA.
[2]Dept. of Biomedical Engineering, Case Western Reserve University, Cleveland, OH, USA
[3]Dept. of Chemical & Biomedical Engineering, Cleveland State University, Cleveland, OH, USA.

11:15-11:30 **THE EFFECTS OF SKELETAL METASTASIS ON BONE TISSUE PROPERTIES**

Ara Nazarian[1,5], Jae Y Rho[3], Marc Grynpas[4], David Zurakowski[2], Ralph Müller[5] and Brian D. Snyder[1, 2]
[1]Orthopedic Biomechanics Laboratory, Beth Israel Deaconess Medical Center and
Harvard Medical School, Boston, MA. [2]Dept. of Orthopaedic Surgery, The Children's Hospital, Boston, MA.
[3]Dept. of Biomed. Eng., University of Memphis, Memphis, TN.
[4]Institute for Biomat. and Biomedical Engineering, University of Toronto, Toronto, Canada.
[5]Institute for Biomedical Engineering, Swiss Federal Institute of Technology, Zürich, CH.

11:30-11:45 **METHODS TO DETERMINE *IN VIVO* CARTILAGE STRESS IN THE PATELLOFEMORAL JOINT FROM WEIGHT-BEARING MRI**

Thor Besier[1], Garry Gold[2], Christine Draper[1], Chris Powers[3], Scott Delp[1,4], and Gary Beaupré[4]
Departments of Mechanical Engineering[1], Bioengineering[1], and Radiology[2], Stanford University, Stanford. CA.
[3]Department of Biokinesiology and Physical Therapy, University of Southern California, LA.
[4]VA Palo Alto Rehabilitation R&D Center, Palo Alto, CA.

11:45 - 12:00 **DO THE MECHANICAL PROPERTIES OF INTERVERTEBRAL DISCS MATCH THOSE OF ADJACENT VERTEBRAE?**

Daniel Skrzypiec, Phill Pollintine, Michael A. Adams
Department of Anatomy, University of Bristol, Bristol BS2 8EJ, UK.

12:00 - 12:15 **INTERVERTEBRAL NECK INJURY CRITERION FOR SIMULATED FRONTAL IMPACTS**

Paul C. Ivancic, Shigeki Ito, Manohar M. Panjabi, Adam M. Pearson, Yasuhiro Tominaga, Jaw-Lin Wang, S. Elena Gimenez
Biomechanics Research Laboratory, Yale University School of Medicine, New Haven, CT, USA.

12:15 - 12:30 **OBLIQUE IMPACT TESTING OF BICYCLE HELMETS**

Steven M. Madey, Larry W. Ehmke, Mark B. Sommers, and Michael Bottlang
Biomechanics Laboratory, Legacy Research & Technology Center, Portland, OR

## 9:20 am - 10:50 am Biomechanical Modeling **Room A**

Chairs: Rahman Davoodi (University of Southern California), Ahmet Erdemir (The Cleveland Clinic Foundation)

9.20 - 9:35 **USING COMPUTED MUSCLE CONTROL TO GENERATE FORWARD DYNAMIC SIMULATIONS OF GAIT FROM EXPERIMENTAL DATA**
Darryl G. Thelen[1] and Frank C. Anderson[2]
[1]Dept. of Mechanical Engineering, University of Wisconsin-Madison, Madison, WI, USA.
[2]Dept. of Mechanical Engineering, Stanford University, Stanford, CA, USA.

9.35 - 9:50 **COMPUTATION OF MOTION PATTERNS OF THE COCHLEAR PARTITION**
Hongxue Cai, Brett Shoelson, and Richard S. Chadwick
Section on Auditory Mechanics, NIDCD/NIH, Bethesda, MD 20892

9.50 - 10:05 **INVESTIGATING CHRONIC STRESS EXPOSURE FOLLOWING INTRAARTICULAR FRACTURE USING A FINITE ELEMENT MODEL OF THE ANKLE**
Donald D. Anderson, Nicole M. Grosland, and Thomas D. Brown
Department of Orthopaedics and Rehabilitation, The University of Iowa, Iowa City, IA, USA.

10:05 - 10:20 **CLINICIAN-FRIENDLY SOFTWARE FOR BIOMECHANICAL MODELING AND CONTROL OF MOVEMENT**
Rahman Davoodi, Chet Urata, Emanuel Todorov, and Gerald E. Loeb A.E.
Mann Institute and Biomedical Engineering Department, University of Southern California Los Angeles, CA, USA.

10.20 - 10:35 **MINIMAL ACTUATION REQUIREMENTS FOR POWERING THE PASSIVE WALKING MODEL WITH KNEES**
Jesse C. Dean[1] and Arthur D. Kuo[1,2]
[1]Dept. of Biomedical Engineering, [2]Dept. of Mechanical Engineering University of Michigan, Ann Arbor, MI.

10:35 - 10:50 **STATIC FORCE PRODUCTION IN A THREE-DIMENSIONAL MUSCULOSKELETAL MODEL OF THE CAT HINDLIMB**
Lale Korkmaz[1], Thomas J. Burkholder[2] and Lena H. Ting[3]
[1]Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA.
[2]School of Applied Physiology, Georgia Institute of Technology, Atlanta, GA.
[3]Coulter Department of Biomedical Engineering, Georgia Tech/Emory University, Atlanta, GA.

## 9:20 am - 10:50 am Muscle and Reflex **Room B**

Chairs: David A Hawkins (University of California - Davis), Kevin P. Granata (Virginia Tech)

9.20 - 9:35 **MAGNETIC RESONANCE ELASTOGRAPHY FOR THE ASSESSMENT OF MUSCLES IN HYPERTHYROIDISM**

Stacie I. Ringleb[1], Laurel Littrell[2], Qingshan Chen[1], Sabine Bensamoun[1], Michael D. Brennan[3], Kenton R. Kaufman[4], Richard L. Ehman[2], Kai-Nan An[1]
[1]Orthopedics Biomechanics Laboratory, Mayo Clinic College of Medicine, Rochester, MN.
[2]MRI Research Laboratory, Mayo Clinic College of Medicine, Rochester, MN.
[3]Dept. of Endocrinology, Mayo Clinic, Rochester, MN. [4]Motion Analysis Laboratory, Mayo Clinic College of Medicine, Rochester, MN.

9.35 - 9:50 **SMALL CHANGES IN THE TIMING OF ACTIVATION AFFECTS FIBER LENGTHS AND SERIAL SARCOMERE NUMBER ADAPTATIONS IN RABBIT TIBIALIS ANTERIOR EXPOSED TO ECCENTRIC EXERCISE**

Timothy A Butterfield, Walter Herzog.
Human Performance Laboratory, University of Calgary, Calgary, Alberta, Canada.

9.50 - 10:05 **STRESS-DEPENDENT AND STRESS-INDEPENDENT GENE EXPRESSION IN RAT SKELETAL MUSCLE AFTER A SINGLE BOUT OF "EXERCISE"**

Eric Hentzen[1], Michelle Lahey[1], Liby Mathew[1], David Peters[1], Ilona A. Barash[1], Jan Fridén[2] and Richard L. Lieber[1]
[1]Departments of Orthopaedic Surgery and Bioengineering, University of California, San Diego, Veterans Affairs Medical Center, San Diego.
[2]Department of Hand Surgery, Sahlgrenska University Hospital, Göteborg, Sweden.

10:05 - 10:20 **EFFECTS OF STATIC FLEXION-RELAXATION ON PARASPINAL REFLEX BEHAVIOR**

Ellen Rogers, Kevin Moorhouse, and Kevin Granata[1]
Musculoskeletal Biomechanics Laboratory, Virginia Polytechnic Institute, Blacksburg, VA, USA.

10.20 - 10:35 **FORCE TRANSMISSION VIA MYOFASCIAL PATHWAYS IN DYNAMIC CONDITIONS OF A SINGLE HEAD OF MULTI-TENDONED RAT EDL MUSCLE**

Huub Maas[1], and Peter A. Huijing[2,3]
[1]School of Applied Physiology, Georgia Institute of Technology, Atlanta, GA, USA.
[2]Faculty of Human Movement Sciences, Vrije Universiteit Amsterdam, The Netherlands.
[3]Institute for Biomedical Technology, Universiteit Twente, Enschede, The Netherlands.

10:35 - 10:50 **QUANTITATIVE CHARACTERIZATION OF LATERAL FORCE TRANSMISSION IN PASSIVE SKELETAL MUSCLE**

Carina J. Bender, M.S. and David A. Hawkins, Ph.D.
Human Performance Laboratory, Exercise Science Graduate Group, University of California, Davis.

# Posters

Poster Presentations will be displayed throughout the entire conference without rotation to maximize exposure. Posters will be ordered by subjects, as indicated below, and displayed in poster area A (Willamette Ballroom) and poster area B (Pacific Northwest Ballroom).

Presenters of odd-numbered posters are encouraged to attend their poster during the first half of each poster session, (i.e. 3:30-4:15 pm on Thursday, 3:30 pm - 4:00 and Friday) and Presenters of even-numbered posters are encouraged to attend their poster during the second half of each poster session. (i.e., 4:15 pm – 5:00 pm on Thursday and 4:00 - 4:30 on Friday).

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|---|---|---|
| Poster setup: | Wednesday, Sept. 8 | 11:00 am - 6:00 pm |
| Poster dismantle: | Saturday, Sept. 11 | 7:00 am - noon |

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| **Subject** | **Poster #'s** | **Poster Area** |
|---|---|---|
| Bone | 100-111 | A |
| Cartilage/Tendon/Ligament | 112-137 | A |
| Lower Extremity | 138-180 | A |
| Upper Extremity | 181-203 | A |
| Spine | 204-226 | A |
| Methods | 227-241 | B |
| Muscle | 242-271 | B |
| Posture and Balance | 272-282 | B |
| Rehabilitation Engineering | 283-288 | B |
| Gait and Movement | 289-314 | B |
| Aging | 315-325 | B |
| Cardiovascular | 326-330 | B |
| Sport Science | 331-341 | B |

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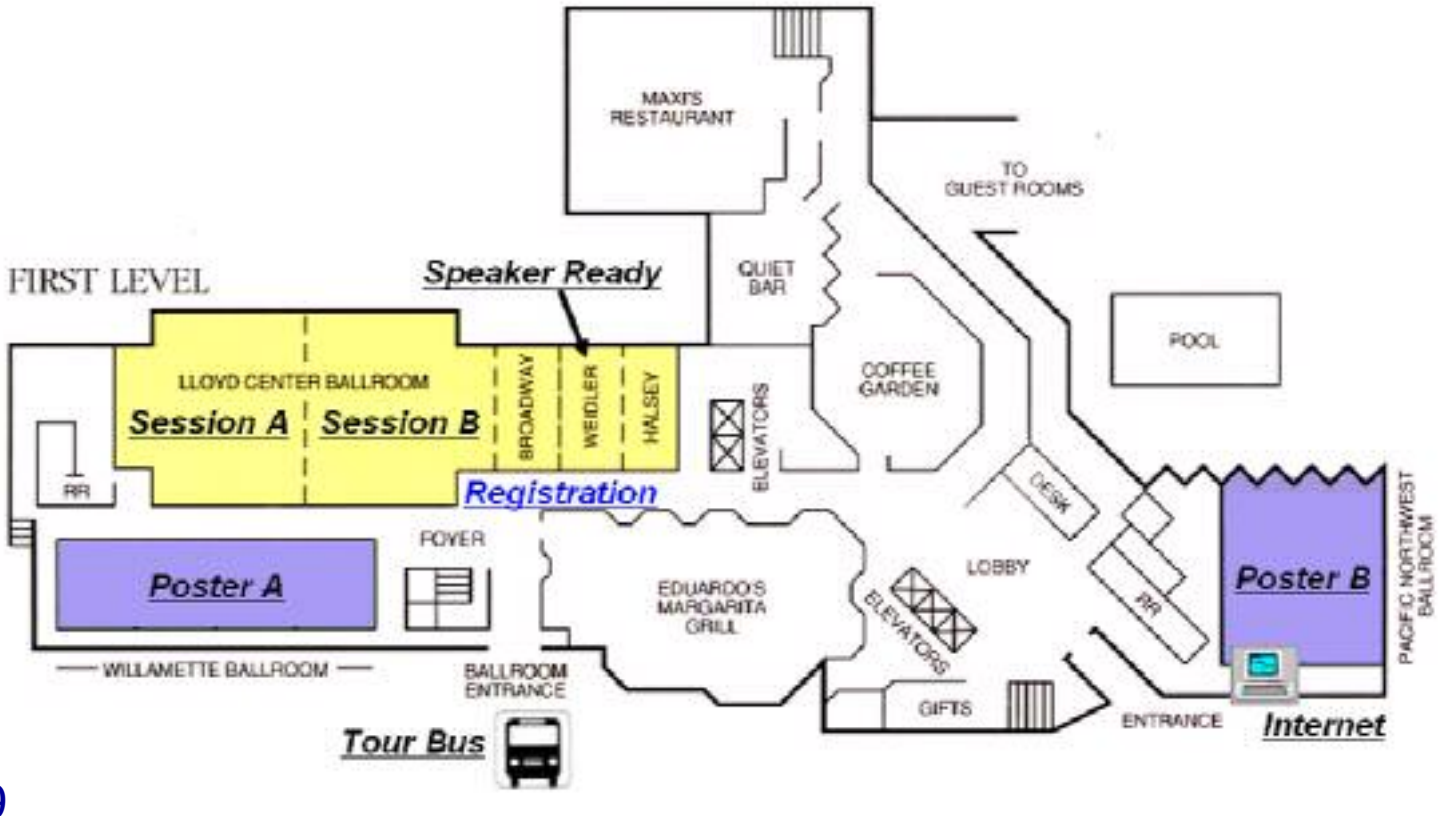

**# 100 DISPLACED OLECRANON FRACTURES IN CHILREN: A BIOMECHANICAL ANALYSIS OF FIXATION METHODS**

Stefan Parent[1], Michelle Wedemeyer[1], Megan Anderson[2], Fran Faro[2], Andrew Mahar[1,2],Francois Lalonde[1], Peter Newton[1,2]
[1]Department of Orthopedics,Children's Hospital, San Diego San Diego, CA, USA; [2]Department of Orthopaedic Surgery, University of California, San Diego,San Diego, CA, USA.

**# 101 VISCOELASTIC EFFECTS AT THE BONE-SCREW INTERFACE**

Serkan İnceoğlu[1], Atilla Akbay[1], and Robert F. McLain[2]
[1]Spine Research Laboratory, Spine Institute, The Cleveland Clinic Foundation, Cleveland, OH, USA
[2]Dept. of Orthopeadic Surgery, Spine Institute, The Cleveland Clinic Foundation, Cleveland, OH, USA

**# 102 BIOMECHANICAL EVALUATION OF VERTEBRAL AUGMENTATION WITH CALCIUM SULFATE CEMENT IN CADAVERIC OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURES**

Andrew Mahar[1,2] , Andrew Perry[1], Noemi Arrieta[1], Steven Garfin[1], Jennifer Massie[1], Choll Kim[1]
[1]Department of Orthopaedics University of California, San Diego, San Diego, CA; [2]Department of Orthopedics Children's Hospital, San Diego, San Diego, CA.

**# 103 QUANTIFYING FRACTURE ENERGY IN A CLINICAL SERIES OF TIBIAL PILON FRACTURE CASES**

Donald D. Anderson, Valerie L. Muehling, J. Lawrence Marsh, and Thomas D. Brown
Department of Orthopaedics and Rehabilitation, The University of Iowa, Iowa City, IA, USA

**# 104 EFFECT OF FLOOR STIFFNESS ON IMPACT FORCES DURING FALLS ON THE HIP**

Andrew C.T. Laing, Iman Tootoonchi, Stephen N. Robinovitch
Injury Prevention and Mobility Laboratory, School of Kinesiology, Simon Fraser University, Burnaby, BC, Canada.

**# 105 FURTHER EVIDENCE THAT BONE MINERAL DENSITY AND SOFT TISSUES INFLUENCE PELVIC FRACTURE IN OLDER WOMEN DURING LATERAL IMPACT**

Brandon S. Etheridge[1], David P. Beason[1], Jorge E. Alonso[2], Robert Lopez[3], *Alan W. Eberhardt[1]
[1]Dept. of Biomedical Engineering, [2]Division of Orthopaedic Surgery, [3]Department of Radiology University of Alabama at Birmingham, Birmingham, Alabama, USA.

**# 106 THREE-DIMENSIONAL FINITE ELEMENT BONE DAMAGE SIMULATIONS USING QUASI-CONTINUUM DAMAGE MECHANICS**

Victor Kosmopoulos[1] and Tony S. Keller[2]
[1]Department of Mechanical Engineering, School of Engineering, The College of New Jersey, Ewing, NJ, United States;
[2]Department of Mechanical Engineering, College of Engineering and Mathematics, The University of Vermont, Burlington, VT, United States.

**# 107 ANALYSIS OF FATIGUE DAMAGE IN BOVINE TRABECULAR BONE**

Partha Ganguly[1], Tara L. A. Moore[2], and Lorna J. Gibson[3]
[1]Schlumberger-Doll Research Cambridge, MA, USA; [2]Exponent, Inc., Philadelphia, PA, USA
[3]Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA.

**# 108 BONE STRENGTH IS NOT COMPROMISED WITH AGING IN BLACK BEARS (URSUS AMERICANUS) DESPITE ANNUAL PERIODS OF DISUSE (HIBERNATION)**

Seth W. Donahue[1, 2] and Kristin B. Harvey[1]
Departments of [1]Mechanical Engineering - Engineering Mechanics and [2]Biomedical Engineering, Michigan Technological University, Houghton, MI

**# 109 CHARACTERIZATION OF A HUMAN VERTEBRAL BODY COLLAPSE USING A 6-DOF ROBOTIC SYSTEM**

Wafa Tawackoli, Kay Sun, Michael A.K. Liebschner
Department of Bioengineering, Rice University, Houston, TX, USA.

**# 110 PERMEABILITY & MICROARCHITECTURAL MEASUREMENTS IN CALCANEUS**

S. Solomon Praveen, Craig J. Bennetts, Kimerly A. Powell, and Brian L. Davis
Orthopaedic Research Center, The Cleveland Clinic Foundation, Cleveland, OH, USA

**# 111 COMPARISON OF THREE DIFFERENT HYDROXYAPATITE COATINGS IN AN UNLOADED IMPLANT MODEL-EXPERIMENTAL CANINE STUDY**

[1]Daugaard, H; 1Elmengaard, B; [2]Bechtold, J E, 1Jensen T B, 1Søballe, K
[1]Orthopaedic Research Laboratory, Aarhus University Hospital, Denmark; [2]Midwest Orthopaedic and Minneapolis Medical Research Foundation

## Cartilage Tendon Ligaments

**# 112 DYNAMIC BENDING MECHANICS OF THE DEVELOPING SPINE**

David J. Nuckley, Richard M. Harrington, and Randal P. Ching
Applied Biomechanics Laboratory, Mechanical Engineering Department, University of Washington, Seattle, WA, USA.

**# 113 TRACKING NON-UNIFORM STRAIN OF THE AORTIC VALVE**

Todd C. Doehring[1] and Ivan Vesely[2]
[1] Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, OH, USA,
[2] Saban Research Institute, Los Angeles, CA, USA

**# 114 LIGAMENTOUS VERSUS PHYSEAL FAILURE IN MURINE MEDIAL COLLATERAL LIGAMENT BIOMECHANICAL TESTING**

Hossam B. El- Zawawy; Matt J. Silva; Linda J. Sandell; Rick W. Wright
Department of Orthopaedic Surgery, Washington University School of Medicine at Barnes Jewish Hospital, St. Louis, MO.

**# 115 VISCOELASTIC CHARACTERIZATION OF CERVICAL SPINAL LIGAMENTS**

Scott R. Lucas[1], Cameron R. Bass[1], Robert S. Salzar[1], James B. Folk[1], Lucy E. Donnellan[1], Glenn Paskoff[2], and Barry S. Shender[2]
[1]Center for Applied Biomechanics, University of Virginia; [2]NAVAIR, Patuxent River.

**# 116 RESPONSE SURFACE ANALYSIS OF FLEXURAL AND MEMBRANE STRESSES TO CHARACTERIZE FLEXIBLE BIOLOGIC MATERIALS**

Sean S. Kohles[1]
[1]Kohles Bioengineering, Portland State University, and Oregon Health & Science University, Portland, OR.

**# 117 SERUM COMP CONCENTRATION IS RELATED TO LOAD DISTRIBUTION AT THE KNEE DURING WALKING IN HEALTHY ADULTS**

Anne Mündermann[1,2], Karen B. King[3], Chris O. Dyrby[1,2], Thomas P. Andriacchi[1,2,4]
[1]Division of Biomechanical Engineering, Stanford University, Stanford, CA; [2]Bone and Joint Center, Palo Alto VA, Palo Alto, CA; [3]Department of Medicine, University of California San Francisco, San Francisco, CA; [4]Department of Orthopedic Surgery, Stanford University Medical Center, Stanford, CA.

**# 118 A MICRO-MECHANICAL COMPOSITE ANALYSIS OF ENGINEERED CARTILAGE**

Sean S. Kohles[1], Christopher G. Wilson[2], and Lawrence J. Bonassar[3]
[1]Kohles Bioengineering, Portland State University, and Oregon Health & Science University, Portland, OR; [2]Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology; Atlanta, GA;[3]Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY.

**# 119 CHARACTERIZATION OF PLANTAR TISSUES UNDER THE METATARSAL HEADS**

Andrew R. Fauth[1,2] and Neil A. Sharkey[1,2,3]
[1]Center for Locomotion Studies, The Pennsylvania State University, University Park, PA; [2]Dept. of Kinesiology, The Pennsylvania State University, University Park, PA; [3]Dept. of Orthopaedics and Rehabilitation, The Pennsylvania State University, Hershey, PA.
These data describe the *in vitro* material properties of the plantar soft tissues beneath the first and second metatarsal heads and can be used in detailed hyperelastic numerical models of the soft tissues on the plantar surface of the foot.

**# 120 HYPERELASTIC PROPERTIES OF NORMAL AND DIABETIC HEEL PADS FROM AN INVERSE FINITE ELEMENT MODEL OF INDENTATION**

Ahmet Erdemir[1], Meredith L. Viverios[2], Jan S. Ulbrecht[3], and Peter R. Cavanagh[1]
[1] Department of Biomedical Engineering, Cleveland Clinic Foundation, Cleveland, OH, USA; [2] Instron Corporation Headquarters, Canton, MA, USA; [3] Depts of Biobehavioral Health and Medicine, Penn State University, University Park, PA, USA.

**# 121 FACTORS INFLUENCING THE ACCURACY OF ARTICULAR CARTILAGE THICKNESS MEASUREMENT FROM MRI**

Seungbum Koo[1], Peter Kornaat[2], Garry Gold[2] and Thomas P. Andriacchi[1,3]
[1]Biomotion Laboratory, Stanford University, Stanford, CA, USA; [2]Department of Radiology, Stanford University, Stanford, CA, USA; [3]Department of Orthopaedic Surgery, Stanford University, Stanford, CA, USA

**# 122 LIGAMENTOUS INJURY DURING SIMULATED FRONTAL IMPACT**

Manohar M. Panjabi, Adam M. Pearson, Shigeki Ito, Paul C. Ivancic, S. Elena Gimenez, Yasuhiro Tominaga
Biomechanics Research Laboratory, Yale University School of Medicine, New Haven, CT, USA

**# 123 FE ANALSIS OF THE MECHANICAL BEHAVIOR OF CHONDROCYTES**

S.K.Han1, S. Federico[1], A. Grillo[2], F. Musumeci2, G. Giaquinta[2], and W. Herzog[1]
[1]Human Performance Laboratory, the University of Calgary, Canada; [2]Dept of Physical and Chemical Methodologies for Engineering, University of Catania, Italy.

**# 124 SHEAR-STRESS-INDUCED CHONDROCYTE DEATH IS REDUCED BY ANTIOXIDANT TREATMENT**

James A. Martin, Anneliese D. Heiner, Benjamin R. Beecher, and Thomas D. Brown
Department of Orthopaedics and Rehabilitation, The University of Iowa, Iowa City, Iowa

**# 125 SPEED EFFECTS ON KNEE ADDUCTION MOMENTS USING INTERVENTION FOOTWEAR: IMPLICATION FOR THE TREATMENT OF KNEE OSTEOARTHRITIS**

David Fisher[1], Anne Mündermann[1,2], and Thomas Andriacchi[1,2]
[1]Stanford Biomotion Laboratory, Biomechanical Engineering Division, Mechanical Engineering Department, Stanford, CA, USA; [2] Department of Veterans Affairs, VA Palo Alto Health Care System Rehabilitation R&D Center, Palo Alto, CA, USA.

**# 126 NORMAL VIBRATION FREQUENCIES OF THE VOCAL LIGAMENT**

Ingo R. Titze[1,2] and Eric J. Hunter[1]
[1]National Center for Voice and Speech, A division of Denver Center for the Performing Arts, Denver, CO, USA; [2]Department of Speech Pathology and Audiology, The University of Iowa, Iowa City, IA, USA.

**# 127 LUMBAR FACET JOINT CAPSULE CREEP DURING STATIC FLEXION**

Jesse S. Little[1] and Partap S. Khalsa[1]
[1]Dept. of Biomedical Engineering, State University of New York at Stony Brook, Stony Brook, NY, USA;

**# 128 BIOMECHANICAL COMPARISON OF AN INTRA- CORTICAL FIXATION ANCHOR VERSUS STANDARD ANCHOR FIXATION FOR ROTATOR CUFF REPAIR**

Andrew Mahar[1,2], Darin Allred[2], Gaurav Abbi[2], Michelle Wedemeyer[1], Robert Pedowitz[2]
[1]Department of Orthopedics Children's Hospital, San Diego San Diego, CA; [2]Department of Orthopaedics University of California, San Diego, San Diego, CA

**# 129 CAPSULE REPRESENTATION IN A TOTAL HIP DISLOCATION FINITE ELEMENT MODEL**

Kristofer J. Stewart[1], Douglas R. Pedersen[1,2], John J. Callaghan[1,2], and Thomas D. Brown[1,2]
[1]Department of Orthopaedics and Rehabilitation, University of Iowa, Iowa City, IA, USA; [2]Department of Biomedical Engineering, University of Iowa, Iowa City, IA

**# 130 INFLUENCE OF VASTI ORIENTATION ON THE PATELLAR LIGAMENT FORCE/ QUADRICEPS FORCE RATIO DURING KNEE EXTENSION**

Sam Chen[1], Irving Scher[2], Christopher Powers[1], and Thay Lee[3]
[1]Musculoskeletal Biomechanics Research Laboratory, Department of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA, USA; [2]Exponent, Failure Analysis Associates, Los Angeles, CA, USA; [3]Orthopedic Biomechanics Laboratory, Long Beach VA Heathcare System, Long Beach, CA.

**# 131 PATELLOFEMORAL LESIONS INCREASE PRESSURE APPLIED TO SURROUNDING CARTILAGE**

John J. Elias[1], Derek R. Bratton[1], David M. Weinstein[1], Andrew J. Cosgarea[2]
[1]Medical Education and Research Institute of Colorado, Colorado Springs, CO; [2]Department of Orthopaedic Surgery, Johns Hopkins University, Baltimore, MD.

**# 132 IN VIVO QUANTIFICATION OF ACHILLES TENDON DYNAMIC CREEP**

Russell Dunning, B.S. and David A. Hawkins, Ph.D.
Human Performance Laboratory, Biomedical Engineering Graduate Group University of California, Davis

**# 133 NON-LINEAR, VISCOELASTIC PROPERTIES OF THE HUMAN LUMBAR FACET JOINT CAPSULE**
Jesse S. Little[1] and Partap S. Khalsa[1]
[1]Dept. of Biomedical Engineering, State University of New York at Stony Brook, Stony Brook, NY USA

**# 134 HUMAN LUMBAR FACET JOINT CAPSULE STRAINS DURING AXIAL ROTATIONS**
Allyson Ianuzzi[1] and Partap S. Khalsa[1]
[1]Dept. of Biomedical Engineering, Stony Brook University, Stony Brook, NY, USA

**# 135 POSTERIOR CRUCIATE LIGAMENT RESPONSE TO PROXIMAL TIBIA IMPACTS**
Adam J. Bartsch[1,2], Alan S. Litsky[1,3,4], Joseph R. Leith[4], Rod G. Herriott[1,5] and Joseph D. McFadden[1,6]
[1]Biotrauma Laboratory; [2]Department of Mechanical Engineering; [3]Biomedical Engineering Center and [4]Department of Orthopaedics, The Ohio State University, Columbus, OH, USA; [5]Transportation Research Center, East Liberty, OH, USA; [6]National Highway Traffic Safety Administration, East Liberty, OH, USA.

**# 136 MICROMOTION OF MULTI-STRAND FREE TENDON GRAFTS SECURED WITH INTERFERENCE FIXATION**
Douglas J. Adams, Matthew W. Wheeler, and Carl W. Nissen
Department of Orthopaedic Surgery, University of Connecticut Health Center, Farmington, CT

**# 137 QUANTITATIVE PREDICTION OF ARTICULAR CARTILAGE DEGENERATION FOLLOWING INCONGRUOUS INTRA-ARTICULAR FRACTURE REDUCTION**
Yang Dai[2], Thomas D. Brown[1, 2], J. Lawrence Marsh[1]
[1]Department of Orthopaedics and Rehabilitation, University of Iowa, Iowa City, IA, USA; [2] Department of Biomedical Engineering, University of Iowa, Iowa City, IA.

## Lower Extremity

**# 138 THE EFFECTS OF ADDED LEG MASS ON THE BIOMECHANICS AND ENERGETICS OF WALKING**
Raymond C. Browning[1], Jesse Modica[1], Rodger Kram[1] and Ambarish Goswami[2]
[1]Locomotion Laboratory, Department of Integrative Physiology, University of Colorado, Boulder, CO, USA. [2]Honda Research and Development, San Jose, CA.

**# 139 DOES SUSTAINING A LOWER EXTREMITY STRESS FRACTURE ALTER LOWER EXTREMITY MECHANICS IN RUNNERS?**
Clare E. Milner[1], Irene S. Davis[1,2] and Joseph Hamill[3]
[1]Department of Physical Therapy, University of Delaware, Newark, DE, USA; [2]Joyner Sportsmedicine Institute, Lexington, KY, USA; [3]Department of Exercise Science, University of Massachusetts, Amherst, MA, USA.

**# 140 CORONAL KNEE MOTION IN CHILDREN PERFORMING DROP LANDINGS IS NOT INFLUENCED BY GENDER**
Jeremy J. Bauer, Michael J. Pavol, Wilson C. Hayes, Christine M. Snow
Bone Research Laboratory and Biomechanics Laboratory, Dept. of Exercise & Sport Science, Oregon State University, Corvallis, OR, USA.

**# 141 CHARACTERIZING KINEMATICS OF 3-D HUMAN MOVEMENTS USING QUATERNIONS**
Laurie Held[1], Jill L. McNitt-Gray [1,2,3], and Henryk Flashner[3,4]
Biomechanics Research Lab, Departments of Biomedical Engineering[1]; Kinesiology[2]; Biological Sciences[3], and Aerospace and Mechanical Engineering[4] University of Southern California, Los Angeles, CA.

**# 142 CLASSIFICATION TREE ANALYSIS OF FOOT TYPES USING 3-D MEASURES**
Eric S. Rohr[1], William R. Ledoux[1,2,3], Jane B. Shofer[1], Randal P. Ching[1,2,3], and Bruce J. Sangeorzan[1,2]
[1]RR&D Center of Excellence for Limb Loss Prevention and Prosthetic Engineering, VA Puget Sound Health Care System, Seattle, WA; Departments of [2]Orthopaedics and Sports Medicine and [3]Mechanical Engineering, University of Washington, Seattle, WA.

**# 143 THE INFLUENCE OF DIFFERENT MIDSOLE HARDNESS ON KNEE JOINT LOADS DURING RUNNING**
Katja J. Michel[1,2] Frank I. Kleindienst[1] Alex Stacoff[2] Berthold Krabbe[1] and Edgar Stüssi[2]
[1]Biomechanical Lab, adidas Innovation Team, adidas-Salomon AG, Scheinfeld, Germany; [2]Biomechanical Laboratory, Department of Materials, Swiss Federal Institute of Technology, Zürich, Switzerland.

**# 144 EFFECT OF DYNAMIC ANKLE JOINT STIFFNESS ON JOINT MECHANICS DURING GAIT**

Prism S. Schneider[1], James M. Wakeling[2] and Ronald F. Zernicke[1]
[1]Human Performance Laboratory, University of Calgary, Calgary, Canada; [2]Department of Basic Veterinary Sciences, Royal Veterinary College, London, UK

**# 145 DIFFERENCES IN FRONTAL PLANE MECHANICS DURING WALKING BETWEEN PATIENTS WITH MEDIAL AND LATERAL KNEE OSTEOARTHRITIS**

Robert J. Butler[1], Irene S. Davis[1,2], Todd Royer[3], Stephanie Crenshaw[3] and Emily Mika[1]
[1]Department of Physical Therapy, University of Delaware, Newark, DE, USA; [2]Joyner Sportsmedicine Institute, Harrisburg, PA USA; [3]Department of Health and Exercise Science, University of Delaware, Newark, DE USA.

**# 146 COMPUTATIONAL ASSESSMENT OF CONSTRAINT IN POSTERIOR-STABILIZED TOTAL KNEE REPLACEMENTS**

Matthew F. Moran[1,2], Safia Bhimji[5], Joseph Racanelli[5] and Stephen J. Piazza[1,2,3,4]
[1]Center for Locomotion Studies and Departments of [2]Kinesiology, [3]Mechanical Engineering, and [4]Orthopaedics and Rehabilitation, The Pennsylvania State University, University Park, PA; 5Stryker Orthopedics, Mahwah, NJ.

**# 147 DIRECTION-DEPENDENCE OF POLYETHYLENE WEAR FOR METAL COUNTERFACE SCRATCH TRAVERSE**

Matthew C. Paul[2,1], Liam Glennon[2,1], Thomas E. Baer[1], Thomas D. Brown[1,2]
[1]Dept. of Orthopaedics and Rehabilitation; [2]Dept. of Biomedical Engineering, Univ. of Iowa

**# 148 MODELING THE EFFECT OF HALLUX LIMITUS ON FIRST RAY PLANTAR PRESSURE DISTRIBUTIONS**

Marc Petre[1,2], Ahmet Erdemir[1], Sachin Budhabhatti[1,3] and Peter R. Cavanagh[1]
[1]Dept. of Biomedical Engineering, Cleveland Clinic Foundation, Cleveland, OH, USA; [2]Dept. of Biomedical Engineering, Case Western Reserve University, Cleveland, OH, USA [3]Dept. of Chemical & Biomedical Engineering, Cleveland State University, Cleveland, OH, USA.

**# 149 THE EFFECT OF FOOT TYPE ON PLANTAR PRESSURE**

William R. Ledoux[1,2,3], Eric S. Rohr[1], Charles Harp[1,3], Randal P. Ching[1,3], and Bruce J. Sangeorzan[1,2]
[1]RR&D Center of Excellence for Limb Loss Prevention and Prosthetic Engineering, VA Puget Sound Health Care System, Seattle, WA; Departments of [2]Orthopaedics and Sports Medicine and [3]Mechanical Engineering, University of Washington, Seattle, WA.

**# 150 EFFECT OF GENDER ON LANDING STRATEGY IN PREADOLESCENT CHILDREN**

Michelle Sabick, Ph.D., Jeanie Sutter, M.S., Ronald Pfeiffer, Ed.D. A.T.C., Kevin Shea, M.D.
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**# 153 KNEE MOMENTS WHILST CARRYING A LOAD DURING WALKING**

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**# 155 THE ROLE OF SELECT BIARTICULAR MUSCLES DURING SLOPE WALKING**

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**# 160 COMPARISON OF KNEE JOINT MOMENTS REPORTED IN DIFFERENT SEGMENTAL REFERENCE FRAMES**

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**# 161 DYNAMICS AND MULTIJOINT CONTROL DURING SINGLE LEG SQUAT WITH AND WITHOUT ACTIVATION OF ABDOMINAL OBLIQUE MUSCLES**

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**# 163 HORIZONTAL IMPULSE GENERATION CHARACTERISTICS DURING THE SPRINT START ARE INFLUENCED BY SHANK SEGMENT CONTROL**

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**# 164 MODELING THE INFLUENCE OF FLIGHT PHASE CONTROL ON CENTER OF MASS TRAJECTORY AND REACTION FORCES DURING LANDING**

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**# 165 DAILY ACTIVITY PROFILE OF TOTAL KNEE REPLACEMENT PATIENTS**

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**# 166 FACTORS PRODUCING A "SOFT" LANDING IN TERMS OF BOTH FORCE AND SOUND**

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**# 167 ANTERIOR CRUCIATE LIGAMENT INJURY AND PATELLAR LIGAMENT INSERTION ANGLE**

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**# 168 ANKLE BIOMECHANICS DURING A SPIN TURN**

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**# 169 EFFECT OF INTERNAL AND EXTERNAL KNEE ROTATION ON HOOP STRAIN IN THE MEDIAL MENISCUS**

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**# 170 EFFECT OF POSITIVE POSTERIOR HEEL FLARE ON LOWER EXTREMITY KINEMATICS DURING RUNNING GAIT**

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**# 171 EFFECTS OF AGE GROUP ON LANDING MECHANICS IN THE ADOLESCENT FEMALE BASKETBALL PLAYER**

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**# 172 OBJECTIVE QUANTIFICATION OF FOOT ARCH BY CURVATURE MAPS**

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**# 173 EFFECTIVENESS OF TWO KNEE BRACES ON MEDIAL COMPARTMENT OSTEOARTHRITIS**

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**# 174 A PARAMETRIC FINITE ELEMENT STUDY OF CONSTRAINED ACETABULAR LINERS**

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**# 175 DROP LANDING EXERCISE DOES NOT INCREASE MAXIMUM JUMP HEIGHT IN CHILDREN**

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**# 176 CLINICAL QUANTIFICATION OF FRONTAL PLANE KNEE ANGLE: CORRELATION OF 2D AND 3D MOTION ANALYSIS**

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**# 177 THE ROLE OF THE VASTUS MEDIALIS AND VASTUS LATERALIS IN MEDIAL-LATERAL KNEE JOINT STABILITY**

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**# 178 INITIAL HORIZONTAL MOMENTUM ALTERS CONTROL OF THE REACTION FORCE RELATIVE TO THE CENTER OF MASS**

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**# 179** **A DYNAMIC MODEL FOR ASSESSMENT OF MICROMOTION AND MIGRATION IN KNEE ARTHROPLASTIES**

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**# 180** **PROBLEMATIC SITES OF THIRD BODY EMBEDMENT IN POLYETHYLENE FOR WEAR ACCELERATION IN TOTAL HIP ARTHROPLASTY**

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## Upper Extremity

**# 181** **REALISTIC TESTING OF RIOT HELMET PROTECTION AGAINST PROJECTILES**

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**# 182** **VARIATION IN MUSCLE MOMENT ARMS WITH INDEX FINGER POSTURE**

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**# 183** **A MUSCULOSKELETAL MODEL OF THE UPPER EXTREMITY FOR SURGICAL SIMULATION AND NEUROCONTROL APPLICATIONS**

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**# 184** **CONTROL OF FINGER FORCE VECTOR IN THE FLEXION-EXTENSION PLANE**

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**# 185** **MEASUREMENT FORCES DURING MANIPULATION IN NON-HUMAN PRIMATES**

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**# 186** **THE EFFECT OF HAND POSITION ON GROUND REACTION FORCES WHEN FALLING FORWARD FROM KNEELING HEIGHT**

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**# 187** **WHAT EFFECT DOES THE FLEXOR CARPI RADIALIS HAVE ON SCAPHOID MOTION?**

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**# 188** **THUMB KINEMATICS WITH NON-ORTHOGONAL AND NON-INTERSECTING AXES OF ROTATION MAY BE NECESSARY TO PREDICT REALISTIC ISOMETRIC THUMBTIP FORCES IN MULTIPLE DIRECTIONS**

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**# 189** **FINGER COORDINATION DURING MOMENT PRODUCTION ON A MECHANICALLY FIXED OBJECT**

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**# 190 A CONCENTRIC AND ECCENTRIC LOADING REGIME FOR SHOULDER REHABILITATION**

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**# 191 INTERNAL AND EXTERNAL ROTATION OF THE SHOULDER: EFFECTS OF PLANE, END RANGE DETERMINATION, AND SCAPULAR MOTION**

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**# 192 CARPAL TUNNEL SYNDROME AFFECTS FINGER FORCE PRODUCTION**

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**# 193 A ROBOT-ASSISTED MEASURE OF FINGER JOINT STIFFNESS**

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**# 194 THE EFFECT OF PECTORALIS MINOR RESTING LENGTH VARIABILITY ON SCAPULAR KINEMATICS**

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**# 195 FLUOROSCOPIC ASSESSMENT OF THE EFFECTS OF ROTATOR CUFF FATIGUE ON GLENOHUMERAL KINEMATICS IN SHOULDER IMPINGEMENT SYNDROME**

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**# 196 RELIABILITY OF A KINEMATIC MODEL OF THE UPPER EXTREMITY**

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**# 197 QUANTIFICATION OF UPPER EXTREMITY MOTION DURING A TRIP-INDUCED FALL IN OLDER ADULTS**

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**# 198 WRIST POSITION INFLUENCES RANGE OF MOTION**

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**# 199 DIRECTIONAL FORCE CONTROL OF THE THUMB**

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**# 200 RELATIVE TIMING OF MUSCLE FATIGUE AND COORDINATION CHANGES DURING REPETITIVE DUMBBELL LIFTING**

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**# 201 UPPER EXTREMITY JOINT STRESSES ASSOCIATED WITH WALKER-ASSISTED AMBULATION IN POST-SURGICAL PATIENTS**

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**# 202 EFFECT OF WEARING A WRIST SPLINT ON SHOULDER POSTURE WHEN PICKING AN OBJECT FROM A BOX**

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**# 203 IS THE THUMB A FIFTH FINGER?**

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## Spine

**# 204 POSITIONAL STABILITY TESTING OF A PROSTHETIC DISC NUCLEUS DEVICE**

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**# 205 SPINAL INSTABILITY DUE TO SIMULATED FRONTAL IMPACTS**

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**# 206 BIOMECHANICAL RESPONSE OF ENTIRE LUMBAR SPINE TO LARGE COMPRESSION –A FINITE ELEMENT MODEL STUDY**

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**# 207 OCCUPATIONAL VIBRATION AND POSITION SENSE**

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**# 208 EFFECT OF LOADING RATE ON COMPRESSIVE FAILURE MECHANICS OF THE PEDIATRIC CERVICAL SPINE**

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**# 209 ANALYSIS OF THE 360 DEGREE MOTION ENVELOPE OF HUMAN LUMBOSACRAL JOINTS**

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**# 210 DIGITAL FLUOROSCOPIC VIDEO ASSESSMENT OF SAGITTAL PLANE LUMBAR SPINE FLEXION**

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**# 211 STABILIZATION OF INTERVERTEBRAL DISCS BY TISSUE ENGINEERED NUCLEUS REPLACEMENT: A BIOMECHANICAL FEASIBILITY STUDY**

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**# 212 IN VITRO BIOMECHANICS OF LUMBAR DISC ARTHROPLASTY WITH THE PRODISC TOTAL DISC IMPLANT**

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**# 213 FINITE ELEMENT ANALYSIS OF HUMAN FACET JOINT CAPSULE DURING PHYSIOLOGICAL MOTIONS FOR TWO LUMBAR MOTION SEGMENTS**

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**# 214 STRUCTURAL BEHAVIOUR OF THORACIC SPINAL UNIT; THE ROLE OF THE POSTERIOR ARTICULAR FACETS IN SPINAL DEFORMITY**

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**# 215 CERVICAL SPINE TOLERANCE TO DYNAMIC TENSILE LOADING**

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**# 216 CAN A PENDULUM BE USED TO STUDY DYNAMIC PROPERTIES OF THE SPINE?**

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**# 217 AN ERGONOMICS INTERVENTION WITH CONSTRUCTION CONCRETE LABORERS TO DECREASE LOW BACK INJURY RISK**

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**# 218 COMPARISON OF THE PASSIVE STABILIZATION PROVIDED TO THE HUMAN CERVICAL SPINE BY THREE DIFFERENT CERVICAL BRACES**

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**# 219 COMPRESSIVE STRENGTH EVALUATION OF OSTEOPOROSIS VERTEBRA BY FINITE-ELEMENT ANALYSIS BASED ON PATIENT-SPECIFIC MODELS**

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**# 220 EFFICACY AND KINEMATIC CHARACTERISTICS OF TWO NEW CERVICAL ORTHOSES**

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**# 221 A VIRTUAL MODEL OF THE HUMAN CERVICAL SPINE FOR PHYSICS-BASED SIMULATION**

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**# 222 DYNAMIC FIXATION SYSTEMS COMPARED TO THE RIGID SPINAL INSTRUMENTATION-A FINITE ELEMENT INVESTIGATION**

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**# 223 THE THREE-DIMENSIONAL LUMBAR SPINE KINEMATICS OF TRANSFEMORAL AMPUTEES WITH AND WITHOUT BACK PAIN WHILE WALKING**

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**# 224 BIOMECHANICAL EXAMINATION OF INTERVERTEBRAL DISCS SUBSEQUENT TO BURST FRACTURE**

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**# 225 TRUNK MUSCLE ACTIVATION PATTERNS IN INDIVIDUALS WITH DEGENERATIVE DISC DISEASE: A COMPARISON OF SUBJECTS WITH AND WITHOUT LOW BACK PAIN**

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**# 226 EVALUATION OF 3D RECONSTRUCTION OF THE RIB CAGE FROM BIPLANAR RADIOGRAPHY**

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**# 228 COMPUTATIONAL SIMULATION OF CORNEAL APPLANATION**

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**# 230 FACTORS AFFECTING THE ACCURACY OF 2D-DLT CALIBRATION**

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**# 233 LARGE DEFORMATION AND FLUID MODELING IN THE ANTERIOR CHAMBER IN IMPACTS TO THE HUMAN EYE**

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**# 234 RELIABILITY OF A TECHNIQUE FOR DETERMINING SAGITTAL KNEE GEOMETRY FROM LATERAL KNEE RADIOGRAPHS**

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**# 240 CAPSTONE DESIGN OF A CRANIAL VASCULAR MECHANICAL MODEL**

Ryan Mangan[2], Sean S. Kohles[1], Nedzib Biberic[2], Nick Leech[2], Trenton J. McKinney[3], Edward Stan[3], Mihaela L. Surdu[3], Cathy Biber[2], and James McNames[3]
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**# 241 CEREBRAL MECHANICS DURING TRAUMATIC BRAIN INJURY**

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## Muscle

**# 242 DYNAMIC TRUNK KINEMATIC STIFFNESS DURING FLEXION AND EXTENSION**

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**# 243 MUSCLE CONTRIBUTIONS TO FORWARD PROGRESSION DURING WALKING**

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**# 244 DENSITY AND HYDRATION OF FIXED HUMAN MUSCLE TISSUE**

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**# 246 RECTUS FEMORIS FIBER EXCURSIONS PREDICTED BY A 3D MODEL OF MUSCLE**

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**# 247 A BIOMECHANICAL METHOD TO IMPROVE INDIVIDUAL PLANNING AND CONTROLLING OF TRAINING**

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**# 248 MORPHOLOGY, ARCHITECTURE AND BIOMECHANICS OF HUMAN CERVICAL MULTIFIDUS MUSCLES**

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**# 250 MRI-BASED GEOMETRY OF NECK MUSCLES FOR BIOMECHANICAL MODELS**

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**# 251 MUSCLE-TENDON ULTRASOUND: QUANTITATIVE CONSIDERATIONS**

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**# 252 PASSIVE AND ACTIVE SARCOMERE LENGTH NON-UNIFORMITY IN SKELETAL MUSCLE**

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**# 253 A THREE-DIMENSIONAL MODEL OF VOCAL FOLD ABDUCTION/ADDUCTION**

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**# 254 MUSCLE WEAKNESS AND FORCE SHARING IN THE CAT HINDLIMB**

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**# 255 SARCOMERE NON-UNIFORMITY ASSOCIATED WITH STABILITY OF SKELETAL MUSCLE MYOFIBRILS**

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**# 256 TEMPERATURE DEPENDENCE OF CROSSBRIDGE KINETICS IN SLOW AND FAST SKELETAL MUSCLE FIBERS: CROSSBRIDGE MODELING**

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**# 257 THUMB FORCE DEFICIT AFTER LOWER MEDIAN NERVE BLOCK**

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**# 258 KNEE JOINT KINETICS AND LOWER EXTREMITY MUSCLE ACTIVATION DURING FRONT AND BACK SQUATS**

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**# 259 DEVELOPING AND TESTING OF AN EMG DRIVEN MODEL TO ESTIMATE ANKLE MOMENTS AND MUSCLE FORCES**

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**# 260 ANGULAR ACCELERATION OF THE HEAD/NECK SYSTEM INDUCED BY STERNOCLEIDOMASTOID**

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**# 261 AMPLIFICATION OF MUSCLE FIBER LENGTH CHANGES IN THE HUMAN SOLEUS MUSCLE-TENDON COMPLEX**

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**# 262 MUSCLE FUNCTION IN THE GENERATION OF PROPULSIVE AND BRAKING FORCES DURING RUNNING**

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**# 263 STRAIN DISTRIBUTION IN *IN-VIVO* HUMAN TRICEPS SURAE DURING PASSIVE AND ACTIVE DYNAMIC MOVEMENTS**

Hae-Dong Lee[1,2], Taija Finni[3], John A. Hodgson[2], V. Reggie Edgerton[2], and Shantanu Sinha[1]
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**# 264 EXPERIMENTAL VALIDATION OF A SURFACE EMG MODEL**

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**# 265 SURFACE ELECTROMYOGRAPHIC SPIKE ACTIVITY AND MOTOR UNIT FIRING RATES AT DIFFERENT LEVELS OF MAXIMUM CONTRACTION**

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**# 266 EFFECT OF POSITIVE POSTERIOR HEEL FLARE ON KINETICS AND TIBIALIS ANTERIOR MUSCLE ACTIVATION DURING RUNNING GAIT**

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**# 267 A NOVEL METHOD FOR THE ASSESSMENT OF MEASURED ISOMETRIC FORCE-TIME FUNCTIONS**

Sigrid Thaller and Markus Tilp
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**# 268 EFFECTIVENESS OF A COLLAGEN HYDROLYSATE-BASED NUTRITIONAL SUPPLEMENT ON THE LEVEL OF JOINT PAIN, RANGE OF MOTION AND MUSCLE FUNCTION IN INDIVIDUALS WITH MILD OSTEOARTHRITIS OF THE KNEE: A RANDOMIZED CLINICAL TRIAL**

Carpenter MR, McCarthy S, Kline G, Angelopoulos TJ, Rippe JM.
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**# 269 RELATIONSHIP OF MUSCLE FIBER PENNATION ANGLE TO EMG AND JOINT MOMENT DURING GRADED ISOMETRIC CONTRACTIONS USING ULTRASOUND IMAGING**

Dustyn P. Roberts and Thomas S. Buchanan
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**# 270 MUSCLE ACTIVATION PATTERNS IN MALES AND FEMALES DURING DROP LANDINGS ONTO THE HEELS**

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**# 271** **ON THE ANATOMY OF THE EXTENSOR MECHANISM AND WHY COCONTRACTION IS NECESSARY FOR VERSATILE STATIC FINGERTIP FORCES**

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## Posture & Balance

**# 272** **AUDIO BIOFEEDBACK OF TRUNK ACCELERATIONS IMPROVES BALANCE IN SUBJECTS WITH BILATERAL VESTIBULAR LOSS**

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**# 273** **EFFECTS OF PREPARATION ON POSTURAL STABILITY WHILE ACCEPTING A WEIGHT IN THE OUTSTRETCHED HANDS**

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**# 274** **THE EFFECTS OF SOLDIER LOADS ON FOOT PLACEMENT DURING QUIET STANCE**

Jeffrey M. Schiffman, Leif Hasselquist, Karen P. Norton, Carolyn K. Bensel
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**# 275** **DETECTING A LOSS OF BALANCE IN YOUNG ADULTS PERFORMING A MAXIMAL FORWARD REACH**

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**# 276** **PREDICTION OF MUSCLE ACTIVATION PATTERNS FOR POSTURAL CONTROL USING A LINEAR FEEDBACK MODEL**

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**# 277** **HOW DOES ABILITY TO RECOVER BALANCE DEPEND ON THE TIME REQUIRED TO EXECUTE A STEP?**

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**# 278** **NONLINEAR ANALYSIS OF POSTURAL CONTROL IN DIFFERENT POSITIONS**

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**# 279** **EFFECTS OF SUPPORT SURFACE ML COMPLIANCE ON STEPPING BEHAVIOR OF HEALTHY ADULTS: AGE AND GENDER DIFFERENCES**

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**# 280** **THE EFFECT OF HIGH INTENSITY STRENGTH TRAINING ON ANKLE INVERSE DYNAMICS IN BALANCE IMPAIRED OLDER ADULTS**

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**# 281** **TAI CHI AND STANCE WIDTH EFFECTS ON POSTURAL SWAY AND KNEE FLEXION**

Arun K. Ramachandran[1], Yang Yang[2], Karl S. Rosengren[2], and Elizabeth T. Hsiao-Wecksler[1]
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**# 282** **MINIMAL FORWARD STEP LENGTH NEEDED FOR BALANCE RECOVERY OF HUMAN BODY AFTER PERTURBATIONS**

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## Rehabilitation Engineering

**# 283 EMG ACTIVITY OF TRUNK MUSCLES DURING WHEELCHAIR PROPULSION**

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**# 284 VARIABLE STIFFNESS PROSTHESIS FOR TRANSTIBIAL AMPUTEES**

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**# 285 TRUNK MOVEMENT PATTERNS AND PROPULSION EFFICIENCY IN WHEELCHAIR USERS WITH AND WITHOUT SCI**

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**# 286 PARAMETERS AFFECTING AXIAL STIFFNESS OF TIBIAL FIXATION IN AN ILIZAROV ANKLE DISTRACTOR**

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**# 287 BIOMECHANICAL ANALYSIS OF A WHEELCHAIR WHEELIE IN PERSONS WITH SCI**

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**# 288 DRAG FORCE NORMALIZED WHEELCHAIR PROPULSION FORCES**

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## Gait and Movement

**# 289 GAIT DEVIATIONS IN A VIRTUAL REALITY ENVIRONMENT**

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**# 290 PREDICTED HIP JOINT REACTION FORCES DURING PRONE HIP EXTENSION WITH VARYING CONTRIBUTION FROM THE GLUTEAL MUSCLES**

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**# 291 TRADE-OFFS IN THE DETERMINATION OF OPTIMUM STEP LENGTH IN HUMAN WALKING**

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**# 292 AN ARTIFICIAL NEURAL NETWORK THAT UTILIZES A CHAOTIC CONTROL SCHEME FOR STABLE LOCOMOTION**

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**# 293 ASSESSMENT OF BACKPACK INTERFACE LOADING USING A WHOLE BODY GAIT MODEL**

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**# 294 FULL BODY INVERSE DYNAMICS SOLUTIONS: AN ERROR ANALYSIS AND A HYBRID APPROACH**

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**# 295 EFFECTS OF GAIT VELOCITY ON COP SYMMETRY MEASURES IN INDIVIDUALS WITH STROKE**

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**# 296 THE EFFECTS OF MUSCLE TRAINING ON GAIT CHARACTERISTICS IN CHILDREN WITH DOWN SYNDROME**

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**# 297 THE ROLE OF HEAD STABILIZATION IN NECK AND TRUNK MOVEMENT DURING FOUR DIFFERENT LOCOMOTION TASKS**

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**# 298 TIBIOFEMORAL LOAD DISTRIBUTION DURING GAIT OF NORMAL SUBJECTS**

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**# 299 NEUROMUSCULAR RESPONSE TO UNEXPECTED GAIT PERTURBATIONS IN ANTERIOR CRUCIATE LIGAMENT INJURED NON-COPERS**

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**# 300 ACCELERATION DURING WALKING: THE EFFECT OF ANKLE KINETICS ON CENTER OF MASS POSITION AND VELOCITY**

Michael S. Orendurff, Ava D. Segal, Jocelyn S. Berge, Kevin C. Flick and Glenn K. Klute
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**# 301 EFFECT OF EXTERNALLY-CUED STRIDE FREQUENCY SELECTION ON TEMPERO-SPATIAL PARAMETERS OF GAIT**

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**# 302 EFFECTS OF CHANGING PROTOCOL, GRADE, AND DIRECTION ON THE PREFERRED GAIT TRANSITION SPEED DURING HUMAN LOCOMOTION**

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**# 303 JOINT LOADING AND BONE MINERAL DENSITY IN PERSONS WITH UNILATERAL, TRANS-TIBIAL AMPUTATION**

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**# 304 EVALUATING SYMMETRY OF THE SWING LEG DURING RUNNING WITH VELOCITY-VELOCITY PROFILES**

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**# 305 EMOTION RECOGNITION FROM BODY MOVEMENT KINEMATICS**

M. Melissa Gross[1], Geoffrey E. Gerstner[2], Daniel E. Koditschek[3], Barbara L. Fredrickson[4] and Elizabeth A. Crane[1]
[1]Department of Movement Science; [2]Department of Biologic and Materials Science; [3]Department of Electrical Engineering and Computer Science, and [4]Department of Psychology University of Michigan, Ann Arbor, MI, USA.

**# 306 STIFFNESS DURING WALKING: A COMPARISON BETWEEN CHILDREN WITH AND WITHOUT SPASTICITY**

Robin D. Dorociak[1], Molly P. Nichols[1], Susan Sienko Thomas[2], and Cathleen E. Buckon[2]
[1]Motion Analysis Laboratory and [2]Clinical Research, Shriners Hospitals for Children Portland, Portland, OR, USA.

**# 307 FOOT ORTHOSES ALTER MUSCLE ACTIVITY PATTERNS IN RUNNERS DIAGNOSED WITH PATELLOFEMORAL PAIN SYNDROME**

Yukiko Toyoda[1], Benno Nigg[1], Preston Wiley[2] and Neil Humble[3]
[1]Human Performance Lab, Faculty of Kinesiology, University of Calgary, Calgary, Canada; [2]Sport Medicine Center, Faculty of Kinesiology, University of Calgary, Calgary, Canada; [3]Department Surgery, University of Calgary, Canada.

**# 308 EXTERNAL LOAD AFFECTS GROUND REACTION FORCE PARAMETERS NONUNIFORMLY DURING RUNNING IN WEIGHTLESSNESS**

John K. DeWitt[1], Grant Schaffner[2], Mitzi S. Laughlin[2], James A. Loehr[2] and R. Donald Hagan[3]
[1]Bergaila Engineering Services, Houston, TX, USA; [2]Wyle Life Sciences, Houston, TX, USA; [3]NASA Johnson Space Center, Houston, TX, USA.

**# 309 DIRECTLY COMPARING STANDING AND WALKING STABILITIES**

Hyun Gu Kang[1] and Jonathan B. Dingwell[1,2]
[1]Nonlinear Biodynamics Lab, Dept. of Kinesiology, University of Texas, Austin, TX, USA; [2]Dept. of Biomedical Engineering, University of Texas, Austin, TX, USA.

**# 310 ARM CONSTRAINT AND INTER-LIMB COORDINATION DURING WALKING IN HEALTHY ADULTS**

Matthew P. Ford PT, PhD[1], Robert C. Wagenaar PhD[2], Karl M. Newell, PhD[3]
[1]Department of Physical Therapy, The University of Alabama at Birmingham, Birmingham, AL; [2]Department of Rehabilitation Sciences, Boston University, Boston, MA; [3]Department of Kinesiology, The Pennsylvania State University, University Park, PA.

**# 311 VALIDATION OF A THREE-DIMENSIONAL WHOLE BODY MULTISEGMENT MODEL FOR LOAD CARRIAGE STUDIES**

Lei Ren[1,2], Richard Jones[2], David Howard[1,2] and Jim Richards[2]
[1]School of Computing, Science & Engineering; [2]Centre for Rehabilitation and Human Performance Research Salford University, UK.

**# 312 THE USE OF CENTER OF MASS ANALYSIS FOR GAIT ASSESSMENT IN CHILDREN WITH CEREBRAL PALSY**

Bradford C. Bennett, Adam Wolovick, Tim Franklin, Paul E. Allaire, & Mark F. Abel
Motion Analysis and Motor Performance Laboratory, University of Virginia.

**# 313 INITIAL CONDITION VARIABLES AND AGE GROUP AS DETERMINANTS OF SLIP SEVERITY**

Brian E. Moyer[1], April J. Chambers, Mark S. Redfern, and Rakié Cham
Human Movement and Balance Laboratory, Bioengineering Department, University of Pittsburgh, Pittsburgh, PA, USA.

**# 314 INSTRUMENTATION SYSTEM FOR BIOMECHANICAL ANALYSIS OF FACTORS AFFECTING BACKPACK USER COMFORT**

Jennifer L. Springer, B.S. and David A. Hawkins, Ph.D.
Human Performance Laboratory, Biomedical Engineering Graduate Group, University of California, Davis, CA.

**# 315 THE PRESENCE OF AN OBSTACLE INFLUENCES THE STEPPING RESPONSE DURING SIMULATED AND REAL TRIPS**

Karen L. Troy[1] and Mark D. Grabiner[1]
[1]Musculoskeletal Biomechanics Laboratory, University of Illinois at Chicago, Chicago, IL, USA

**# 316 STEPPING UP TO A NEW LEVEL. EFFECTS OF BLURRING VISION IN THE ELDERLY**

[1]Karen Heasley, [1]John G Buckley, [2]Andy Scally, [3]Pete Twigg, and [1]David B. Elliott
[1]Vision and Mobility Research Laboratory, Department of Optometry; [2]Institute of Health Research, School of Health, and [3]School of Engineering, Design and Technology, University of Bradford.

**# 317 EFFECT OF INITIAL VELOCITY ON THE THRESHOLD OF BALANCE RECOVERY PRELIMINARY RESULTS**

Kodjo E. Moglo, Marc-André Cyr and Cécile Smeesters
Research Centre on Aging, Sherbrooke Geriatric University Institute, Sherbrooke, QC, Canada;
Department of Mechanical Engineering, Université de Sherbrooke, Sherbrooke, QC, Canada

**# 318 INFLUENCE OF PASSIVE ELASTIC JOINT MOMENTS ON THE METABOLIC ENERGY CONSUMPTION OF MUSCLES DURING GAIT**

Darryl G. Thelen
Dept. of Mechanical Engineering, University of Wisconsin-Madison, Madison, WI, USA

**# 319 A BIOMECHANICAL MODEL FOR TISSUE INJURY IN PELVIC ORGAN PROLAPSE**

Amanda Clark[1], Qi Liu[2], and Marie Shea[2]
[1]Division of Urogynecology and Reconstructive Pelvic Surgery; [2]Orthopaedic Biomechanics Laboratory, Oregon Health & Science University, Portland, OR, USA.

**# 320 AGE INDUCED MECHANICAL PLASTICITY IN LOCOMOTION**

Paul DeVita, Joe Helseth, Brandon Noyes, Michelle Pullen, Doug Powell & Tibor Hortobagyi
Biomechanics Laboratory, Dept. of Exercise and Sport Science, East Carolina University,Greenville, NC, USA

**# 321 AGE-RELATED DIFFERENCES IN PEAK JOINT VELOCITIES DURING SINGLE STEP RECOVERY FROM A FORWARD FALL**

Michael L. Madigan and Emily M. Lloyd
Musculoskeletal Biomechanics Laboratory, Virginia Tech, Blacksburg, VA, USA

**# 322 THE RELATIONS BETWEEN MUSCLE STRENGTH AND MOVEMENT OF CENTER OF MASS OF THE BODY DURING OBSTACLE NEGOTIATION IN THE COMMUNITY-DWELLING OLDER ADULTS**

Hsiu-Chen Lin[1], Shu-Ya Chen[1], Hong-Wen Wu[1], Ching-Sheng Li[1], Hui-Fen Pan[1], Horng-Chaung Hsu[2]
[1]School of Physical Therapy, China Medical University, Taichung, Taiwan; [2]Department of Orthopedics, China Medical University Hospital, Taichung, Taiwan.

**# 323 THE ALTERATIONS TRAJECTORY OF CENTER OF MASS WHEN NEGOTIATING OBSTACLES WITH DIFFERENT HEIGHTS IN THE OLDER ADULTS**

Shu-Ya Chen[1], Hsiu-Chen Lin[1], Hong-WenWu[1], Hui-Fen Pan[1], Ching-Sheng Li[1], Horng-Chaung Hsu[2]
[1]School of Physical Therapy, China Medical University, Taichung, Taiwan; [2]Department of Orthopedics, China Medical University Hospital, Taichung, Taiwan.

**# 324 SAGITTAL AND FRONTAL SWAY ANGLES DURING LOCOMOTION IN THE ELDERLY**

Heng-Ju Lee and Li-Shan Chou
Motion Analysis Laboratory, Department of Exercise and Movement Science, University of Oregon, Eugene, Oregon, U.S.A.

**# 325 QUIET STANDING AND STABILITY LIMITS: EFFECT OF WORK EXPERIENCE AND AGE**

Steven R. Torgerud[1], Shirley Rietdyk[1], James D. McGlothlin[2] and Mark J. Knezovich[2]
[1]Biomechanics Laboratory, [2]School of Health Sciences, Purdue University, IN, USA.

## Cardiovascular

**# 326 EFFECT OF CONSTRICTION SHAPE ON FLOWS IN STENOSED CHANNELS**

Xiaohong Yu and Allen T. Chwang
Department of Mechanical Engineering, The University of Hong Kong, HK.

**# 327 THE EFFECT OF ANTI-HYPERTENSIVE DRUGS ON CAROTID HAEMODYNAMICS**

Fadi P. Glor[1,2], Ben Ariff[3], Alun D. Hughes[3], Lindsey A. Crowe[4], Pascal R. Verdonck[1], Simon A.McG. Thom[3], David N. Firmin[4], X. Yun Xu[2]
[1]Cardiovascular Mechanics and Biofluid Dynamics Research Unit, Ghent University, Belgium; [2]Department of Chemical Engineering & Chemical Technology, Imperial College London, UK; [3]Clinical Pharmacology and Therapeutics, St. Mary's Hospital, Imperial College London, UK; [4]Cardiovascular Magnetic Resonance Unit, R. Brompton and Harefield NHS Trust, London, UK.

**# 328 IMAGE-BASED COMPUTATIONAL FLUID DYNAMICS FOR CAROTID ARTERIES: A COMPARISON BETWEEN IMAGING TECHNIQUES**

Fadi P. Glor[1,2], Ben Ariff [3], Alun D. Hughes[3], Lindsey A. Crowe[4], Pascal R. Verdonck[1], Dean C. Barratt[5], Simon A.McG. Thom[3], David N. Firmin[4], X. Yun Xu[2]
[1]Cardiovascular Mechanics and Biofluid Dynamics Research Unit, Ghent University, Belgium; [2]Department of Chemical Engineering & Chemical Technology, Imperial College London, UK; [3]Clinical Pharmacology and Therapeutics, St. Mary's Hospital, Imperial College London, UK; [4]Cardiovascular Magnetic Resonance Unit, R. Brompton and Harefield NHS Trust, London, UK; [5]Computational Imaging Sciences Group, Imaging Sciences, Guy's Hospital, London, UK.

**# 329 CONSTITUTIVE MODELING OF VASCULAR CONSTRUCTS: A MODIFIED BURST PRESSURE METHOD**

Kathryn A. Lagerquist[1,2] , Samuel Jensen-Segal[1], Sean J. Kirkpatrick[2], Monica T. Hinds[2], and Kenton W. Gregory[1]
[1]Oregon Medical Laser Center, Portland, OR, USA; [2]Dept. of Biomedical Engineering, Oregon Health & Science University, Portland, OR, USA.

**# 330 LONGITUDINAL TENSILE PROPERTIES OF ELASTIN, CURED ELASTIN, AND NATIVE CAROTID ARTERY**

Ping-Cheng Wu, Ann Bazar, and Kenton W. Gregory
Oregon Medical Laser Center, Providence St. Vincent Medical Center, Portland, OR.

## Sport Science

**# 331 ANGULAR MOMENTUM TRANSFER DURING A POWER TENNIS SERVE**

Brian J. Gordon and Jesús Dapena
Biomechanics Laboratory, Dept. of Kinesiology, Indiana University, Bloomington, IN, USA.

**# 332 BICYCLE SEAT INTERFACE PRESSURE: RELIABILITY, VALIDITY, AND INFLUENCE OF HAND POSITION AND WORKLOAD**

Eadric Bressel[1], John Cronin[2], and Alicia Exeter[1]
[1]Biomechanics Laboratory, Utah State University, Logan UT, USA; [2]Sport Performance Centre, Auckland University of Technology, Auckland, New Zealand.

**# 333 THE USE OF A WIRELESS NETWORK TO PROVIDE REAL-TIME AUGMENTED FEEDBACK FOR ON-WATER ROWING**

DJ Collins[1,2], Dr Ross Anderson[1] & Dr Derek T. O'Keeffe
[1] Department of PE and Sport Science, University of Limerick, Limerick, Ireland; [2] Biomedical Electronics Laboratory, Department of Electronic and Computer Engineering, University of Limerick, Ireland.

**# 334 FOOT AND ANKLE PRESSURE MEASUREMENT DURING FORWARD SKATING**

David J. Pearsall, Curt Dewan, René Turcotte, and David L. Montgomery
Department of Kinesiology and Physical Education, Montréal, Québec, Canada

**# 335 3D COMPUTER SIMULATION OF ROUNDHOUSE KICK IN TAEKWONDO**

Young-Kwan Kim[1], Gary T. Yamaguchi[2], and Richard N. Hinrichs[1]
[1]Department of Kinesiology, Arizona State University, Tempe, AZ, USA; [2]Exponent®, Inc., Phoenix, AZ, USA

**# 336 LOWER TRUNK KINEMATICS AND MUSCLE ACTIVITY DURING DIFFERENT TYPES OF TENNIS SERVES**

John W. Chow, Soo-An Park, Mark D. Tillman and Guy B. Grover
Center for Exercise Science, University of Florida, Gainesville, FL, USA.

**# 337 INFLUENCE OF TORSO ROTATION AND ARM COCKING STYLES ON ELBOW VARUS TORQUE IN BASEBALL PITCHING**

Jeff T. Wight[1], Guy B. Grover[1], John W. Chow[1], James G. Richards[2], and Mark D. Tillman[1]
[1]Center for Exercise Science, University of Florida, Gainesville, FL, USA; [2]Dept. of Health, Nutrition, and Exercise Sciences, U. of Delaware, Newark, DE, USA.

**# 338 RELATIONSHIPS BETWEEN EMG FREQUENCY SPECTRUM AND RATE OF FORCE DEVELOPMENT CHANGES**

Loren Z.F. Chiu[1], Andrew C. Fry[2], Brian K. Schilling[2], and Lawrence W. Weiss[2]
[1]Musculoskeletal Biomechanics Research Laboratory, Biokinesiology & Physical Therapy, University of Southern California, Los Angeles, CA, USA; [2]Musculoskeletal Dynamics Laboratory, Human Movement Sciences & Education, The University of Memphis, Memphis, TN, USA.

**# 339 THE EFFECTS OF ALTERED CYCLING POSTURE AND CADENCE ON SUBSEQUENT RUNNING MECHANICS**

Rachel D. Durham and Julianne Abendroth-Smith, Ed.D.
Willamette University, Salem OR.

**# 340 AMPLITUDES OF MUSCLE ACTIVITY DURING EARLY PRACTICE TRIALS COMPARED WITH THOSE OF A WELL-LEARNED SKILL**

Gary D. Heise and Cory Christiansen
School of Sport and Exercise Science, University of Northern Colorado, Greeley, CO, USA.

**# 341 GASTROC-SOLEUS MUSCLE ACTIVATION AND ITS ASSOCIATION TO ANKLE AND KNEE MOMENTS DURING EXPECTED AND UNEXPECTED SIDE STEP CUT TASKS**

Jeff R. Houck [1], Sara Bigham [1], Patty Cruz [1], Megan Vanderhoof [1], Luke McCann [1], Cheri Ward [1],Kenneth De Haven [2], Andrew Duncan [2]
[1]Ithaca College- Rochester, 300 East River Road, Rochester, NY, [2]University of Rochester Medical Center, Rochester, NY

**# 342 A COMPARISON OF VERTICAL GROUND REACTION FORCES BETWEEN ONE AND TWO-LEG DROP LANDINGS**

Steven T. McCaw, Saori Hanaki, Meredith A. Olson, and Joshua J. Kauten
School of Kinesiology and Recreation, Illinois State University, Normal, IL, USA

Poster Session I: Thursday, 3:30 pm - 5:00 pm:

Poster Session II: Friday, 3:30 pm - 4:30 pm:

# Explore Portland

## Check out the Portland favorites of the Legacy Biomechanics Lab Team:

Biomechanics Laboratory

**Michael's Favorite:**

Fernando's Hideaway offers authentic cuisine of Spain at its best, with 'tapas' and a great wine selection. After a dinner in the quite and elegant restaurant, venture upstairs to Portland's hottest Salsa Club or join a free Salsa lesson at 9 pm. You will not regret it!
(503) 248 4709; 824 SW 1st Ave.; take MAX westbound red or blue to to exit 'Morrison/SW 3rd Ave' .

**Tanja's Favorite:**
The Hawthorne district between 32nd and 39th of Hawthorne street is a fun place to explore. You will find plenty of charming coffee shops and interesting stores. Nice restaurants and bars will come into your sight as you walk along. The "Cold Stone" will make your ice cream dreams come true. A short cab ride will get you there.
Alternatively, you can explore the more upscale Pearl District, with its ever growing variety of restaurants and shops. Combine it with a visit to Powells, the worlds largest independent book store!
Take westbound red- or blue line MAX (free) to Galleria, then switch to northbound Streetcar (free) to 10th & Couch.

**Larry's Favorite:**

Bike Portland! Rent a bike and head out to the largest urban park in the U.S. for a few hours of mountain biking. The Fat Tire Farm in NW Portland will set you up with a bike for $20/2hr or $40/day (Cruisers for $25/day). When you're tired of single track, ride into downtown Portland and explore it on your bike!
(503) 223 2182; 2714 NW Thurman; *www.fattirefarm.com/trails/trail_forestpark.html*
Grab a bite to eat afterwards at Portland's best Thai Restaurant: Beau Thai - 730 NW 21st Ave.

**Mark's Family Favorite:**
It doesn't matter how old of a kid you are or have at the Oregon Museum of Science and Industry (OMSI) every age will be able to discover new things related to science and technology in a most enjoyable way. A museum for the kid in each of us!
(503) 797-OMSI (6674); 1945 SE Water Avenue; MAX downtown, then bus Route 83 to OMSI

**Marcus' Favorite:**

Want to get a taste of fine northwestern microbrews? Bridgeport Brew Pub is Oregon's oldest craft brewery, serving award winning beers in a century old brick stone building. Tip: Try their cask-conditioned IPA!
1313 NW Marshall St.; Take westbound red- or blue line MAX (free) to Galleria, then switch to northbound Streetcar ($1.30) to 14th & Northrup. Walk one block south.

**Matt's Favorite:**
Head up through trendy Hawthorne blvd to the landmark McMenamins Bagdad theater and pub for dinner and a movie. Beer, Pizza, and $3.00 2nd-run movies are a great bargain for a night on the town. Plus, it's located in the heart of Hawthorne District, an oasis of alternative restaurants, bars, and eclectic stores.
(503) 225-5555; 3702 SE Hawthorne Blvd at the corner of 37th Ave. A short cab-ride from hotel.

**Savas' Favorite:**

The Portland City Grill. Enjoy spectacular views from the 36th floor at one of Portland's most popular restaurant, offering USDA Prime steaks, fresh Hawaiian, Pacific Coast and Alaskan seafood prepared with classic, Northwest, island, and Asian influences. While the restaurant is rather spendy, its bar attracts crowds with plenty of affordable appetizers, live piano, and stunning view on downtown and the cascade mountains.
(503) 450 0030; 111 SW Fifth Avenue; a short cab-ride from the hotel.

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| TIME | Wednesday, 9/8/04 | Thursday, 9/9/04 | Friday, 9/10/04 | Saturday, 9/11/04 |
|---|---|---|---|---|
| 7:45 | | **Welcome Remarks**<br>Michael Bottlang (meeting chair)<br>Steve Robinovitch (program chair) | **Welcome Remarks**<br>Steve Madey (meeting co-chair)<br>Tony Melaragno, MD (Legacy Chief of Research) | **Welcome Remarks**<br>Marie Shea (OHSU Biomechanics)<br>Stephen Hanson (OGI Dean of BME) |
| 8:00 | | **Keynote**<br>Steven Vogel, Ph.D.<br>*Comparative Biomechanics: Life's Physical World* | **Keynote**<br>Wilson C (Toby) Hayes, Ph.D.<br>*Lessons on Forensic Injury Biomechanics* | **Keynote**<br>Farshid Guliak, Ph.D.: *Biomechanics & Arthritis: From Organism to Organell* |
| 9:00 | | **Break** NIKE | **Break** Stryker | **Break** OGI |
| 9:20 | | **A Parallel Session B**<br>Symposium I: *Joint Neuromechanics*<br>Gait and Movement I: *Basic Science* | **A Parallel Session B**<br>Symposium II: *Cell & Tissue Biomechanics*<br>Gait and Movement II: *Clinical & Methods* | **A Parallel Session B**<br>Biomechanical Modeling<br>Muscle & Reflex |
| 10:50 | | **Break** NIKE | **Break** Stryker | **Break** OGI |
| 11:00 | *Registration opens* | **A Parallel Session B**<br>Sport Biomechanics<br>Orthopaedics I: *Basic Science* | **A Parallel Session B**<br>Balance & Fall<br>Orthopaedics II: *Clinical* | **Award Session III**<br>*BORELLI Lecture & Award Announcements*<br>Closing Remarks: Michael Bottlang |
| 12:30 | **Laboratory Tours:**<br>NIKE, Legacy<br>*Tour buses leave every 1/2 h from 12:30 - 3:30. Tours leaving after 2:00 will no return in time for workshops.*<br>ASB: Executive Meeting I (Halsey) | **Lunch**<br>Lab Tours: Legacy, NSI<br>Student Luncheon: Mt St. Helens | **Lunch**<br>Lab Tours: Legacy, NSI | ASB: Executive Meeting II (Halsey) |
| 2:00 | | **Award Session I**<br>Young Scientist Awards<br>Jim Hay Award Inauguration | **Keynote**<br>Andrew Schwartz, Ph.D.:<br>*Usful signal s from motor cortex* | |
| 3:30 | | **Poster Session I**<br>Willamette Ballroom *(refreshments served)*<br>Pacific NW Ballroom | **Poster Session II**<br>Willamette Ballroom *(refreshments served)*<br>Pacific NW Ballroom | |
| 4:00 | **A Parallel Workshops B**<br>Richard Lieber, Ph.D.: *Molecular Biology in Biomechanics*<br>Walter Herzog, Ph.D.: *Muscle Mechanics* | | | ENJOY OREGON! |
| 5:00 | | **ASB General Meeting** | **Award Session II** (4:30 - 6:00)<br>Clinical Biomech., ASB Microstrain, J. Biomech. Awards | |
| 6:30 | ***Welcome Reception*** SYNTHES | | **Banquet** LEGACY, OHSU<br>*Classical Chinese Garden* | |

| POSTER Category | Poster # | Area |
|---|---|---|
| Bone | 100-111 | A |
| Cartilage/Tendon/Ligament | 112-137 | A |
| Lower Extremity | 138-180 | A |
| Upper Extremity | 181-203 | A |
| Spine | 204-226 | A |
| Methods | 227-241 | B |
| Muscle | 242-271 | B |
| Posture and Balance | 272-282 | B |
| Rehabilitation Engineering | 283-288 | B |
| Gait and Movement | 289-314 | B |
| Aging | 315-325 | B |
| Cardiovascular | 326-330 | B |
| Sport Science | 331-341 | B |