



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 Association of Sport and Exercise Sciences/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

This time of year is one for reflection because in May our students at the Department of Physical Therapy and Rehabilitation Science at the University of Maryland School of Medicine finally graduate. All their hard work has paid off, and they are ready to move on. Commencements mark the end of student life and the beginning of the next stage of professional and scientific development—entering the “real world.”

Over the years, the International Society of Biomechanics has served its members well by supporting the development of students in biomechanics through the ISB student grants. This issue of the newsletter contains eight of their reports, highlighting the work that they have accomplished. I think you'll be interested in their results.

In addition, Alex Stacoff announces the new student grant recipients for 2004. We in the ISB are quite fortunate to have extremely talented students involved with our society. They are our future and will continue the work of those visionary biomechanists who have gone before us all. Motoshi Kaya, the current ISB student representative asked for feedback in the last newsletter. Your responses are vitally important, so please let him know your thoughts if you are a student, and please encourage your students to respond if you are in an advisory role. His email address is: motoshi@hp10.kin.ucalgary.ca

Also in this newsletter is a call for nominations for Honorary Membership of the ISB. This membership is restricted to a few individuals who, through their work, have made outstanding contributions to the development of biomechanics. Please take time to read and make any nominations you see fit.

In other news, I have been representing the ISB in communications with other scientific and professional organizations—specifically the International Society of Electrophysiology and Kinesiology, Human Kinetics, Elsevier, European Society of Biomechanics, and the like—and I have greatly enjoyed having this opportunity. I am pleased to report that the *Journal of Applied Biomechanics* for individual members will remain the same in 2004 as in 2003, and thus there will be no change to the fee Human Kinetics charges the ISB to provide the journal to members (i.e., the fee will remain \$47 per year for each professional member and \$33 per year for each student member).

I made recommendations to the *Journal of Biomechanics* regarding new editorial board ISB rep-

resentatives to replace Professor Benno Nigg and Professor John Paul who have completed their terms. Our thanks go to both men for their excellent service! Professor John Paul will continue on the editorial board as an independent member. Thanks to Professor Paavo Komi and Professor Savio Woo for agreeing to serve as the new ISB representatives on the editorial board. We also look forward to the new online access to *J Biomech* available to ISB members.

The ISB also affiliates itself with other societies in a variety of ways. The common ISEK and ISB session at the ISEK conference is highlighted in this issue, and a picture of biomechanics in Denmark is also featured. The International Shoulder Group, a technical group with ISB, has a session at ESB in July. We are working with other societies to facilitate these activities in the future.

To keep the ISB alive and functioning at its current level—let's face it—we need money. As a result, sponsorship is critical to our organization and the ISB has drafted new guidelines to address this. If you have any ideas on ways for us to attract more sponsors, please let Mark Grabiner know (mgrabiner@uic.edu). In addition, I've been developing a member survey to make sure that the ISB is meeting your expectations. The survey will be on the website, and your input on this survey will be critical. If you prefer to have a mailed copy, please complete the enclosed request form and we will send you a paper copy. As we look forward to increasing electronic delivery of ISB services, it would be very helpful to know if this approach will create any issues for members.

Before I conclude, one last thing I'd like to mention is how important I think it is that the ISB brings together so many of us from around the world. With all the prominent conflicts in the news at this time, it's especially important for us to continue our scientific collaborations and to foster increased understanding of our similarities and our rich diversity. Through organizations like the ISB, thousands of us from different cultures, countries, and continents work together to reach common goals. We collaborate on research and network at conferences. We aid students and forge ahead to fulfill our international mission. And, through all these actions, we, on some level, help to make the world a better place.

That's one of the many reasons that I'm proud to be a part of this community.

Until next time...Mary Rodgers

Biomechanics in Denmark – in a historical and geographical perspective

In 1977 The University of Copenhagen hosted the 6th International Congress of Biomechanics. The program was composed of the sessions: Muscles, Neuromuscular control, Electromyography, Gait, Sport, Posture & ergonomics, Orthopaedics, and Rehabilitation & training. In most of the sessions presentations were given by Danish researchers demonstrating a large pallet of research in the area of biomechanics that was established in Denmark for more that 30 years ago. Particular strong research areas at the University of Copenhagen were by then neuromuscular control and muscle activity, and which still are strong roots in the biomechanical research profile in Denmark.



The main locations at the University of Copenhagen involved in biomechanical research were the Laboratory for theory of Gymnastics [now the Institute of Exercise and Sport Sciences] at the August Krogh Institute, Faculty of Science (muscle, sport, and ergonomics), the Institute of Medical Anatomy at the Panum Institute, Faculty of Medicine (gait) and the University Hospital, Rigshospitalet (neuromuscular control). Also other hospitals such as Gentofte Hospital housed clinical oriented biomechanical disciplines. To day in particular the Department of Sports Medicine at Bispebjerg Hospital has become known for its advances in training studies in collaboration with the Copenhagen Muscle Research Centre (CMRC), that allows to combine mechanics with sophisticated tissue biochemical analysis. Areas of research further include tendon mechanics and in collaboration with the University of Copenhagen also movement analysis via inverse and forward dynamics, mostly of sports specific movements. Recently a professorship in motor control was established at the Institute of Exercise and Sport Sciences that may envisage a boost in that area.

Already in the 1970'es a branch was established from Copenhagen to the relative young University of Aalborg dealing with the neuromuscular control aspects. This has since then developed into the presently flourishing international research centre: Sensory-Motor-Interaction (SMI), as a point of pivot having electrical signals from sensory input to the nervous system extracted and transposed into motor control. The research area at SMI is interdisciplinary and focused on three inter-related areas within neuroscience: 1) Basic motor control and biomechanics including activities regarding the muscle-tendon units mechanics, 2) Sensory systems that comprise human experimental pain research, and 3) Rehabilitation that includes development of implantable devices for restoration of lost motor function for e.g. spinal injured patients and applies the technique of Functional Electrical Stimulation. More recently Biomedical Engineering was established as a discipline at the Department of Medical Informatics and Image Analysis (MIBA) and high expertise is developed in the area of medico technical sciences. Finally, a collaborative initiative between several departments dealing with

biomechanical approaches resulted in the project AnyBody aiming at development of models for movement strategies in humans performing various tasks, in order to maximize sports performance or optimise ergonomics and man/machine interfaces.

Later in the 1980'es a branch of biomechanics was established to the National Institute of Occupational Health from the University Copenhagen encompassing in particular ergonomics and occupational biomechanics. During the years whole body 3D biomechanical models have been developed for the study of e.g. load carrying, and spine stability during work related loadings has been quantified by novel methods. In particular shoulder models –including EMG driven models- have been developed to quantify the occupational loadings e.g. during monotonous work. Also, the biomechanical responses during a number of tasks performed have been measured in the work places as a basis for development of preventive strategies in job design. Specifically, for the light monotonous work delicate techniques were developed for the identification of repeated recruitment of single muscle fibres. Even the effect of mental load on muscle fibre activation has been studied.

About a decade later in the 1990'es biomechanics was also established as a discipline at the University of Southern Denmark at the Institute of Exercise Physiology and Biomechanics at the Faculty of Health Sciences with roots origination from the University of Copenhagen. Two lines of biomechanics were established: sports and clinical biomechanics. The sports biomechanics includes e.g. quantification of power in training studies that also encompassed the elderly, cycling including significance of internal power and muscle fibre composition, and even basic *in vitro* muscle mechanics. The clinical biomechanics focus is on low back pain and neck pain including research on whiplash patients and cervicogenetic headache. The scope of the clinical biomechanics research is to establish fundamentals for chiropractor treatment. This is the only university institute in the Nordic countries that offers an academic degree in chiropractic.

At the University of Aarhus - in parallel with Copenhagen - biomechanics was established as a

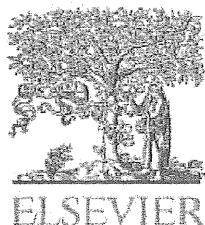
research discipline in the 1970'es. However, the line of research was quite different or complementary to that in Copenhagen. The focus here was – and still is - on orthopaedics including in particular bone mechanics and nested at the Faculty of Health Sciences. Testing and development of implants has attained international recognition. Biomechanics is also an important topic at the Orthodontic Department of the university's Dental School, where moving teeth using orthodontic applications is entirely based on biomechanical principles. Research includes both animal experiments and tissue reactions and the finite element analysis. Later, at the university hospital (Skejby) a research group developed novel biomechanical approaches in the area of fluid dynamics to be applied in cardiovascular research in particular heart functioning. Finally, in the late 1990'es an Institute of Sport Science was formed under the Faculty of Science including biomechanics in its curriculum. Presently, the institute concentrates on kinematics and tissue mechanics and plans to become a fully equipped gait and movement-analysis laboratory that will collaborate with the Orthopaedic Research Laboratory at the Faculty of Health Sciences.

The above presentation does not intend to reflect the full present state biomechanics research in Denmark but merely indicate the wide range of activities in this area. These spread from whole body kinematics in a variety of conditions, to general motor control aspects, and to specific tissue mechanics. During the last decades the research has matured to international recognition in many areas and collaboration with guest researchers is highly facilitated. There does not exist a Danish Society of Biomechanics but a European Society of Biomechanics that perhaps may intensify collaboration with the ISB? In any case the next ISB congress will be a welcome opportunity to invite many of our good colleagues and friends to participate in the Danish biomechanics research.

Gisela Sjøgaard
Member of the ISB

*Graduated from the University of Copenhagen,
presently professor at the National Institute of Occupational Health and associated to the
University of Southern Denmark*

**Step-by-step guide to online access to
Journal of Biomechanics
for members of the International Society of Biomechanics**



Journal of Biomechanics is now available online to Society members who subscribe to the journal only via a new site. For your free access to the journal online please follow these instructions.

1 - Activating access to *Journal of Biomechanics*

To activate access and to create your personal account, you will need your Elsevier Customer Reference Number. Your Customer Reference Number can be found on the mailing label of the paper issue of *Journal of Biomechanics*.

2 - Type in the following URL:

<https://cs.sciencedirect.com/activate/jbio/isb>

Note that "https://" MUST be entered for this URL – "http://" will not work. This is to ensure that your registration details are secured when you enter them into the registration form.

3 - Enter your Customer Reference Number and click on "submit".

The next step is completing a user profile. You will be asked to fill out a form and choose your own password. A username will be assigned to you. You will be notified of this. Both username and password will be case sensitive. After registration you can directly login with your new username and password.

Note – please do NOT use special characters, such as ö, ä, æ when entering your personal details into the profile form.

4 - Now you have registered you can go straight to:

<http://www.sciencedirect.com/jbio> and enter your personal username and password in the login bar on the top of the page

If you encounter any problems registering, please note that older browsers may not support SSL encryption, which is required for secure data transmission. Also, cookies must be enabled in your browser to support the registration process. Should you require any assistance, including if you cannot find your Customer Reference Number, please do not hesitate to contact the Customer Support department as follows:
Customers in North, Central & South America - Tel: +1 888 615 4500 (+1 212 462 1978 outside USA & Canada) Fax: +1 212 633 3680 Email: usinfo@sciencedirect.com
Customers in Europe, The Middle East & Africa – Tel: + 31 20 485 3767 Fax: +31 20 485 3432 E-mail: nlinfo@sciencedirect.com
Customers in Asia Pacific (incl. Australia) – Tel: +65 434 3727 Fax: +65 337 2230 Email: sginfo@sciencedirect.com
Customers in Japan – Tel: +81 3 5561 5034 Fax: +81 3 5561 5047 Email: jp.dls@elsevier.com

ISB Student Grant Update Alex Stacoff

The 2004 ISB student grants have been awarded to a total of 15 ISB student members. I would like to thank the reviewers for their time and effort in reviewing the original 21 applications: Mary Rodgers, Kit Vaughan, Rick Hinrichs, Peter Milburn, Michiyoshi Ae, Sicco Bus (Student Member).

Grant categories and recipients are listed below. Congratulations to the awardees, and good luck with your research work !

ISB Dissertation Grants (2000 US \$)

Recipient

Lamvohee, J.M. Steeve
Moran, Matthew
Morrison, Bryan
Rajagopalan, Sumitra
Seth, Ajay
Shyhalla, Katheleen
Smith, Jeremy
Xu, Chun

Institution

Anglia Polytechnic University, Chelmsford, U.K.
Pennsylvania State University, USA
Arizona State University, USA
University of Montréal, Canada
University of Texas at Austin, USA
The State University of New York, USA
Pennsylvania State University, USA
Drexel University, Philadelphia, USA

ISB Travel Grants (2000 US \$)

Recipient

Ardigo', Luca Paolo
Bosé, Dipan
Chaux, Christelle
Donoghue, Orna
Formenti, Federico
Tolley, Ivo
Yang, Yan

Institution

Manchester Metropolitan University; U.K.
University of Virginia, USA
CHU S. J. Bonnefonds Saint Etienne, France
University of Limerick, Ireland
Manchester Metropolitan University; U.K.
ETH Zurich, Switzerland
Anglia Polytechnic University, Chelmsford, U.K.

The recipients' reports will be published in the Newsletter.

Request for nomination of Honorary Members of the ISB

Honorary membership of the ISB is restricted to a few individuals whose work has made outstanding contributions to the development of Biomechanics.

These include the following:

Levan W. Chkhaidze, Russia; James G. Hay, New Zealand; E. Jokl, USA; Hideji Matsui, Japan; Mitsumasa Miyashita, Japan; Chauncey A. Morehouse, USA; Richard C. Nelson, USA; David Winter, Canada.

We invite the membership to nominate worthy candidates with material supporting the nomination for consideration by Council.

Please send nominations to:

Sandra J Olney, Past President ISB
School of Rehabilitation Therapy
Queen's University, Kingston, Ontario
Canada K7L 3N6
olneys@post.queensu.ca

**International Society of Biomechanics Travel Grant Reports
XIXth Congress, Dunedin, New Zealand, July 6th – 11th 2003**

**Zachary Domire, PhD Student
The Pennsylvania State University, USA
zjd100@psu.edu**

I would like to thank the International Society of Biomechanics for the grant to attend this meeting. Without these funds I would not have been able to afford the airfare to attend. I, like many other attendees, had a bit of an adventure getting to Dunedin as a result of the weather, but once there it was an excellent meeting.

I presented an abstract titled Effect of Squat Depth on Maximal Height Vertical Jumping. This was part of my doctoral dissertation. I had the chance to speak with several attendees about my work while at the meeting and received valuable feedback. I strongly believe opportunities such as this strength research greatly.

There were a number of wonderful presentations at the meeting. Keynotes by Stuart McGill, Roger Enoka, and Jesus Dapena were both entertaining and educational. The Muybridge Lecture given by Tetsuo Fukunaga was excellent as well.

I would also like to thank the organizers for the wonderful social and recreational activities planned. The chance to see Dunedin and some of the country was a great experience.

Again I would like to thank the ISB for giving me the opportunity to attend the congress and I looking forward to the next meeting in Cleveland.

**Christopher J. Hasson
University of Massachusetts, USA
Biomechanics Laboratory**

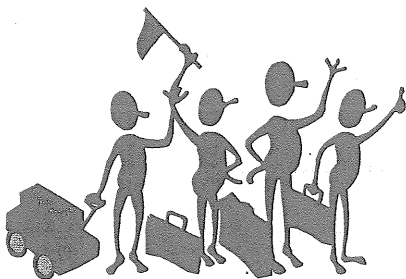
Travel to the ISB XIXth Congress in New Zealand was a unique experience in many respects: geographically, I had never traveled to another continent; scientifically, I had never been to such a large conference (especially one focused on biomechanics); socially, I had never met with so many great scientists.

I would often receive a notice about a very interesting conference through the biomechanics listserve BIOMCH-L, only to be saddened by the fact that it was on some far away continent that would require a pricy plane ticket in order to attend. I was extremely excited that I could finally attend one of these conferences through the help of the ISB.

It was of great value to be able to place faces with the many names that I have become familiar with over the course of my study as a graduate student. Many of the prominent scientists were extremely kind and eager to converse about things ranging from the best methods of optimization (modeling and simulation), to the best place to have a drink. The end result was to fortify my love of science, and help in opening my mind to many different ideas and viewpoints.

With all of these revelations, I almost stopped worrying about my podium presentation, which was on the bulk of my masters thesis research. However, the presentation went very well. I gained valuable experience and engaged in some excellent discussions. Fortunately, my talk was on the first day of the conference, which allowed me to focus exclusively on the many great talks that followed.

Of course, these wonderful experiences would not have been possible without the generosity of the ISB. Thank you for giving me the opportunity to grow as a scientist.



Tim L. A. Doyle, PhD Candidate
Edith Cowan University, Perth, Australia
t.doyle@ecu.edu.au

Sean Craig, M.Sc.,
University of Calgary, Canada

I would like to thank the International Society of Biomechanics for the opportunity to attend the most recent ISB Congress in Dunedin. The student grant program they run is an excellent opportunity for students to gain experience in writing grants, attendance and presentation at an international conference, and exposure to the wider biomechanics community.

With my presentation scheduled for Monday, I felt a slight panic at the airport Saturday when told that we would not be flying into Dunedin because the airport was closed; they would try again Sunday. Fortunately, we did fly out Sunday arriving in Dunedin that afternoon. Together with other delegates, we made our way from the airport and were impressed with the St. Margaret's College accommodation.

After my presentation on Monday afternoon I had a number of people approach me to ask further detail. It was nice to know that others had an interest in my work.

The next four days then provided time to relax and take in many of the other sessions and keynote speeches. In particular, the forensic biomechanics session was quite memorable. By listening to many of the researchers present, a better appreciation of how others do their research was gained, this is of great benefit as it allows me to expand my field of vision when it comes to conceiving, developing, and performing my research. It is also good to be able to put faces to many of the names previously only seen in journals and books. For me, I find that conferences are an excellent means by which to re-invigorate your interests... and develop new interests. In my case, I found this particularly so as I had only recently finished my Masters and was just two weeks into my PhD.

There were quite a number of students at the congress, and it was good to catch up with many that I had previously studied with. It also provided the opportunity to meet new students from many parts of the globe. In particular, the social program helped to facilitate this process.

Again, thank you to the ISB for this opportunity.

I would like to begin by thanking the International Society of Biomechanics Council for awarding me a congress travel grant. I am privileged to have had the chance to travel to the other side of the world to Dunedin, New Zealand to participate in the XIXth ISB congress.

I learned a great deal from this experience. I was presented with many different ideas from many different areas of biomechanics. I attended all the sessions that were related to my area of research as well as those that were of personal interest. There were so many interesting sessions, making it hard to decide which presentations to attend at any given time. I found that the presentations I attended exposed me to new information and knowledge, which I know will help me to better understand my work and the area of biomechanics as a whole.

The presentation I gave at the congress was a portion of my thesis work in the area of cartilage biomechanics. The title of my presentation was "The Effects of In-Vivo Joint loading on Articular Cartilage Cell Viability." It was exciting to present this work in such a highly scientific setting. Following my presentation suggestions were made which may further expand my own research.

During my stay in Dunedin, I also took time to enjoy the amazing scenery, with trips to the albatross and penguin colonies on the peninsula. I also enjoyed the sights and sounds of the city of Dunedin. After the conclusion of the conference, I was lucky enough to spend some time traveling throughout the southern and northern island. Alas there was so much to see and so little time. I will defiantly be returning to New Zealand to further explore its remarkable diversity.

In summary, my travel to New Zealand for the ISB congress was an amazing experience. I was exposed to different cultures, obtained invaluable educational and research experiences, and discovered new friends. I would once again like to extend my sincere appreciation and thanks to the International Society of Biomechanics for helping fund my attendance of the XIXth ISB congress.

Carol Scovil
University of Calgary, Canada
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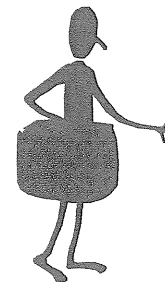
Many Thanks to the ISB who generously supported me with a US\$1000 Congress Travel Grant to attend the XIXth ISB congress in Dunedin, New Zealand last summer. This grant helped cover the costs of travelling from Calgary, Canada first to Sydney, Australia to attend the International Society of Computer Simulation in Biomechanics (ISCSB) pre-symposium, and then on to the main event in Dunedin. Both conferences were very worthwhile and enjoyable.

The ISCSB symposium was held at the Manly Quarantine Station on the north shore of Sydney harbour. This was a really beautiful environment in which to stay, quite remote (it felt almost 'summer cottage' like to us Canadians), but within walking distance of the Manly Beach area. The conference itself was great - a good sharing of ideas and we really got to know each other well. I gave a presentation paper here entitled The Sensitivity of a Gait Simulation of Rotational Malunion of the Tibia (Scovil and Ronsky). This work was well received, and I got some very helpful questions and advice from other modellers. We were also given a chance to learn more about the history of Sydney and the Quarantine Station by going on a 'Ghost Tour' of the station, to find out about the people who were accommodated here when they first arrived to Australia on ships. This, in addition to seeing many other researchers' work, made for a very useful and enjoyable conference.

There was a group of us who travelled together from the ISCSB to ISB in Dunedin, with a few delays for the snow that had fallen in southern New Zealand. As a Canadian, it seemed amazing that the only de-

icing resource available was to drive the plane into the hangar where the snow could melt off! ISB itself was really well organized, with many interesting presentations. I learned a lot, and again got some helpful feedback to my poster presentation, An Analytical Approach for Evaluation of the Sensitivity of a Hill Based Muscle Model (Scovil and Ronsky). Dunedin itself was a beautiful city, and the conference organizers ensured that we got a chance to experience both the ancient Mauri culture, and the modern 'sitting by a warm fire in a pub' winter in NZ culture. I was fortunate to be able to take some time to travel in NZ after ISB, and it was fun to run into Biomechanists all over the country, who were also touring around. In addition, the weather cooperated for us tourists, if not for the conference organizers, as it rained (and snowed) while we were inside for the conference, and was sunny and beautiful for the two weeks afterwards.

This conference was a great opportunity for me, especially coming so close to the completion of my thesis. The feedback I received, as well as the exposure other work has been invaluable as I have finished writing my thesis. I wish to express my gratitude to the ISB for the travel grant which made it possible for me to attend this event.



International Society of Biomechanics Student Dissertation Grant Reports

Kristin Lee Miller
University of Alberta, Canada

This has been a year of changes and frustration for me. My original dissertation project was a collaborative project that was to quantify the quality and health of the bone at the implant interface in a primate model under controlled dynamic loading and monitor

changes in the bone-implant interface with the Perio-test® and Resonance Frequency Analysis. Unfortunately, the main source of funding for the project fell through and as a result a new project had to be decided upon—one that was similar enough that I did not lose two years of work. I was fortunate to get such a project with orthodontics.

Orthodontic treatment requires application of force systems to individual teeth or groups of teeth, which results in a cellular response with periodontal ligament and alveolar bone remodeling. The forces applied must be of sufficient magnitude and duration to exceed the normal physiologic threshold associated with daily oral function. Excessive force levels will result in areas of tissue necrosis with delayed tooth movement and increased risk of root resorption. Although orthodontic tooth movement is achieved in a large segment of the population, the optimum force level has not been defined. The optimum force for tooth movement depends on individual root geometry as well as biologic characteristics of surrounding tissue including bone density, periodontal thickness, and fluid dynamics.

The purpose of my research (currently) is to develop and test a biomechanical model of the tooth and supporting tissues for distal movement of the human maxillary canine tooth in response to various force systems that produce different levels of stress in the supporting tissues. Additionally, a split-mouth experimental study will be done in which two known compressive stress levels (13 and 22 kPa) will be applied to the canines using customized activated T-loops. The objectives for the experimental study are: evaluation of the rate of bodily tooth movement, monitoring the changes in the supporting tissue using the Periotest®, and evaluation of an implant placed in the roof of the mouth (palatal implant) for orthodontic anchorage in adolescent patients.

In the past year, we have been involved in the preparation for the experimental study: finalizing the proposal and protocol for the study, obtaining both ethics approval for the project from the University of Alberta and Health Canada approval for the use of the palatal implant in adolescent patients. We are building a spring tester to measure the forces generated by an activated T-loop to verify the forces calculated numerically. (In the orthodontic clinic, the geometry of the activated T-loops will be measured and used to numerically calculate the forces.) In addition, we are working on a two dimensional dynamic model of a tooth response to a mechanical impact. This will model instruments such as the Periotest® which is designed to measure impact response. Since the dynamic tooth response is governed by the characteristics of the periodontal ligament (PDL), analysis of the raw signal obtained from the Periotest® will allow for the mechanical properties of the PDL to be evaluated during the retraction. A Periotest® has been purchased for our lab and the funds from the ISB grant were used to purchase a laptop computer to facilitate data acquisition and analysis from patients. This is required since the research and data acquisition is being done in a clinical setting, not a typical

lab environment. As a result it was imperative that any data acquisition had to be mobile and unobtrusive to both the patient and the orthodontist. Shortly we will be starting the experimental study and thanks to ISB for their financial support through the Matching Dissertation Award we have the equipment in place to properly perform the data acquisition and analysis required in the study.

Pui Wah Kong
School of Sport and Exercise Sciences,
Loughborough University, UK

I would like to thank the International Society of Biomechanics for the Student Dissertation Award. My current research is to investigate the mechanics of takeoff in springboard diving using a computer simulation model.

In springboard diving, the diver aims to obtain height thus time in the air; generate sufficient angular momentum for somersault and/or twist; and travel safely away from the springboard. The amount of linear and angular momentum are all determined during the takeoff phase. As rotational requirement increases, there is a compromise in obtaining height in the air. It is therefore crucial to understand the mechanics of takeoff in terms of generating linear and angular momentum.

An eight-segment simulation model of a diver and a springboard was developed. Wobbling masses were included within the trunk, thigh and shank segments to represent soft tissue movement. The springboard was represented by a 0.3m rod with vertical, horizontal and rotational motion. The foot-springboard interface was modelled using three pairs of normal and perpendicular massless damped springs acting at the toes, ball and heel.

A high speed video camera was used to record an elite female diver performing dives in the forward and reverse groups from a one-metre springboard. Kinematic data and the springboard parameters were determined from the video recordings. Subject-specific segmental inertias were calculated from anthropometric measurements. An angle driven model was used to determine spring parameters by optimising the match between simulations and recorded dives. The difference was less than 10% / 10° in takeoff variables.

The spring parameters obtained will be used in a torque driven model with torque generators acted at the shoulder, hip, knee and ankle. A 10-parameter function based upon isokinetic dynamometer meas-

urements will be used to represent the torque-angle-angular velocity relationship. The model will be evaluated by finding activation timings which minimised the difference between simulation and performance. After satisfactory evaluation, the model will be used to investigate takeoff techniques and to optimise diving performances. I look forward to present my results in the coming XX ISB Congress in Cleveland. Thanks again to ISB for their financial support and encouragement to young researchers.

Steven Jones
University of Bradford, UK.
s.f.jones1@bradford.ac.uk

The ISB awarded me \$2000 to assist my research into unilateral lower-limb amputee balance and postural control. The funds were mostly used in purchasing a computer and software licence. This has enabled me to process and analyse motion capture data away from our biomechanics laboratory, which is heavily used for teaching and other research projects. Funds have also provided consumables, necessary to keep the research program running.

The purpose of my research program is to determine the balance and postural control adaptations employed by unilateral lower-limb amputees during 'everyday' functional tasks involving a gait initiation. Because of the observation that amputees tend to lead with their sound limb when ascending steps/stairs and with their prosthesis when descending steps/stairs, the study begins by investigating the gait initiation process when performing a single step up or down to a new level.

During the initiation of gait there is a separation of the centre of mass (CM) and the centre of pressure (CP). Studies involving able-body individuals have reported that lower limb muscle activity (plantar/dorsiflexor and rectus femoris) during this period moves the CP backwards, and swing limb hip abductors tend to move the CP towards the swing limb (Jian et al., 1993). This results in a forwards and towards the stance limb movement of the CM. At swing limb heel-off (ending the first phase of the gait initiation process) further muscle activity (swing/stance limb hip abductors) unloads body-weight from the swing limb, resulting in a rapid movement of the CP across to the stance limb. Because muscle activity across the ankle and hip joints has an important role in the gait initiation process, disruption to the musculo-skeletal system, for example, through amputation, will introduce limitations that require compensatory balance and postural control adaptations. The ability of unilateral lower-limb

amputees to perform a single step upwards or downwards will be severely affected because of the loss of the foot and ankle musculature and the reduced availability of important sources of proprioceptive and somatosensory feedback (e.g. that which usually originates from cutaneous receptors within the foot and leg).

It is likely that because amputees tend to lead with their sound limb when ascending steps/stairs and with their prosthesis when descending steps/stairs, the adaptations used during stepping up and down will be different. To highlight such adaptations, data collected for a group of transfemoral (TF) and a group of transtibial (TT) lower-limb amputees were compared to that collected for a group of able-body individuals.

The study, which is being undertaken at the University of Bradford, has been going for 12 months, and within this time I have collected and analysed data from ten amputee subjects (5 TF and 5 TT) and eight able-body control subjects. Subjects perform repeated single steps upwards and downwards to heights of 73 (low step) and 219 mm (high step). These heights are equivalent to stepping up to a kerb or on to a bus respectively and thus represented 'everyday' functional tasks. Motion data are captured using a Vicon 5-camera system and each subject is modelled using a standard linked segment model, with whole-body CM being calculated using anthropometric regression equations supplied by Dempster (1955). Using splines quintic multiple point interpolation CM and CP trajectory data for each subject are normalised to 100 points across the total movement time (i.e. initiation to swing limb foot-contact). An 'ensembled average' CM and CP trajectory for each subject group is used to qualitatively highlight differences in the interaction of the CM and CP between each subject group. Quantitative differences are also determined.

My initial study, which I presented preliminary findings of to the 2nd International Conference, for 'Biomechanics of the Lower Limb in Health, Disease and Rehabilitation' held in Salford, Manchester, UK, September 1st - 3rd 2003, was solely concerned with stepping up. The stepping movement was divided into two phases, the anticipatory postural adjustment (APA) phase (Brenière et al., 1981) and the step execution (SE) phase (Gélat and Brenière, 2000). Temporal parameters (expressed as a percentage of the total movement time), CM and CP peak displacements and peak CM velocities for each subject at each step height were used to determine mean and standard errors of the mean (SEM) for each subject group. Differences between the able-body group and each of the amputee sub-groups were assessed by evaluating magnitude of effects (effect size, ES,

Cohen, 1969), and by assessing qualitative differences in the 'ensembled' average CM and CP trajectories.

Findings suggest that, compared to able-body controls, unilateral lower-limb amputee individuals developed most of their forward momentum whilst their swing limb (sound limb) was still on the ground, and this allowed them to use their prosthesis as a rigid lever during the subsequent single-support phase when stepping up to a new level.

My second study, which is currently on-going, compares the gait initiation process for stepping up and stepping down. Initial findings indicate the CM and CP trajectory interactions are different for the two stepping conditions. These findings tend to suggest that the gait initiation process is not a fixed motor program, but instead is determined by the mechanical and/or safety requirements of the task. I hope to extend these findings by looking at the postural control adaptations of lower-limb amputees during performing a gait termination process when stepping up or down to a new level.

I would like to thank the International Society of Biomechanics Student Grants Committee for selecting my research to receive the ISB Student Dissertation Award. I look forward to presenting my research findings at the next ISB congress.

References:

- Brenière, Y., Do, M.C., Sanchez, J., 1981. A biomechanical study of the gait initiation process. *J. Biophys. Med. Nucl.* 5, 197-205.
- Cohen, J., 1969. *Statistical power analysis for the behavioural sciences*, second edition. Academic Press, New York
- Dempster, W.T., 1955. *Space requirements of the seated operator*. Wright Patterson Air Force Base, OH: WADC Technical Report, 55-159.
- Jian, Y., Winter, D.A., Ishac, M.G., Gilchrist, L., 1993. Trajectory of the body COG and COP during initiation and termination of gait. *Gait Posture* 1, 9-22.
- Gélat, T., Brenière, Y., 2000. Adaptation of the gait initiation process for stepping on to a new level using a single step. *Exp. Br. Res.* 133, 538-546.

Notes from the archives

John Challis

In the archives are correspondence about the forming of the society, here follows some of the pertinent information.

The decision to establish the society was made at the 3rd International Seminar on Biomechanics held in Rome in 1971. This meeting was organized by the "Working Group on Biomechanics" which was part of the International Council of Sport and Physical Education, which itself was part of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). At this meeting on September 29 it was voted to form the ISB at the next meeting.

Seven questions were posed to those present at the 3rd International Seminar on Biomechanics in Rome, those questions included,

- Whether to form an international society?
- How often should conferences be held?
- What membership fees should be charged?

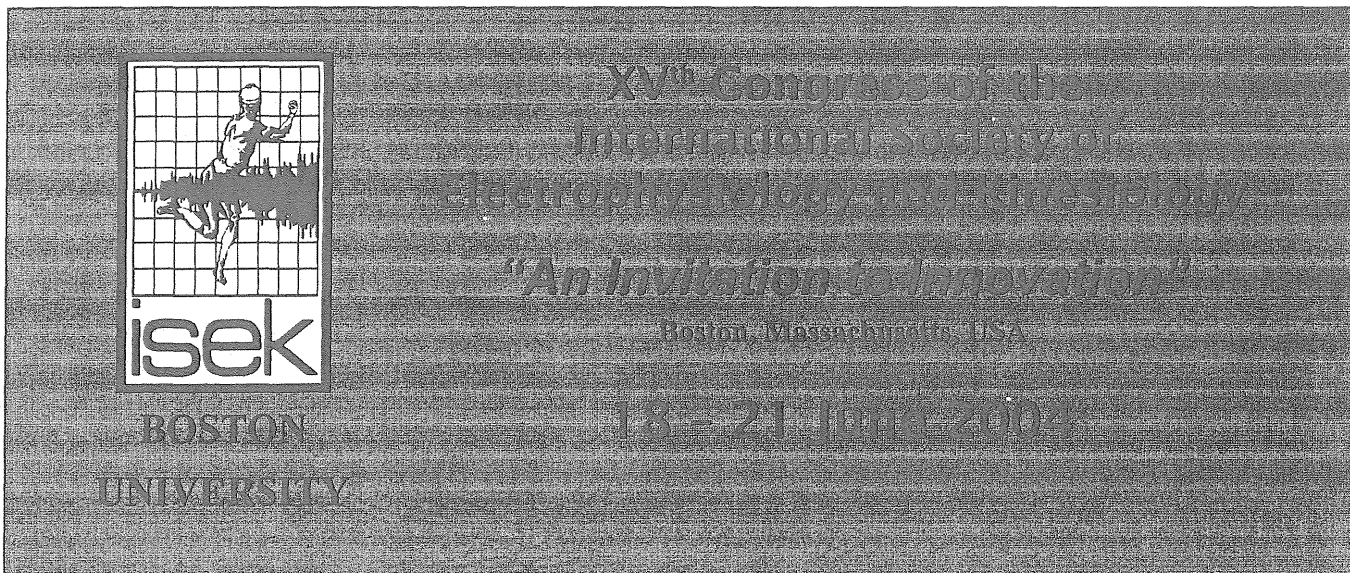
It was agreed to form the society (59% in favor), that conferences should be every two years, and people were prepared to pay an annual membership fee of \$3 (currently 2.44 Euros). At the time the abbreviation used for the International Society of Biomechanics was ISOB. The next meeting was scheduled for Penn. State University where delegates were infor-

med that "room and food" would be "about \$8". Time has seen many more meetings, the adoption of ISB as the abbreviation for the society, and an increase in the cost of both the membership fee and conference accommodation.

The 4th International Seminar on Biomechanics was held at Penn. State University from August 26 until August 31, 1973. The constitution was voted on and approved on August 29th. Two hundred and fifty of those present became charter members of the society.

An unusual aspect about the formation of the ISB is that it pre-dates the formation of most national societies. One of the earliest formed was the Canadian Society for Biomechanics (Société Canadienne de Biomécanique) which was formed at the end of 1973, the European Society of Biomechanics was formed in 1976. If any of your national societies were formed before 1973 please let me know and I will present the information in a future newsletter.

[The ISB has an archive of its important materials, kept at Penn. State University. 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).]



Letter from ISEK to ISB Membership

Dear Members of ISB,

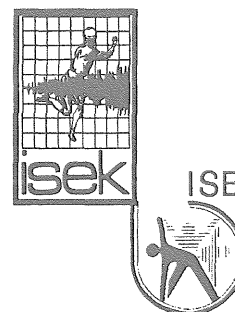
As we rapidly approach the ISEK2004 Congress date, we want to take a moment and express our appreciation for the long-standing interest shared by the ISB and ISEK societies. ISEK members have traditionally looked forward to the ISB Congresses and your membership have likewise supported ISEK when we hold our biennial Congress. It is a pleasure to have shared such a long history of common areas of interest and we will continue to maintain our interests in the related areas of scientific endeavor.

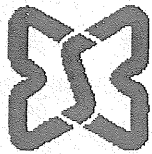
Our theme for ISEK2004 is: "An Invitation to Innovation", which is intended to recognize the tremendous advancements that have taken place in technology and methods in Kinesiology and Electrophysiology since the first ISEK Congress 30 years ago. In fact, one need not look back 30 years to recognize such change; it is obvious just in the past decade, or less. We have tools and methods at our disposal that have completely changed the way we conduct our research and pursue our ideas. The end product of such advancement is new knowledge and information as well as products that enhance human performance for persons needing to improve the quality of their lives. ISEK2004 will be held in Boston, a city known for academic achievement and

scientific innovation as well as music, art, history, and diverse culture. It will feature 17 Scientific Tracks and workshops on Dynamics of Movement, Incontinence, Motor Unit Decomposition, Occupational Injuries, and Prosthetics & Orthotics. Minisymposia on Functional Tissue Engineering for Restoration of Ligamentous Knee Injuries, Spinal Pain Disorders, and TMS and Movement/Sensation will be included. We are pleased to continue to offer a combined ISB/ISEK program session which will be chaired by the past president of ISB, Dr. Gunther Rau and the current president of ISEK, Dr. Hermie Hermens. Awards include the John Basmajian Student Award for Best Presentation or Poster and a DelSys Prize for EMG Innovation.

website: <http://isek2004.bu.edu>

email: info@isek.bu.edu





European Society of Biomechanics Conference 2004

4 – 7 July 2004, 's Hertogenbosch, The Netherlands.

Organization: Dept. of Biomedical Engineering,
Eindhoven University of Technology.

Conference Chairman: *prof. Frank Baaijens*

The 14th European Society of Biomechanics (ESB) conference in 's-Hertogenbosch aims to bring together scientists from all over the world to discuss a broad range of topics in biomechanics. Conference themes are centered on both well-developed and emerging biomechanics research areas. The aim is to attract researchers from a variety of disciplines, including biology, solid and fluid mechanics, clinicians etc. The conference is organized around six tracks:

1. Cardiovascular and Biofluid Mechanics (Frans van de Vosse)
2. Tissue and Cellular Engineering (Frank Baaijens)
3. Soft Tissue Biomechanics (Jacques Huyghe)
4. Bone Mechanics (Bert van Rietbergen)
5. Orthopaedic and Dental Biomechanics (Rik Huiskes)
6. Musculo- Skeletal Dynamics (Frans van der Helm)

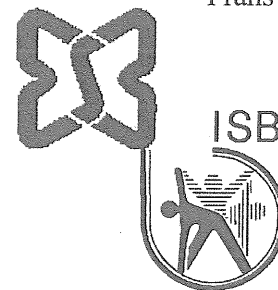
Of interest for many of the ISB members will be the focus on orthopaedic and musculoskeletal biomechanics, next to the cardio-vascular and tissue biomechanics topics which have a long-lasting history at the ESB conferences. Many well-known scientists from inside and outside Europe have contributed to the conference.

In the orthopaedic and dental biomechanics track there will be special sessions on implants, fracture healing, spine orthopaedics and joint stability. In the musculo-skeletal dynamics track special sessions are organized for the control of gait, balance control, muscle dynamics, proprioceptive control and shoulder biomechanics.

The shoulder biomechanics mini-symposium is organized by DirkJan Veeger, as a representative of the International Shoulder Group. The ISG is a technical group within the ISB, and attempts to bring researchers in upper extremity biomechanics in contact with each other. The mini-symposium is one of the indicators to show the close ties between the ESB and ISB organizations in promoting biomechanics research. More information about the scientific programme, registration, accomodation, etc. can be found at the website:

<http://www.esb2004.tue.nl/>. I hope to see you all in 's Hertogenbosch!

Frans van der Helm



Editor's notes and requests

Untill now, there have been no responses on Lutz Bauers gyro puzzle in the March Newsletter. Maybe this was too difficult for the Newsletter readers? Proof that this is not the case in the next Newsletter. Deadline is 15th of August. Next issue will among other thing give a resume of the upcoming council meeting and maybe the result of the ongoing survey. Talking about the survey take the chance to give your opinion also about the Newsletter. How offen do you read it

and would you prefer it in an electronic version? Untill then for the next paper version Newsletter; descriptions about past and current biomechanics activities in the local societies or in your country are still most welcome. And so are factual and anecdotic information about the ISB history exist. Get inspired by this issues story from the archives. Please send your contribution in electronic form in any form of English to ks@ami.dk

Karen Søgaard, Newsletter Editor

Upcoming Meetings, Workshops

2004

ISEK XV

International Society of
Electrophysiology and
Kinesiology

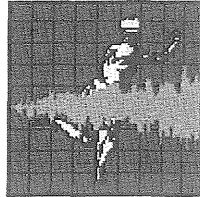
Dates: June 18-21, 2004

Venue: Boston University,
Boston, MA, USA

Information:

E-mail: Dr. Serge Roy, sroy@bu.edu

See website: <http://isek2004.bu.edu/>



CSB XIII

Canadian Society for Biomechanics / Société canadienne de biomécanique

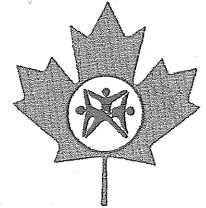
Dates: August 4-8, 2004

Venue: Westin Hotel, Halifax

Information:

Contact: Dr. Cheryl Kozey, Dalhousie University, Halifax, clk@dal.ca

See website: <http://www.csb2004.ca>



ESB 2004

The 14th European Society of
Biomechanics conference

Dates: July 4-7, 2004

Venue: 's-Hertogenbosch

Eindhoven University of

Technology, Department of Biomedical Engineering,
P.O. Box 513, 5600 MB Eindhoven, The Netherlands

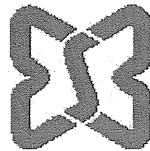
Tel: + 31 40 24 72 851

Fax: + 31 40 24 47 355

Information:

E-mail: esb2004@tue.nl

See website: <http://www.esb2004.tue.nl>



ISBS XXII

International Society of
Biomechanics in Sports

Dates: August 9-12, 2004

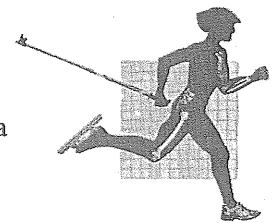
Venue: University of Ottawa
Ottawa, Ontario, Canada

Information:

E-mail:

ISBS2004@uottawa.ca

See website: <http://www.health.uottawa.ca/isbs2004/>



ICVPB 2004 Marseille



International Conference on Voice Physiology
and Biomechanics

Dates: August 18-20, 2004

Venue: Marseille (France)

Information:

E-mail: agiovann@ap-hm.fr

See website: <http://icv2004.free.fr>

The IASTED International Conference on BIOMECHANICS

INTERNATIONAL ASSOCIATION OF SCIENCE
AND TECHNOLOGY FOR DEVELOPMENT

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Dates: August 23-25, 2004

Venue: Honolulu, Hawaii, USA

Information:

See website: www.iasted.org

5th Triennial International Hand & Wrist Biomechanics Symposium

Dates: September 7, 2004

Venue: Syracuse, New York

Information:

E-mail: wernerf@upstate.edu

See website:

<http://www.upstate.edu/ortho/handmtg.htm>



The Fifth Australasian Biomechanics Conference.

Dates: December 9-10, 2004

Venue: The University of New South Wales, Kensington.

Information: Email: abc5@unsw.edu.au

2005

American Society of Biomechanics, Annual Meeting Dates:

September 8-11, 2004

Venue: The Lloyd Center Ballroom

Doubletree Lloyd Center Hotel

Portland, Oregon

Information:

Email: Dr. Michael Bootlang, mbootlang@lhs.org

See website:

<http://www.legacyhealth.org/healthcare/research/asbcnf.ssi>



ISB XX

International Society of Biomechanics Congress

Dates: 1-5 August 2005

Venue: Cleveland, Ohio, USA

Information:

E-mail: info@isb2005.org

See website:

<http://www.ISB2005.org>



5th Conference on Engineering of Sport

Dates: September 13-16, 2004

Venue: University of California, Davis

Sponsored by International Sports Engineering Association and Bioengineering. Division of ASME

Information:

See website: <http://conferences.ucdavis.edu/sportengr>



ISPGR XV

International Society for Postural and Gait Research

Dates: tba

Venue: Marseille, France.

Conference Hotel: tba

Information:

Dr. C. Assisante

See website: <http://www.ispgr.org/index.html>



Third International Workshop on Virtual Rehabilitation



Dates: September 16 and 17, 2004

Venue: EPFL, Lausanne Switzerland,

Information

Email: Daniel Thalmann and Greg Burdea, Cochairs,

2004@iwvr.org

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

2006

5th World Congress of Biomechanics

Dates: 29 July – 4 August 2006.

Venue: Munich, Germany

Information:

Email: Prof. Dr.-Ing. habil.

Dieter Liesch, info@WCB2006.org

See website:

<http://www.wcb2006.org/>

Munich, Germany – July 29 – August 4, 2006

V. World Congress of Biomechanics

First Announcement



ISB Membership News – New Members

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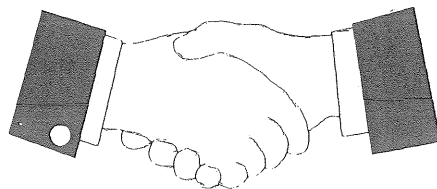
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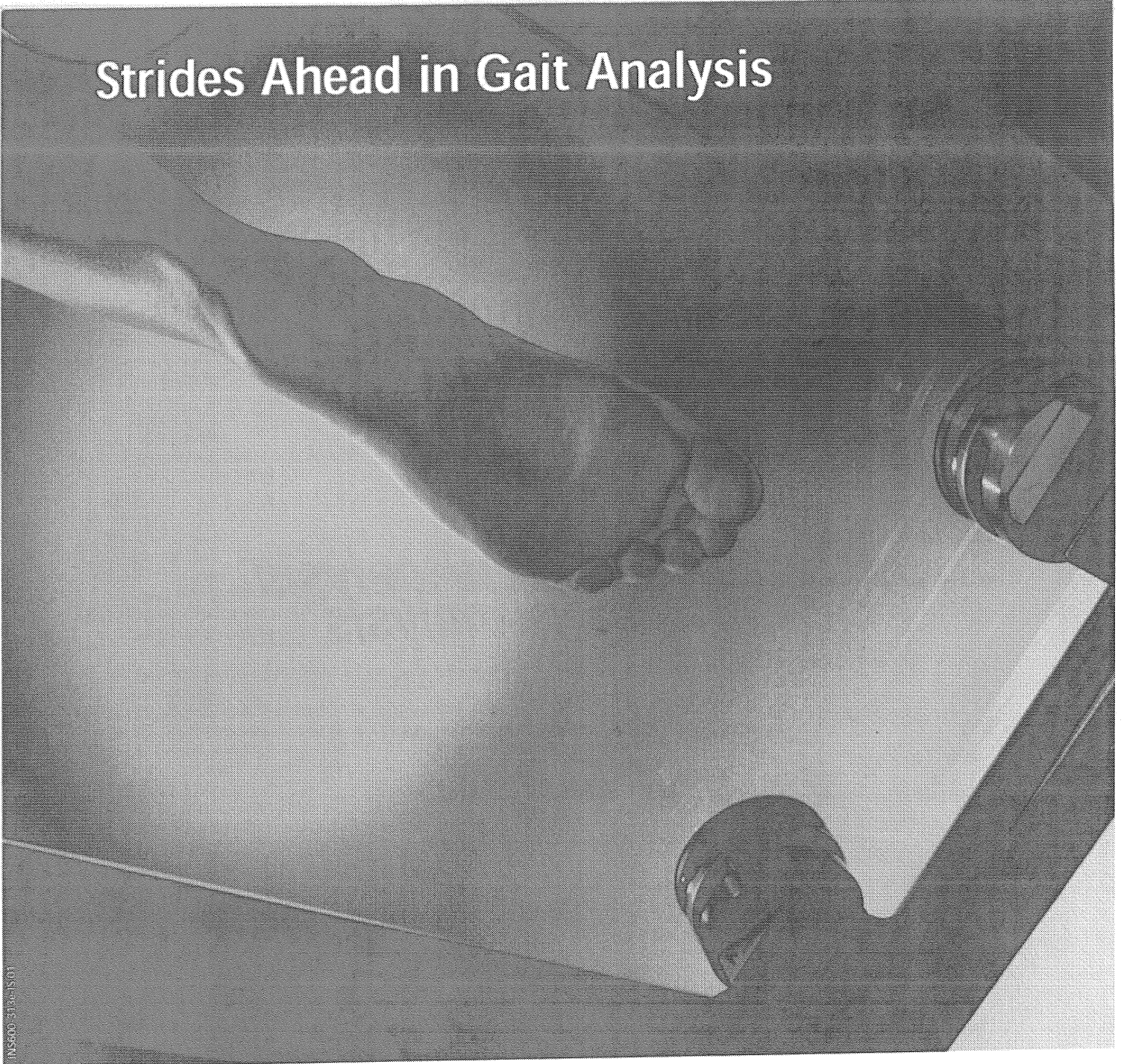


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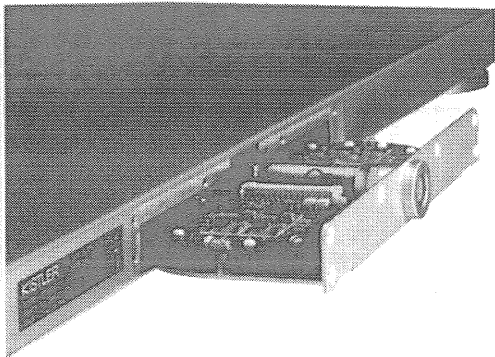
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