



International Society of Biomechanics Newsletter

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AFFILIATE SOCIETIES OF ISB:

American Society of Biomechanics; Australian and New Zealand Society of Biomechanics; British Association of Sport and Exercise Sciences; Bulgarian Society of Biomechanics; Canadian Society of Biomechanics/Société canadienne de biomécanique; Chinese Society of Sports Biomechanics; Comisia de Biomecanica Inginerie si Informatica (Romania); Czech Society of Biomechanics; Taiwanese Society of Biomechanics; Japanese Society of Biomechanics; Korean Society of Sport Biomechanics; Polish Society of Biomechanics; Russian Society of Biomechanics; Société de biomécanique (France).

Note from the President

The new year brings with it many things—a time to start over, a time to improve, and a time to think about the future.

In past president's notes, I've spoken of the importance of the future of the field of biomechanics and how the students of today will be the professionals of tomorrow. ISB continues to strive in assisting students in a number of ways. We give awards and have tutorials. But now we're going one step further and, in essence, are also making history.

As you may know, ISB elections are coming up. For the first time, the student membership will be electing a student representative to the ISB Council. By doing this, we will be giving students a stronger voice in the organization. And making them an even more integral part of the ISB will benefit everyone.

I encourage all of you to vote. By voting, you are helping us to sustain a strong ISB leadership. Regarding the elections, note Past-President Sandra Olney's notice in this newsletter and update on the recruitment of students to run for the office of student representative in the council.

Also with the approach of the new year, it's a good time to reflect on our continuing growth as an international society. Unfortunately, I discovered disturbing news from some recent communications. Some people, it seems, think that the ISB is interested in a hierarchical relationship with other organizations. Let me assure you all that this is not ISB's agenda. Those affiliated with ISB have formalized communication so that they can better work together with ISB in supporting biomechanics worldwide. ISB seeks collaborative relationships in terms of building the biomechanics community. This, along with recent e-mail conversations with other societies and input from our own member survey made me realize how important it is to clearly communicate ISB's purpose.

In 1973, ISB was founded at Penn State University in the United States for the purpose of promoting the study of all areas of biomechanics at the international level, with special emphasis given to the biomechanics of Human Movement.

ISB encourages international contacts among scientists, promotes the dissemination of knowledge, and forms liaisons with other organizations to foster biomechanics research worldwide.

Who are our members? Scientists from a variety of disciplines including anatomy, physiology, engineering (mechanical, industrial aerospace, etc.), orthopedics, rehabilitation medicine, sport science and medicine, ergonomics, electrophysiological kinesiology, and others.

Over the last 31 years, ISB has grown to include over 1,000 members. ISB also provides for affiliate membership of other biomechanics organizations. Two additional societies are requesting affiliation (see Jill McNitt-Gray's description in this newsletter).

In addition, the ISB supports technical and working groups for the purpose of advancing knowledge in specialized areas within the field of biomechanics. Current technical groups include Computer Simulation, Shoulder Biomechanics, Footwear Biomechanics, and 3-D Motion Analysis. (Technical group satellite conferences and symposiums for 2005 are highlighted in this newsletter.)

Members of ISB enjoy a number of perks including the quarterly newsletter which contains a Calendar of Scientific Events, Awards information, and special feature articles. Members also get reduced journal subscription rates and discounts on registration fees at ISB Congresses and those of affiliate societies.

In terms of activities, ISB has the organization of biennial international congresses, a provision of congress proceedings, the distribution of a quarterly ISB newsletter, the sponsorship of scientific meetings related to biomechanics as well as affiliation with the Journal of Biomechanics, the Journal of Applied Biomechanics, Clinical Biomechanics, and the Journal of Electromyography and Kinesiology.

(We discovered, by way of the survey we conducted this past summer, that members would like more journal offerings and electronic access. As a result, we are in discussions with Elsevier regarding adding reduced price sub-

scriptions to *Gait & Posture* and the *Journal of Orthopedic Research*. Electronic access is already available for members who subscribe to the *Journal of Biomechanics*. Later this year, that will be an option for subscribers to *Clinical Biomechanics*.)

ISB's major activity, though, is its biennial International Congress on Biomechanics—both its organization and the event itself. Congresses provide the opportunity for participants to gain more knowledge about the current status of the field and to make valuable professional and personal contacts.

To promote international development of the field, congresses are held in different countries each time. The 2005 congress will be held in Cleveland, Ohio, USA and promises, as usual, to be excellent.

Speaking of the 2005 Congress, the organizers have included the top seven features identified by this summer's member survey that would encourage people to attend: a top notch scientific program, multiple opportunities to present research, reasonable cost, an accessible location, an August date, numerous networking opportunities, and excellent Keynote speakers. Be sure to read what else the conference organizers have to say about ISB Congress 2005 in this newsletter.

The ISB also supports other scientific meetings related to biomechanics by serving as the event's sponsor. In this capacity, the ISB helps with the dissemination of information and promotion, encourages members to participate, and, upon request, will assist with the planning and organization of the event.

Additionally, the ISB supports the internet electronic discussion forum BIOMCH-L and lecture tours for economically developing countries. See Jill McNitt-Gray's note about initiatives for economically developing countries in this newsletter.

And ISB knows how to give kudos. At its congresses, the Society presents a number of awards for excellence including the Muybridge Award (the Society's highest honor for outstanding contributions to biomechanics), the

Wartenweiler Memorial Lectureship (named after ISB's first president), and the Young Investigator and the Clinical Biomechanics Awards for the best papers presented competitively.

As for scholarship, the ISB promotes it through the educational programs held at the congresses, its student Travel Grants (which enables a biomechanics student to travel to another continent to further a research project), and a range of student Grants-in-Aid for Dissertation Research and for ISB Congress attendance. (Please note that the deadline for student grants is coming up in January. Details are in this newsletter and on the Web site.)

Now that you know everything you ever wanted to know about ISB, but were afraid to ask—I leave you with one more bit of information. John Challis, ISB's archivist, has a great article about what the ISB archives include and what types of things he would like members to submit.

I wish you all the best in the coming year.

Until next time... *Mary Rodgers*



Update on the nomination for President-Elect and Council members - 2005

I am pleased to announce that the 2005 candidates for President-Elect of ISB are Dr. Walter Herzog and Dr. Julie Steele. Watch for their profiles to appear on the ISB website in a few weeks time. Nominations have been received and a slate is being prepared for the selection of members of the Executive Council. Of note is that also four students have been nominated and will be included in the slate. All will be posted on the ISB website so check for their appearance. Elections will be conducted electronically this year, which makes it particularly important that we can reach you by e-mail.

Please read the notice about this that appears later in the Newsletter. If you do not have internet access, please let me know by sending me your full mailing address.

Sandra J. Olney, ISB Past President

*e-mail: olneys@post.queensu.ca
School of Rehabilitation Therapy
Queen's University
Kingston, ON Canada K7L 3N6*

Affiliated Societies

The ISB society is interested in working with biomechanics societies worldwide to promote and stimulate international collaboration between national and international biomechanics societies. Societies that are affiliated with ISB have formalized communication with ISB so that we can better work together to support biomechanics worldwide. Biomechanics societies currently affiliated with the ISB include Romania, Poland, China, Czech, Slovak, Bulgaria, USA, Canada, Japan, Britain, France, Korea, Australia and New Zealand. Affiliation Applications have been received from the International Society of Biome-

chanics in Sports and the Brazilian Society of Biomechanics. The Executive Council will vote to recommend their application for consideration by the General Assembly at the ISB 2005 meeting in Cleveland.

ISB would like to expand their affiliation with other international and national societies of biomechanics. If you know of national or international biomechanics societies that are interested in becoming affiliated and working collaboratively with ISB, please contact Jill McNitt-Gray at mcnitt@usc.edu.

Economically Developing Countries

Promotion of Biomechanics

ISB is interested in stimulating biomechanics related research and promoting international collaboration in economically developing countries. ISB would like to invite all ISB Affiliated Societies in economically developing countries to submit a two page proposal outlining their current needs and ways ISB can facilitate their efforts related to biomechanics related education, research, and communication. This may include support for education and training of students, biomechanics related research, technical training, or travel of speakers to regional or national conferences economically developing countries.

Congress Travel Awards for the ISB 2005 Meeting
Members of Affiliated Societies in Economically Developing Countries are encouraged to apply for

travel grants associated with attendance at the ISB 2005 Meeting in Cleveland, OH, USA. Application forms are available at <http://www.isbweb.org/student/grantform.html>. Applications are to be received by **January 15, 2005**. Notification to applicants will be by March 12, 2005. Recipients will submit a brief report to the committee which will be published in the Newsletter.

Liaisons with Economically Developing Countries

If you are interested in assisting the ISB Executive Committee in undertaking actions approved by the ISB council by serving as a liaison and facilitating communication between ISB and an Affiliated Society, please contact Jill McNitt-Gray at mcnitt@usc.edu.

Jill L. McNitt-Gray, Ph.D.

Call for Abstracts: XXth ISB Congress and 29th ASB Conference

Dear Colleagues,

A combined team from Case Western Reserve University, The Cleveland Clinic Foundation, Cleveland State University and Lutheran is organizing the next combined ISB and ASB congress. The meeting will begin on July 31st with four tutorials.

From August 1st through to August 5th, the focus will be on parallel sessions that span the field of biomechanics. Topics that will be covered include:

- Sport
- Locomotion
- Muscle/Motor Control
- Physical Therapy/Rehabilitation
- Orthopaedics and Joint mechanics
- Soft Tissue Biomechanics
- Bone Mechanics
- Modeling / Musculo-Skeletal Dynamics
- Spaceflight biomechanics
- Tissue and Cellular Engineering
- Bio-robotics
- Anthropology
- Neural Prostheses
- Cardiovascular and Biofluid Mechanics
- Forensic biomechanics,
- Imaging in biomechanics
- Plant, animal and insect biomechanics

In addition to podium and poster presentations, there will also be an evening "Pressure Measurement Workshop" offered by Novel GmbH.

The official language of the Congress will be English. Detailed information relating to the Congress is given at <http://www.isb2005.org/>. In particular, please note that **January 31, 2005** is the deadline for the submission of abstracts. Formatting instructions are given at: <http://www.isb2005.org/abstracts/isb2005-template.doc>

Once delegates have spent an entire day discussing the latest findings in the field, they need to relax! For this reason, considerable attention is being given to creating a social program to facilitate interactions between scientists from all over the world. The world-renowned New York Yankee baseball team will be in Cleveland from August 2nd – 4th; there will be optional mid-week excursions to Niagara Falls and other areas around Cleveland; and exciting social events each evening of the week. The final banquet will be held at the Rock 'n Roll Hall of Fame.

Looking forward to seeing you in Cleveland!!

Please do not hesitate to contact us for any relevant information:

Tel: (216) 445-9343

Fax: (216) 444-9198

E-mail: info@isb2005.org

Brian L. Davis, Ph.D

Tutorials at the ISB Conference in Cleveland 2005

The ISB has a long tradition of offering excellent tutorials in a variety of different areas. These tutorials are selected based on input from the membership and suggestions from the ISB executive members and the organizing committee.

At the ISB in Cleveland, it is planned to have once again a series of outstanding tutorials. Four tutorials are scheduled for Sunday July 31st, two running in parallel in the morning and two running in parallel in the afternoon, each lasting approximately two hours.

The following topics and speakers have been identified:

1. Soft Tissue Mechanics by Jeff Weiss
2. Bone and Joint Mechanics by Rik Huiskes
3. 3-D Analysis of Movement by Richard Baker
4. Motor Control by Mark Latash

Please mark your calendars and plan to arrive early to catch one or two of these tutorials given by some of the best researchers in the respective areas.

*Walter Herzog
Tutorial Organizer for the ISB*

Symposium on Footwear Biomechanics ISB Conference in Cleveland 2005

The 7th Symposium on Footwear Biomechanics will be held in Cleveland, Ohio from July 27-29, 2005 at Case Western Reserve University. The meeting will start out with an opening reception Wednesday evening, with two days of meetings culminating with a banquet on Friday at the Glidden House. Keynote speakers will include Benno M. Nigg, professor of biomechanics at the University of Calgary, and Dr. Martyn R. Shorten, President of BioMechanica, LLC, who will provide perspectives on footwear research in the past, at present, and in the future.

Papers are invited involving all aspects of footwear biomechanics. Abstract submissions will be in .pdf form and due January 31, 2005, with notification by March 1, 2005. Specific information regarding format and details for submission and conference registration will be available soon from the ISB Technical Group on Footwear web site at <http://www.staffs.ac.uk/isb-fw>. Research Awards will once again be provided in three categories – for basic research, applied research, and a student award.

In addition, at the closing banquet Nike will be announcing the winner of a special \$25,000 research prize that they are sponsoring this year. The purpose of the award is to encourage research on the role of athletic footwear in the prevention of chronic sport injuries. Full papers will be submitted in the Spring to Nike and finalists will be reviewed by a scientific panel of experts for selection of the award winner. Details are in this newsletter and will also be posted on the footwear web site. Research sponsored by Nike will not be eligible for this award.

Further information can be obtained via email from Keith R. Williams, chairperson of the footwear group (krwilliams@ucdavis.edu), or Joe Hamill, meeting coordinator (jhamill@excsci.umass.edu).

*Keith Williams
Footwear Group*

Symposium on Computer Simulation in Biomechanics ISB Conference in Cleveland 2005

VENUE AND ACCOMMODATION:

Case Western Reserve University, (probably in Dively building)

Accommodation will be at CWRU student residences, one block from the meeting. Keynote speakers will be at the Glidden house. We plan to include the accommodation with the registration. If people want to stay in a hotel instead, they will not get a discounted registration, so we encourage everybody to be together.

PROGRAM includes Keynote Lectures, oral presentations and computer demonstrations.

The meeting will START with a reception on the evening of July 28 (Thursday), and will END with a banquet on Saturday evening.

Local ORGANIZING COMMITTEE:

Robert F. Kirsch (meeting chair)

Musa Audu (scientific program)

Ed Chadwick (technical program)

Ton van den Bogert (ISB/TGCS liaison)

Elizabeth Hardin (accommodation)

Frederico Casalo
Computer Simulation Group

Editor's Notes and Requests

Recent research has shown that mental work will help to keep your brain young and fit. Now that the season's holidays are just around the corner you may have a couple of hours, where you need some challenges for your brain! I am sure that Lutz Bauer's trampoline puzzle can keep you busy for a while.

If you manage to find a solution be sure to send it to the editor before the 15 of February 2005. There is no prize to win in this competition but we can promise that your name and solution will appear in the next Newsletter, so you will reach a dedicated audience.

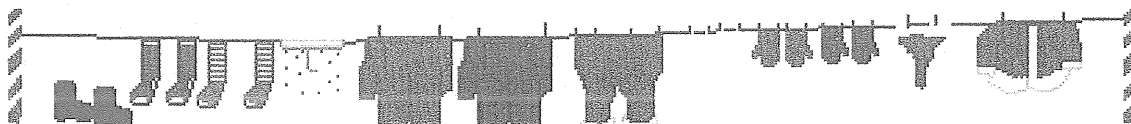
If you get inspired and create your own puzzle, do not hesitate to let the editor know.

In the next Newsletter you can look forward to a description of the two new societies requesting affiliation, the International Society of Biomechanics in Sports and the Brazilian Society of Biomechanics.

You will also have an update from the busy organizers of ISB 2005 in Cleveland. And last but not the least interesting; the first electronic election of ISB council member will have taken place. We will keep you updated on this event as well.




















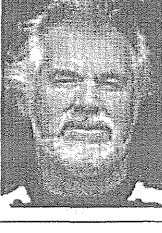
General deadline for the Spring Newsletter is the first of March 2005. Please send your contribution in electronic form in any form of English to ks@ami.dk.

Karen Søgaard



Biomechanics and Music

The Closing Banquet for the 2005 combined ISB/ASB Congress will be held at Cleveland's popular "Rock 'n Roll Hall of Fame". For those of you who are wondering if there will be any live performances at this event - stay "tuned" - we are hoping for some guest appearances of people who - with the help of some make up and hair styling - bear uncanny resemblances to famous musicians!

Dick Nelson, Ph.D. President, ISB 1976 - 1981	Mark Grabiner, Ph.D. President, ASB 1997 - 1998	Kit Vaughan, Ph.D. President, ISB 1999 - 2001	Stu McGill, Ph.D. President, CSB 1999 - 2000
    	    	    	    
Willie Nelson 1993, Country Music Hall of Fame	Frank Zappa 1995, Rock'n Roll Hall of Fame	Elton John 1994, Rock'n Roll Hall of Fame	Kenny Rodgers 1979, Hollywood Walk of Fame

Brian L. Davis, Ph.D.

Notes from the Archives

I am often asked the same questions about the archives of the ISB. I hope to address these questions in the following.

Where and what is the archive?

Our collection is held in the Penn State University Archives, which are in the Paterno Library on campus. This facility is climate controlled to ensure all stored materials are maximally preserved. It is located about 400 meters from the Biomechanics Laboratory.

The library controls access to the materials, so that no paperwork leaves the archive.

The library is named for Joe and Sue Paterno to honor their hard work and leadership in the Campaign for the Library, which raised \$13.75 million in private gifts to build the library. Joe Paterno, for those of you who do not know, is the football coach at Penn State.

Along with the constitution, and its revisions, the archive contains minutes of executive council meetings, financial records, meeting proceedings, details of nominees and awardees for society awards, copies of correspondence, and other materials.

What do I try to do with the archive?

Ensure the archive contains all the information that the society wants to preserve. This, of course, includes giving people a gentle nudge when this information is not forthcoming.

Go through the process of ensuring all of the records are color coded (e.g., financial records are in green folders; presidential correspondence are in red, etc.), so that identification of specific records is easier.

On receipt of information it is categorized, labeled, cataloged, and then sent on to the library for entry into the archive.

Progressively work through the archive, noting gaps and omissions, and then work at trying to fill these gaps and omissions.

Move to having more of the information stored electronically (e.g., important documents stored in hard copy as well as PDF files).

Provide information, as requested, from the archive to officers of the society.

How can our membership help?

Contact me if you have some paperwork you think could be added to the archive.

At the moment we do not have a complete set of Newsletters. The gaps are in the years prior to 1990. Anybody who is looking to recover some shelf space and would like to donate their Newsletters please let me know.

I will notify you of any other materials we would like to add as I become aware of them.

[If you have any materials you think should be in the archive, and you would consider donating them to the archive please contact John Challis (jhc10@psu.edu).]

John Challis



The Nike Award for Athletic Footwear Research

Nike will sponsor a prize of UD\$25,000 on a biennial basis to encourage research on athletic footwear. The topic for this year competition will be the role of athletic footwear in the prevention of chronic sport injuries. The prize will be granted for the first time at the meeting of the ISB Footwear Biomechanics Technical Group to be held July 17-19, 2005 at Case Western University, Cleveland, Ohio in conjunction with the 2005 ISB congress.

The prize will be awarded competitively on the scientific merit of the work*. A panel of experts from the field will be assembled to determine the winner of the award. Full papers containing original material, not previously submitted for publication, must be received at the following address no later than June 1, 2005:

Mario A. Lafortune
Nike Sport Research Laboratory
1 Bowerman Drive
Beaverton, OR 97005
USA



*Note that research sponsored by Nike will not be eligible for this award.

Preparation of the manuscript

Language: Manuscript must be written in English.

Format: Manuscript must follow a typical scientific publication format such as Journal of Biomechanics. All references must be collected in a separate section at the end of the manuscript.

Length: Manuscript must not exceed 15 typewritten pages of text and should not exceed 25 pages including figures and tables.

Page Size: US letter size (8.5" X 11") or European A4 size. All margins (Top, Bottom, Left and Right) must be 1 inch (2.5 cm).

Line Spacing: 1.5

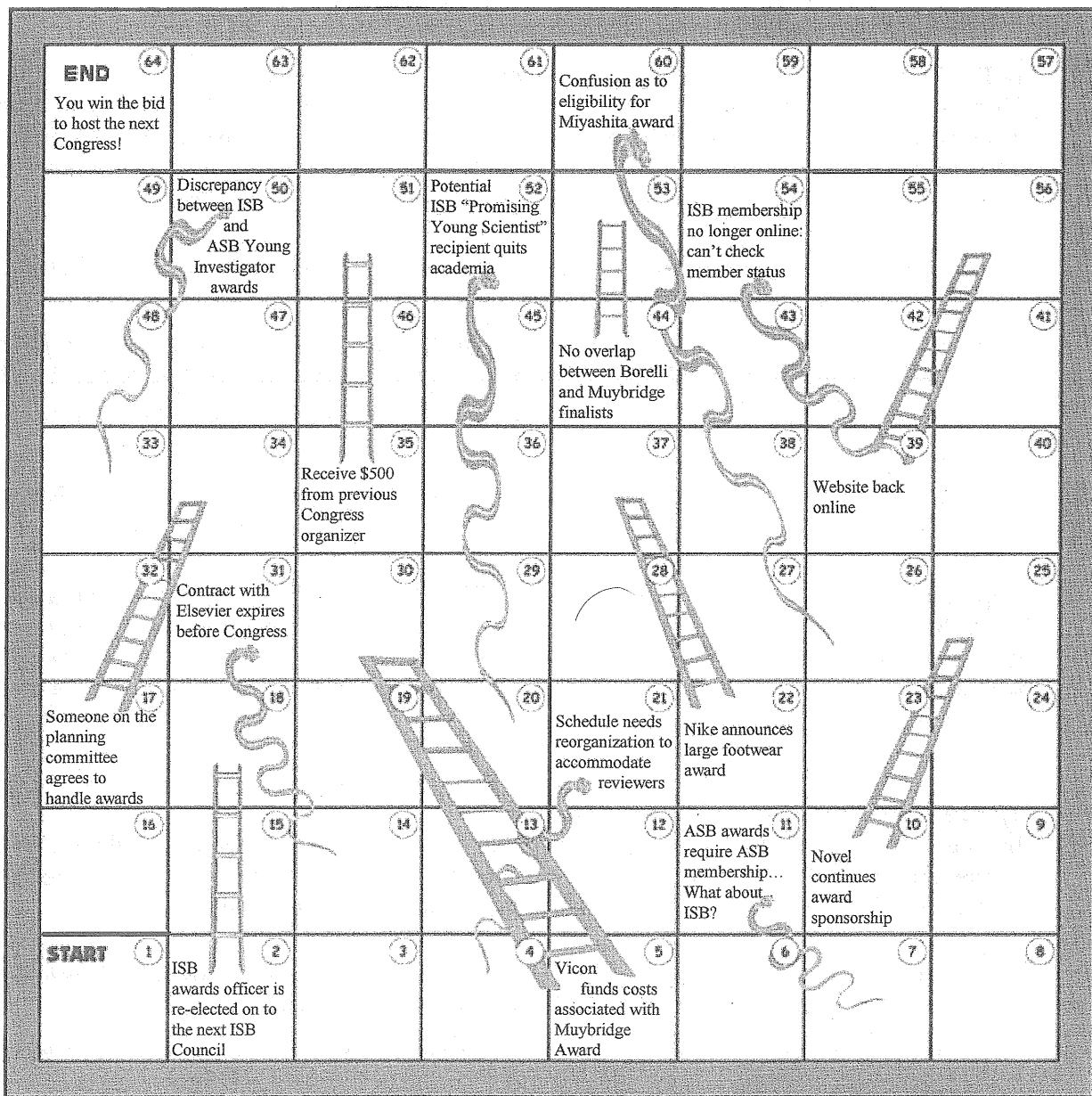
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General Information

The winner of the Nike Award for Athletic Footwear Research will be announced at the ISB Footwear Biomechanics Technical Group meeting to be held at Case Western University, Cleveland, Ohio. The winner of the award will be notified prior to June 25, 2005 and will be handed a check to the amount of UD\$25,000** at the meeting closing banquet. Nike will pay the registration, transportation (economy class) and accommodation costs for the winner to attend the meeting. These costs will be reimbursed if the winner has already made arrangements to attend the meeting. In the event that the winner cannot attend the meeting, Nike will not cover these costs.

**The recipient of the prize will be responsible for all taxes payable on the award both in the US and in his/her country of residence.

Roadmap for dealing with awards at combined ISB/ASB Congresses



Brian L. Davis

International Society of Biomechanics (ISB) Student Grant Guidelines 2005

Student members of ISB are eligible for the following three grants. A number of competitive grants will be awarded each year. All grant amounts are shown in US dollars.

1) The Matching Dissertation Grant Program:

There will be several competitive grants of \$2000 made for doctoral dissertation research. A condition is that the applicant will have a commitment from her/his institution or another source to provide a further matching \$2000. This program is applicable to those who are doctoral candidates and are seeking assistance with costs of their dissertation research. Applications should include the following:

- a) a three page summary which includes the purpose, hypotheses, reference to key related literature, study design, methods, timetable for the measurements and budget;
- b) a CV of the applicant: 2-3 pages in length (including list of publications, passport picture, current grade point average, results of any standardized tests that the applicant has taken (i.e. GRE));
- c) a document from her/his institution or other source which ensures provision of the matching \$2000;
- d) a one page recommendation from the dissertation advisor who must also be an ISB member at the time of application.

Applications are to be received by **January 15, 2005** both by email and airmail (including the signatures). Notification to applicants will be by March 12, 2005. Recipients will present results at the next ISB Congress in 2005 or 2007 and acknowledge ISB support in any publications. A report to the council will include accounting of how funds were spent. Recipients will be encouraged to publish their work in one of the ISB-affiliated journals.

2) The International Travel Grant Program:

In order to allow student members to travel abroad to experience science in other cultures, we will offer several grants of \$2000 for travel related to biomechanics research. A report on the accomplishments during the trip will be expected by the committee. Applications should include:

- a) a three page proposal which includes the purpose of the visit, timetable, activities to be involved in, the total budget for the visit (including other financial assistance, etc.);
- b) a CV of the applicant: 2-3 pages in length (including list of publications, passport picture, current grade point average, results of any standardized tests that the applicant has taken (i.e. GRE));
- c) a document from the host institution verifying support for the visit;
- d) a recommendation letter of support for the travel from the applicant's supervisor who must also be an ISB member at the time of application.

Applications are to be received by **January 15, 2005** both by email and airmail (including the signatures). Notification to applicants will be by March 12, 2005. Recipients will submit a brief report to the committee, which will be published in the Newsletter.

3) The Congress Travel Grant Program:

This grant is offered only in the years of an ISB Congress, therefore, it will be offered in 2005 to help reduce the travel expenses to attend the XXth ISB Congress in Cleveland, USA, <http://www.isb2005.org>. ISB Congresses provide a wonderful opportunity for exchange of information and for meeting other scientists who can be influential in the development of new directions. By virtue of the need to move the congresses between different continents, it is often very difficult for students to afford to travel to the Congresses or to pay the registration fee if they can travel. However, we will offer several travel grants of up to \$1000 to student members who will be presenting their research results at the 2005 ISB Congress in Cleveland, USA. Applications should include the following:

- a) a proposal which should have a maximum length of 3 pages including a copy of the submitted abstract and, the total budget for the travel;
- b) a CV of the applicant: 2-3 pages in length (include list of publications, passport picture, current grade point average, results of any standardized tests that the applicant has taken (i.e. GRE));
- c) a one page recommendation from the supervisor who must also be an ISB member at the time of application.

Recipients will submit a brief report to the committee, which will be published in the Newsletter. Applications are to be received by **January 15, 2005** both by email and airmail (including the signatures). Notification to applicants will be by March 12, 2005.

Final notes:

- Please be aware that applications can only be accepted from FINANCIAL member applicants and supervisors.
- Please provide the ISB membership number in your application. It can be obtained from the ISB website or from Graeme Wood under: gwood@cygnus.uwa.edu.au
- ISB student grants do not cover indirect costs.
- ISB student grants are intended for students only, not post-docs.
- First time applicants are preferred, but others can be considered if the funds allow.
- The evaluation committee is authorized to limit the number of applications per institution.

Grant applications should be mailed (email and airmail) to:

Dr. A. Stacoff
Laboratory for Biomechanics
ETH Hönggerberg, HCI E 365.1
8093 Zürich
SWITZERLAND
Tel: ++41 1 633 62 18
Fax: ++41 1 633 11 24
Email: stacoff@biomech.mat.ethz.ch

Please use the application form from the webpage: <http://www.isbweb.org>



International Society of Biomechanics Matching Dissertation Grant Report

*Justin Keogh
School of Physiotherapy and Exercise Science
Griffith University Gold Coast
Australia*

I sincerely thank the International Society of Biomechanics, and in particular the Awards Committee for awarding me an ISB Matching Dissertation Grant for 2002. This grant was instrumental in allowing me to finish my PhD data collection and present a portion of these findings at the XIX International Society of Biomechanics Congress in Dunedin during July 2003.

My doctoral research had two primary aims:

1. To examine the effects of the normal ageing process on postural and force tremor.
2. To determine the effectiveness of two forms of resistance training in reducing postural and force tremor in elderly adults, and if such an effect was found, to gain some insight into the mechanisms underlying such a change.

Postural tremor is defined as the involuntary, approximately rhythmic and roughly sinusoidal motion of a limb segment in space (Elble & Koller, 1990), while force tremor can be described as the involuntary oscillations in force output that occur during any muscular contraction (Loscher & Gallasch, 1993). While these (and other) forms of physiological tremor are observed across the lifespan, the amplitude of these oscillations may be greater in elderly than young adults in both postural (Birmingham, Wharrad, & Williams, 1985; Loscher & Gallasch, 1993) and isometric force tasks (Burnett, Laidlaw, & Enoka, 2000; Cole, 1991; Laidlaw, Bilodeau, & Enoka, 2000). As a consequence of their increased tremor, the elderly may have increased difficulty in performing fine, dexterous movements involving the fingers such as writing, lifting light objects and using utensils (Hackel, Wolfe, Bang, & Canfield, 1992). Therefore the development of inexpensive, non-invasive intervention programs that can reduce tremor amplitude are warranted. As both postural and force tremor are influenced by a number of neural (coordinative) processes (Laidlaw et al., 2000; Morrison & Keogh, 2001; Morrison & Newell, 2000), it was hypothesized that resistance training could be used to reduce both types of tremor as a re-

sult of the neuromuscular adaptations known to result from this form of training (Behm, 1995; Burnett et al., 2000; Carroll, Riek, & Carson, 2001; Laidlaw et al., 2000).

For the postural tremor tasks, young and elderly adults were assessed performing four unilateral postural pointing tasks. These tasks consisted of all combinations of limb preference (preferred and non-preferred) and visual feedback (normal vision - NV and augmented visual feedback - AV). The AV feedback was provided by the projection of a laser emission (originating from a laser pointer attached to the index finger) onto a concentric circle target 5.5 m away. Postural tremor from the index finger, hand, forearm and upper arm, as well as the surface EMG activity of the extensor digitorum (ED) and flexor digitorum superficialis (FDS) muscles were recorded. Force tremor was assessed in tri-digit finger-pinch tasks involving the thumb, index and middle fingers. The finger-pinch tasks were performed with all combinations of limb (preferred and non-preferred), mean force (20% and 40% MVC) and target shape (constant and sinusoidal). During these tasks, the individual digit forces and surface EMG activity of the flexor pollicis brevis (FPB) and FDS muscles were recorded.

The elderly adults also participated in a resistance-training program. Each elderly adult was assigned into one of three groups: 1) strength-training; 2) coordination-training; or 3) control group. Both training groups performed unilateral training involving dumbbell bicep curls, wrist curls and wrist extensions, two times per week for a period of six weeks. The strength-training group performed three sets of 8-10 repetitions for each exercise in a standard manner. The coordination-training group (utilising a lighter load) performed the same exercises, with the goal being to match their joint angle to a quasi-random angular trajectory (displayed in real-time) on a computer screen. Thus, subjects in the coordination-training group had to continually adjust their mode of contraction (concentric vs eccentric) and

joint angular velocity in order to match the required angular trajectory.

The results of these studies reveal many new features about the control of postural and force tremor. Postural tremor amplitude was greater in elderly than young adults, in the non-preferred than preferred limb and in the AV than NV conditions. Such increases were typically a result of an amplification of the 8-12 Hz (neurogenic) tremor peak, with little change evident for the 2-4 Hz peak. In conjunction with the increased levels of ED and FDS muscle activity and limb stiffness as well as lower levels of intra-limb coupling, these increases in postural tremor appear to be largely mediated through modulation of neural processes. The strength and coordination training programs both proved successful in reducing postural tremor in the elderly adults, with this reduction found in both the trained and untrained limb and in the NV and AV tasks. In accordance with our hypotheses, these decreases in postural tremor amplitude were most pronounced in the 8-12 Hz bandwidth and were associated with reductions in ED and FDS muscle activity and upper limb stiffness as well as greater intra-limb coupling.

Force tremor was quantified in absolute and relative (% MVC) terms. Absolute force tremor was greater in elderly than young adults, in the preferred than non-preferred limb, at high than low forces and in the sinusoidal than constant force tasks. Such increases in force tremor resulted from an amplification of both low (0-2 Hz) and high (5-10 Hz) frequency processes and were also often associated with changes in the coupling of the digit forces and in the coupling between the digit forces and activity of the FPB and FDS muscles. The strength and coordination training programs both proved successful in reducing force tremor in the trained and untrained limb, with the magnitude of this reduction not significantly influenced by force output or target shape. Overall, these reductions in force tremor were associated with an attenuation of power for the dominant low frequency peak and an increase in the frequency of the high frequency peak.

Collectively, the results from these studies indicate that postural and force tremor are oscillatory outputs that originate from a variety of oscillations within the nervous system. Thus, modulation of any of these processes can affect the time- and frequency-domain characteristics of these signals. The results for the resistance-training programs were extremely positive, revealing that even short-term training can reduce both forms of tremor in multiple degree of freedom pointing and finger-pinch tasks, and that this training can reduce tremor in the trained and untrained limb.

Such a cross-education for postural or force tremor has not been shown previously. Thus, resistance-training appears to be an effective tool for not only improving mobility and stability in elderly adults, but also in improving precision upper limb performance.

Presently, I am completing the write-up of my PhD, which I plan to submit in mid-late 2004. These findings will also be submitted for journal review in the near future.

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Announcement of the Winner of the Delsys Contest 2004

Dear ISB readers!

We are very pleased to announce the winner of the Delsys Contest 2004 "Promoting Innovation in Electromyography".

The Delsys Contest was established in 2003 to commemorate the 10-year anniversary of Delsys, Inc., which has been proudly serving the needs of Electromyographers worldwide. Delsys is committed to fostering innovative applications in Electromyography and to providing novel EMG solutions.

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The WINNER of the Delsys Contest is:

Professor Dr. F.C.T van der Helm
Delft University of Technology
Dept. of Mechanical Engineering
Delft, The Netherlands

"Estimation of Proprioceptive Reflex Gains using Surface EMG"

Honorable mention is given to two other proposals, which captured the Contest's spirit of Innovation:

Tobias Gerdin
P&I Laboratory, Tokyo Institute of Technology
"Software Instrument Interfaced using Surface Electromyography"

Dr. William A. Sands
United States Olympic Committee
"EMG Helps Olympic Gymnastics Coaches Select Appropriate Lead-Up Drills and Skills for Still Rings"

Stay Tuned for next year

If you did not get a chance to participate this year, there will be a Delsys Contest 2005. The details of the contest will be announced June 10th and the deadline will be Oct 12th.

For complete information, please visit <http://www.delsys.com>

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Puzzle

Puzzle: 3D Nonlinear model of the vertical spring force of a trampoline - Can mathematical approximations be compensated through curve fitting ?

Submitted June 9th, 2004 by W.Lutz Bauer, University of Bremen

The trampoline bed of Fig. 1 is deflected at the centre through a vertical force F . The amount of vertical deflection is d . To calculate its mathematical model we use the force vector diagrams of the longitudinal-sectional view LL' in Fig. 2 and in the cross-sectional view BB' in Fig. 3.

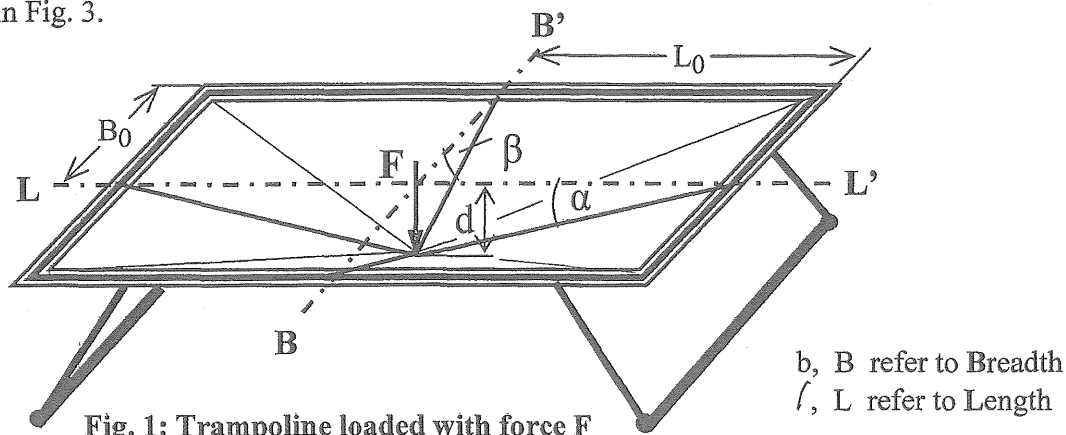


Fig. 1: Trampoline loaded with force F

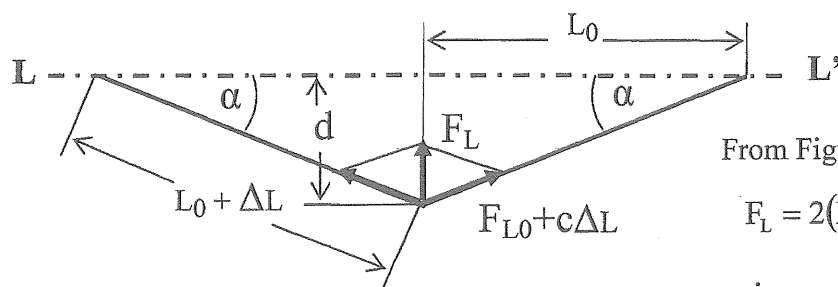


Fig. 2: Longitudinal-sectional view LL'

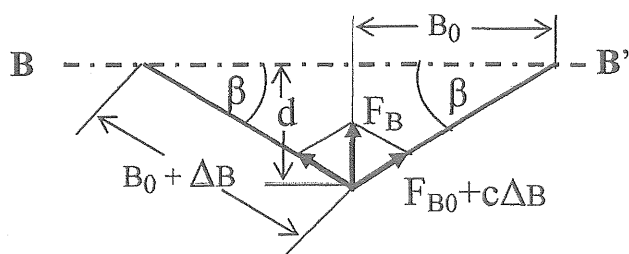


Fig. 3: Cross-sectional view BB'

- c = effective spring constant
- L_0, B_0 = half length/breadth of the tramp
- $\Delta L_0, \Delta B_0$ = initial extension of the springs
- $\Delta L, \Delta B$ = extension of the springs under load
- F_{L_0}, F_{B_0} = prestress force created by $\Delta L_0, \Delta B_0$
- F_L, F_B = spring force created by $\Delta L, \Delta B$
- d = deflection of the trampoline centre
- l, b = half length/breadth of the rigid plate

From Figure 2 we have

$$F_L = 2(F_{L_0} + c\Delta L)\sin\alpha \quad (1)$$

$$\sin\alpha = \frac{d}{L_0 + \Delta L} \quad (2)$$

Introduce

$$F_{L_0} = c\Delta L_0 \quad (3)$$

and substitute (2) and (3) in (1)
we get

$$F_L = 2cd \frac{\Delta L_0 + \Delta L}{L_0 + \Delta L} \quad (4)$$

Using Figure 3 accordingly yields

$$F_B = 2cd \frac{\Delta B_0 + \Delta B}{B_0 + \Delta B} \quad (5)$$

Add Equation (4) and (5) then

$$F = F_L + F_B \quad (6)$$

To find an explicit solution of (6) we introduce the following approximations:

$$L_0 + \Delta L \approx L_0 \quad (7)$$

$$B_0 + \Delta B \approx B_0 \quad (8)$$

Substitute (4),(5),(7) and (8) in (6) then

$$F \approx 2cd \left[\frac{(\Delta L_0 + \Delta L)}{L_0} + \frac{(\Delta B_0 + \Delta B)}{B_0} \right] \quad (9)$$

Applying the Pythagorean theorem to either of the rectangular triangles of Fig. 2 and rearranging we obtain

$$\frac{\Delta L}{L_0} = \sqrt{1 + \frac{d^2}{L_0^2}} - 1 \quad (10)$$

Expanding the square root into a Taylor series and using the first two terms leads to

$$\frac{\Delta L}{L_0} \approx \frac{1}{2} \frac{d^2}{L_0^2} \quad (11)$$

Repeating the same procedure on either of the rectangular triangle of Fig. 3 yields

$$\frac{\Delta B}{B_0} \approx \frac{1}{2} \frac{d^2}{B_0^2} \quad (12)$$

When substituting (11) and (12) in (9) and rearranging, we have

$$F \approx 2c \left(\frac{\Delta L_0}{L_0} + \frac{\Delta B_0}{B_0} \right) d + c \left(\frac{1}{L_0^2} + \frac{1}{B_0^2} \right) d^3 \quad (13)$$

To further improve the models performance, a rigid weightless plate is centrally placed on the trampoline to take the foot contact area of the gymnast into consideration, which causes a force $F_1 > F$ for the same deflection d .

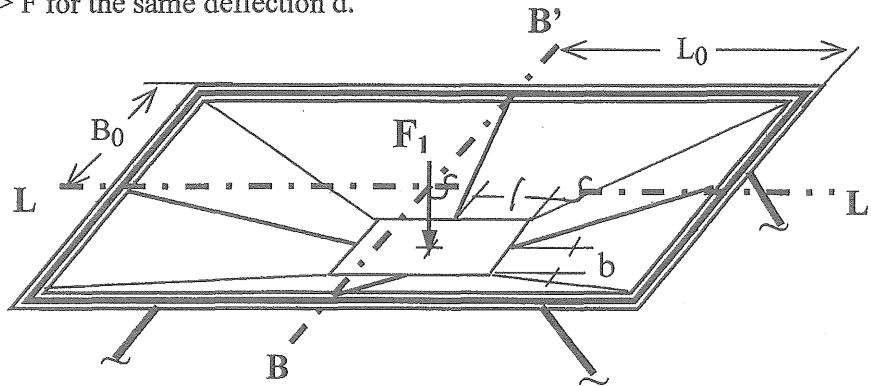


Fig. 4: Trampoline with a weightless rigid plate of an area $4 b l$ (*)

Thus the cross-sectional view has changed and is shown in Fig. 5. The modified longitudinal-sectional view can be set up accordingly when changing B to L , b to l and β to α .

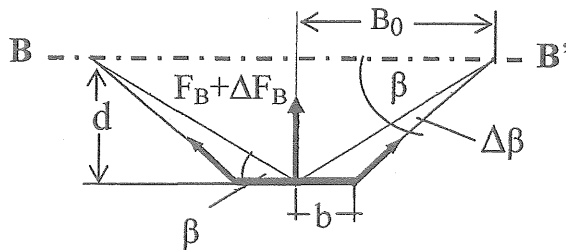


Fig. 5: Cross-sectional view of the modified model

$$\Delta\beta \ll \beta$$

ΔF_B = partial increase of the spring force due to the rigid plate
 b = breadth of the plate

and for the longitudinal view

$$\Delta\alpha \ll \alpha$$

ΔF_L = partial increase of the spring force due to the rigid plate
 l = length of the rigid plate

Consequently the increase ΔF and the total spring force F_1 for the same deflection d due to the rigid plate can be calculated as

$$\Delta F = \Delta F_B + \Delta F_L \quad (14) \quad \text{and}$$

$$F_1 \approx F + \Delta F \quad (15) \quad \text{respectively.}$$

Problems for solution

1. Use Fig. 5 and show that
$$\Delta F \approx c \left(\frac{\lambda}{L_0^3} + \frac{b}{B_0^3} \right) d^3 \quad (16)$$

Combine (13), (15) and (16) and the mathematical model of the vertical spring force F_1 of the trampoline bed with the rigid plate should come out as follows:

$$F_1 \approx 2c \left(\frac{\Delta L_0}{L_0} + \frac{\Delta B_0}{B_0} \right) d + c \left(\frac{1}{L_0^2} + \frac{1}{B_0^2} + \frac{\lambda}{L_0^3} + \frac{b}{B_0^3} \right) d^3 \quad (17)$$

- Equation (17) is of the form $F_1 \approx k_1 d + k_3 d^3$. Check its plausibility when L_0 and B_0 approaches large values, when l and b approaches zero and when ΔL_0 and ΔB_0 approaches small and large values respectively.
 - Asses the impact of the approximations due to equations (7),(8), (11), (12) and (16) on the mathematical model of equation (17).
 - The validation of the model can be made with experimental measurements at a real trampoline and through a curve fitting procedure. Can this curve fitting procedure compensate for eventual parametrical and structural errors of the model which are due to the applied mathematical approximations?
 - Write down the reasons, why the independent variable d of equation (17) only has positive odd exponents.
 - Why is it sufficient to solely use the cross-sectional and longitudinal-sectional view of Fig. 2 and Fig. 3 for setting up the mathematical model of Eq. (17) and disregard all the other possible isosceles triangles through F ?
- *) Kraft, M.: Eine einfache Näherung für die vertikale Federkraft des Trampolinsprungtuchs.
(A simple approximation of the vertical spring force of a trampoline bed.)
<http://opus.tu-bs.de/opus/volltexte/2001/214>

W. Lutz Bauer
University of Bremen

Please send in your suggestion of possible answers to the questions before the 15th of February to ks@ami.dk. Selected answers will be published in next issue of the ISB Newsletter.

Upcoming Meetings, Workshops

2004

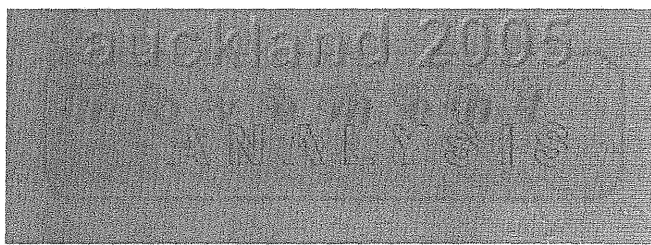
The Fifth Australasian Biomechanics Conference.

Dates: December 9-10, 2004

Venue: The University of New South Wales, Kensington.

Information: E-mail: abc5@unsw.edu.au

2005



Movement Analysis 2005 – Building Bridges

Dates: February 3-5, 2005

Venue: Auckland, New Zealand

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NASPSPA 2005 Conference

Dates: June 9-11, 2005

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Information:

E-mail: naspspa@hotmail.com

Conference Program Chair: fischmg@auburn.edu

See website: www.naspspa.org

The 9th World Multi-Conference on Systemics, Cybernetics and Informatics

Dates: July 10-13, 2005

Venue: Orlando, Florida, USA

Information: See web-site:

www.iiisci.org/sci2005



The 13th International Congress on Physical Education & Sport

Dates: May 20-22, 2005

Venue: Komotini, Greece

Information: See website:

<http://www.phyed.duth.gr/icpes2005/>

ISB XX

International Society of Biomechanics Congress

Dates: August 1-5, 2005

Venue: Cleveland, Ohio, USA

Information:

E-mail: info@isb2005.org

See website: <http://www.ISB2005.org>



ISPGR XVII

International Society for Postural and Gait Research

Dates: May 29 – June 2

Venue: Marseille, France.

Information:

E-mail: christine.assisante@dpm.cnrs-mrs.fr

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ISSP 11th World Congress of Sport Psychology

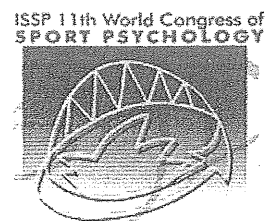
Dates: August 15 – 19, 2005

Venue: Sydney, Australia

Information:

See website:

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15 - 19 August 2005
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Dates: June 1-3, 2006

Venue: Denver, Colorado.

5th World Congress of Biomechanics

Dates: 29 July – 4 August, 2006.

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First Announcement



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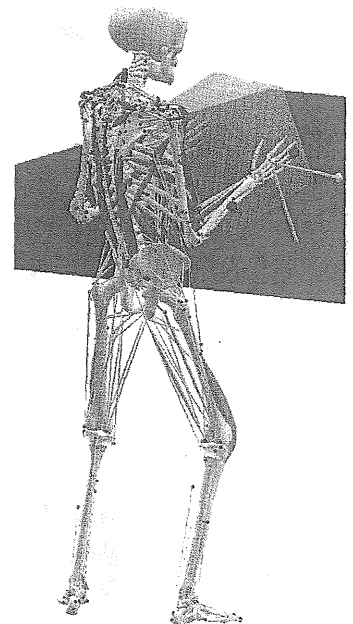
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Graeme

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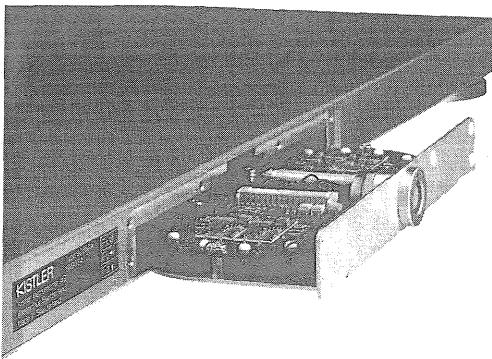
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