



International Society of Biomechanics Newsletter

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ISB Officers

PRESIDENT

Dr. Peter R. Cavanagh
The Centre for Locomotion Studies
Room 10, I.M. Building
Pennsylvania State University
University Park, Pennsylvania
U.S.A. 16802
Tel: + 1 814 865-1972
Fax: + 1 814 863-4755
E-Mail: prc@ecl.psu.edu

PRESIDENT-ELECT

Prof. Dr. Günter Rau
Helmholtz-Institut für
Biomedizinische Technik
Pauweisstraße 20
D-52074 Aachen
GERMANY
Tel: (0241) 80-7111
Fax: (0241) 8888-442
E-mail:

PAST PRESIDENT

Dr. Ronald Zernicke
University of Calgary
Department of Surgery
3330 Hospital Drive N.W.
Calgary, Alberta T2N 4N1
CANADA
Tel: + 1 403 220-8666
Fax: + 1 403 283-5666
E-Mail: zernicke@acs.ucalgary.ca

SECRETARY-GENERAL

Dr. Christopher L. (Kit) Vaughan
University of Virginia
Motion Analysis Laboratory
2270 Ivy Road
Charlottesville, Virginia
U.S.A. 22903
Tel: +1 804 982-0893
Fax: +1 804 982-1727
E-Mail: kvaughan@virginia.edu

TREASURER and NEWSLETTER EDITOR

Dr. Graeme A. Wood
Department of Human Movement
The University of Western Australia
Nedlands, WA 6907
AUSTRALIA
Tel: + 61 9 380-2361
Fax: + 61 9 380-1039
E-Mail: gwood@uniwa.uwa.edu.au

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AFFILIATE SOCIETIES OF ISB:

American 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; Japanese Society of Biomechanics; Korean Society of Sport Biomechanics; Polish Society of Biomechanics; Russian Society of Biomechanics; Société de biomécanique (France).

ISB News

FROM THE PRESIDENT - Peter Cavanagh

In my first message to ISB members, I want to say how privileged I feel to have been given the helm of such a thriving scientific society - thanks in large part to the efforts of my predecessors in this position. I particularly want to thank on your behalf Past President Ron Zernicke who led the Society so effectively in his two years of office. It is also an appropriate time to recognize Professor Aurelio Cappozzo - who leaves the Executive Council after 6 years in the Presidential chain of succession - for his many important contributions to the Society. We also owe thanks to retiring Council members Drs. Micheline Gagnon and Francis Goubel for their fine service to the Society.

The elections that were held in June have provided us with an energetic group who will be working on your behalf over the next two years. Professor Günther Rau from Germany is our new President-Elect and we welcome to the Executive Council Dr. Ton van den Bogert of Canada and Dr. Brian Davis from the United States. The other members of Council who continue into the 1995-1997 term are:

- Dr. Graeme Wood (Newsletter Editor and Treasurer)
- Australia
- Dr. Kit Vaughan (Secretary general) - South Africa
- Dr. Fred Yeardon - United Kingdom
- Dr. Alf Thorstensson - Sweden
- Dr. Sandra Olney - Canada
- Dr. Bruce Elliott - Australia
- Dr. Toshio Moritani - Japan
- Professor Savio Woo - United States
- Professor Mont Hubbard - United States

As you will read elsewhere, this will be the last edition of the Newsletter that is Edited by Graeme Wood. Graeme has carried the heavy burden of holding two important offices for the Society over the last 4 years and the results of his efforts are apparent in the excellent quality of the Newsletter. We offer Graeme our kudos for a job well done and look forward to seeing the directions in which the new editor, Dr. Mark Grabiner of the United States, will take the Newsletter in 1996.

The most important scientific event sponsored by the ISB is the biennial international Congress and this summer has seen one of the most successful Congresses ever organized by the Society. The events began during the last week in June with well attended Satellite meetings of the ISB Working Group on Functional Footwear in Köln, Germany and of the ISB Technical Group on Computer Simulation in Jyväskylä, Finland. Following a day of tutorials, more than 600 scientists gathered in Jyväskylä on July 2, 1995, for the XV Congress of the

ISB for a week of meetings. Those of us who attended will long remember the excellent scientific program, the varied social events, and exciting feeling of being part of a thriving society. Drs. Paavo Komi, Kari Keskinen and Heijo Häkkinen worked tirelessly with a small army of helpers over many months to stage a meeting that has set new standards for excellence in organization and content.

Planning is already well underway for the XVI Congress of the ISB which will be held from Monday August 25 to Friday August 29, 1997 at the Komaba campus of the University of Tokyo. The joint congress chairs are Drs. Mitsumasa Miyashita and Tetsuo Fukunaga and they and their staff have already published the first announcement. The Congress organizers are well aware of the reputation that Japan has for being an expensive place to visit and they have a number of plans that will make this a remarkably affordable Congress. Please plan to be there and to present some of your best work at the Congress.

As you are probably aware, the Executive Council of the ISB meets each year to discuss the business of the Society and I would like to present a brief synopsis of some of the items that were discussed by the Council in Finland. The Society is in good financial health and this is enhanced by the contributions of our commercial sponsors and supporters. We intend to mount a significant membership drive over the next two years in conjunction with a stricter policy on timely payment of membership dues. We would particularly like to increase the membership and participation of students in the Society. One of our most important initiatives in the past two years has been the collaborative program with countries who are "economically developing". We have been joined in this effort by the American, Canadian and Japanese Societies of Biomechanics by the British Society of Sport and Exercise Sciences. This support has enabled us to sponsor visiting lecturers and to provide student awards, principally to countries that were part of the former eastern block. We continue to receive requests for affiliation from other societies and currently list nine national societies as affiliates - the latest being Russia and the Czech republic. Cooperation with discipline related international societies (notably ISEK and ISBS) is being actively explored and we will continue to cooperate in the sponsorship and planning of symposia with the committee of the World Congress of Biomechanics that is held each four years. The association between the ISB and the Journal of Biomechanics will continue. Although the Journal no longer publishes the abstracts of the scientific meetings of any society, papers written by ISB Congress keynote lecturers will continue to be submitted to the Journal of Biomechanics and, following the usual review process, will appear throughout the year in the Journal.

Finally, let me stress that it is my goal to ensure that the Society continues to serve the needs of the biomechanics community using the very latest technological tools at our disposal. I would encourage all of you to subscribe to the list server BIOMCH-L on the Internet where we will be posting details of new services to members as they become available. We intend to provide more resources that will help you in your scientific endeavors and I look forward to sharing details of these efforts with you both on the Internet and in future editions of the Newsletter.

The Executive Council is acutely aware that the Society exists to serve its members. We need to hear from you so that your ideas can help propel the Society forward. Please contact me (PRC@PSU.EDU) or any members of Council with your concerns and ideas. It is an honor to be your President and I look forward to the challenge of the next two years with great enthusiasm.

Peter R. Cavanagh

XVth CONGRESS POSTSCRIPT

Dear Participants to the XVth ISB Congress

After the Congress Finland and Jyväskylä have returned to the normal July weather: the sun is shining, the sky is blue and the forecast for the next weeks is excellent. Thus we are ready to begin our holidays, but we still want to thank you all once more for coming to the Congress. You made it successful, the weather did not change the enthusiastic atmosphere. Please be proud of your contribution to the advancement of Biomechanics! We are planning to welcome you back to Jyväskylä in the year 2015 after another 20 years! Of course you can visit us in a normal way whenever you feel it necessary.

The Book of Abstracts of the XVth Congress of the ISB can be obtained at the special member rates by writing to the supplier. The book contains more than 500 abstracts with 1043 pages. Ordering details are on the next page, together with the other society publications.

Best Wishes to all of you!

Paavo V. Komi, Congress Chairman
Keijo Häkkinen, Congress Vice-Chair
Kari L. Keskinen, Secretary General
Tiina Multasuo, Congress Secretariat

XVIIth CONGRESS OF ISB - 1999

Expressions of interest from a National or Regional group wishing to host the XVIIth ISB Congress in 1999 are now being sought. Printed Guidelines for submission of a proposal and details of the Society's requirements can be obtained from the Secretary-General, Dr Kit Vaughan (see front cover for contact address).

EDITOR'S REFLECTIONS

Personally I have always found the ISB Congresses to be great occasions for catching up with old friends and new science. The Jyväskylä Congress was no exception, but on the homeward journey I picked up on some equally stimulating stuff. An article in the Qantas Airways *Australian Way* magazine reported on Dr Max Perutz's "principles" for establishing a good scientific laboratory. They were as follows:-

- * Choose outstanding people and give them intellectual freedom;
- * Show genuine interest in everyone's work and give younger colleagues public credit;
- * Enlist skilled support staff who can design and build sophisticated and advanced new apparatus and instruments;
- * Facilitate the interchange of ideas in the canteen as much as in seminars; have no secrecy;
- * Be in the lab most of the time and accessible to everybody whenever possible;
- * Engender a happy environment where people's moral is kept high.

It's most unlikely that I'll ever discover anything as important as X-rays, least of all receive a Nobel prize for my scientific achievements as Dr Perutz did, but reading those words sustained an already strong desire to get back to the lab. Thank you Paavo for an energising event.

PROMISING SCIENTIST AWARD

This award, sponsored by Peak Performance Technologies, is made in recognition of superior research indicative of future promise in a single area of biomechanics. While there are no age or educational limitations, the award is intended for ISB members at a relatively early stage of their scientific careers.

The award winner will be expected to make a 15 minute oral presentation on this research at the 1997 ISB Congress in Japan. The award certificate together with a cheque for \$US 1,500 will be presented to the recipient at this congress.

Applicants should identify at least two first author scientific journal articles that they have written in a single area of biomechanics and should provide interpretative summaries describing the contribution of each article. Five copies of each article and brief curriculum vitae should be sent to:

Dr Savio L-Y. Woo
Department of Orthopaedic Surgery
Musculoskeletal Research Laboratories
University of Pittsburgh, M272 Scaife Hall
Pittsburgh, PA. 15261
U.S.A.

UPDATE ON XVIth CONGRESS OF ISB

Welcome to XVIth ISB Tokyo Congress

Organizing Committee of the XVIth ISB Congress:

Congress Chair: M. Mitsumasa & T. Fukunaga
Congress Vice-Chair: K. Kobayashi & T. Ohtsuki
Secretary General: Y. Hirano & S. Fukashiro

We, the organizers of the XVIth ISB Congress, take great pleasure in inviting you to Tokyo, our colleagues and friends in the field of biomechanics throughout the world. We understand that the ISB, by authorizing us to organize the ISB Congress, will take another step towards new biomechanical researches with a global vision. Reading through the details of the Congress as follows, you will know our positive attitude for enlarging the field of biomechanics to cover broader aspects of life sciences from cellular to total body levels.

This is the 2nd Congress held in Asia. Since the VIIIth ISB Congress held in 1981 in Nagoya, young biomechanics researchers have been growing up not only in Japan but also in other Asian countries. Therefore, it is our additional hope that these young Asian researchers of biomechanics shall be given a chance to present their researches and to make contact with biomechanists in various countries.

Although we will do our best, we certainly need your help and cooperation for the great success of the Congress. Again, we give you a warm welcome to an energetic city, Tokyo, in 1997.

Dates: August 25-29, 1997
Place: The University of Tokyo, Komaba, Japan
Information: XVIth ISB Tokyo Congress Secretariat
Fukashiro
Lab. Dept. Life Sci.
The Univ. Tokyo. Komaba 3-8-1
Meguro 153
JAPAN
F a x : + 8 1 - 3 - 5 4 5 4 - 9 4 9 4
E-mail: ISB97@idaten.c.u-tokyo.ac.jp

Senshi FUKASHIRO, Ph.D.
Associate Professor of Biomechanics
Dept. Life Sci., The Univ. Tokyo.
Komaba 3-8-1, Meguro 153, Japan
Phone: +81-3-5454-6865 (Message Phone)
Fax: +81-3-5454-4317
E-mail: fukashiro@idaten.c.u-tokyo.ac.jp
XVIth ISB Tokyo Congress Secretariat
Tel & Fax: +81-3-5454-9494
E-mail: ISB97@idaten.c.u-tokyo.ac.jp

ISB PUBLICATIONS

The following Society publications can be obtained at the special member rates by writing to the supplier shown.

BOOK OF ABSTRACTS, XVth Congress of the International Society of Biomechanics.

Price: 450 FIM (includes postage)
Supplier: University of Jyväskylä
Payment: Pay to the account of the University of Jyväskylä
Account No. 800013-10171
Banker POSTIPANKKI, 00007 Helsinki,
FINLAND, SWIFT PSPBFIHH
Telex 121 698 pgiro sf.
Refer to "ISB Congress book 5620"
(NB: No cheques, foreign currency or credit cards will be accepted)

Then fax a copy of the receipt to:
Minna Korhonen at the University of Jyväskylä
Fax: +358 41 602 071
Tel: +358 41 602 070
E-mail: minnakori@maila.jyu.fi

BOOK OF ABSTRACTS, XIVth Congress of the International Society of Biomechanics.

Price: 550 FF plus postage
Supplier: Professor S. Metral
Explorations Fonction. du Systeme Nervueux
C.H. Bicetre, 78 Avenue du General Leclerc
94275 Kremlin Bicetre, FRANCE
Fax: (33.1) 45.21.27.14

BOOKS OF ABSTRACTS, XIIth and XIIIth Congresses of the International Society of Biomechanics.

Price: \$AUS 40 plus postage (\$AUS40 airmail) ea.
Supplier: Graeme A. Wood
Department of Human Movement
The University of Western Australia
Nedlands, WA 6009, AUSTRALIA
Fax: +61 9 380-1039

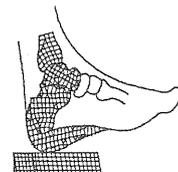
BIOMECHANICS XI-A and XI-B, Proceedings of the XIth Congress of the Intn'l. Society of Biomechanics.

Price: 200 Dfl (includes both volumes and postage)
Supplier: Peter Hollander
Faculty of Human Movement Sciences
Vrije Universiteit
van de Boechorststraat 9
1081 BT Amsterdam
THE NETHERLANDS
Fax: +31-20-6442043

BIOLOCOMOTION: A CENTURY OF RESEARCH USING MOVING PICTURES, edited by A.Cappozzo, M.Marchetti and V.Tosi (ISB Book Series-Volume 1; Hardbound, 356 pages, 180 b&w and 7 colour figures).

Price: \$AUS 65 plus postage (\$AUD 20 airmail)
Supplier: Graeme A. Wood (address as above)

ISB WORKING GROUP ON FUNCTIONAL FOOTWEAR



ISB Working Group on Functional Footwear Second Symposium on The Biomechanics of Functional Footwear, Cologne, Germany, June 28-30 1995.

This Symposium was the second in the group's brief history. Building on the format of the 1994 Calgary Symposium, this meeting included a mixture of original papers, work in progress, invited presentations and an open forum.

Over 70 participants attended the Symposium and heard 28 presentations on a wide variety of topics. Highlights included Mario Lafortune's animated chairmanship of the debate on the Perception of Cushioning, and Finn Bojsen-Moller's talk on feet, the universe and everything.

Peter Brueggemann, Axel Knicker and their team did an excellent job of the local arrangements, making sure everything was smoothly run and convenient for the delegates. They also had the foresight to arrange both hot weather and unlimited free beer, adding significantly to the social ambience of the meeting.

SPONSORS

The Working Group wishes to express its sincere appreciation to the organisations and individuals who contributed to the financial support of this Symposium. Without these sponsors a meeting of the quality we experienced in Cologne would not have been possible. The sponsors were: Adidas America Inc., Novel gmbh, Asics Corp., Elefanten, F.W. Kraemer., NIKE, Inc., and Toyota.

PRIZES

Two prizes were awarded at the end of the Symposium. A prize valued at US\$ 1000 was presented by Adidas America, Inc., and awarded in recognition of the original paper which, in the view of the adjudicators, made the most significant contribution to footwear biomechanics research. In addition, a "New Investigator's Award", valued at DM 1000 was presented by Novel gmbh and awarded to the authors of the most significant contribution based on work conducted as part of a Masters or Doctorate degree.

The Adidas Prize, adjudicated by Ben Nigg and Ned Frederick, was awarded to Mario. A.

Lafortune, Ph.D., School of Human Biology, University of Guelph, Canada, for his paper on "In vivo assessment of footwear rearfoot control during cutting moves".

The Novel Award, adjudicated by Peter Cavanagh, Jie Gao and Martyn Shorten was awarded to Mark Lake, School of Human Biology, University of Guelph, Canada., for his paper on "Mechanical inputs related to perception of lower extremity impact loading severity."

ABSTRACTS ON THE INTERNET

Short abstracts of the Cologne meeting are now available on the Internet, via anonymous FTP or the Web. The anonymous FTP site is: <ftp://ftp.teleport.com> The files are in the directory /users/biomech.

Alternatively, point a web browser to one of the following pages:

Working Group home page:

<http://www.teleport.com/~biomech/sneakers.htm>

Cologne abstracts:

<http://www.teleport.com/~biomech/cologne.htm>

Also, a volume of abstracts from the Calgary Symposium is now available in dead tree format via snail mail.

FUTURE MEETINGS

Planning for a meeting in Tokyo, prior to the 1997 ISB Congress has already begun. A decision about whether a meeting will be held in 1996 will be made by the end of July.

Further information can be found on the Working Group home page or by contacting Martyn Shorten, the Working Group coordinator (Fax: +1 503 774 7868; Internet: biomech@teleport.com).

Martyn R. Shorten, Ph.D.
biomech@teleport.com
2835 SE Tolman St.
Portland OR 97202-8752, USA
Tel: (503) 774-7855
Fax: (503) 774-7868

Special feature articles

A JOINT COORDINATE SYSTEM FOR THE ANKLE COMPLEX

A Proposal Submitted to the ISB Standardization and Terminology Committee

by

The ISB Standards Subcommittee on the Ankle

GENERAL

The scope of this document is to propose a joint coordinate system for the ankle complex which can be used by the Biomechanics community and other associated professional communities, as a standard for reporting on the kinematics of the human ankle complex. For the most part, this proposal follows the guidelines described by the ISB Standardization and Terminology Committee (draft version September 1, 1994).

Based on our terminology, the ankle complex is composed of the talocrural and subtalar joints as well as the tibio-fibular articulation. A complete standard must include a separate set for each of these individual joints and an additional standard for the entire ankle complex (ie. - calcaneus relative to tibia/fibula). However, a standard for the foot to shank system will address the needs of a great majority of the Biomechanics community which is concerned with functional activities such as walking and running. In these studies external anatomical landmarks are being used and it is not possible to directly distinguish between talocrural and the subtalar joints. It was therefore decided to propose a standard for the ankle complex first, and to develop the standards for the talocrural joint and for the tibio-fibular articulation at a later time.

TERMINOLOGY

The talocrural (ankle) joint - The articulation formed between the talus and the tibia/fibula.

The subtalar (talocalcaneal) joint - the articulation between the talus and the calcaneus.

The "Ankle Complex" is defined as the structure composed of the talocrural and the subtalar (talocalcaneal) joints.

Anatomical landmarks used in this proposal.

- M1 - Tip of the medial malleolus
- M2 - Tip of the lateral malleolus
- M3 - The most medial point on the border of the medial tibial condyle.
- M4 - The most lateral point on the border of the lateral tibial condyle located just above the fibular head.

- M5 - Tibial tuberosity
- O1 - The point midway between the medial and lateral malleolii (M1 and M2)
- O2 - The point midway between the medial and lateral tibial condyles (M3 and M4)

DEFINITION OF SEGMENTAL, BODY FIXED ORTHOGONAL REFERENCE FRAMES (Figure 1).

A. Definition of standard anatomical planes.

Frontal plane of the tibia/fibula - The plane containing points O1, M3 and M4.

Sagittal plane of the tibia/fibula - Plane perpendicular to the frontal plane and containing the long axis of the tibia/fibula. (The long axis of the tibia/fibula being defined as the line connecting points O1 and O2).

Transverse plane of the tibia/fibula - the mutual perpendicular to the frontal and sagittal planes.

b. Definition of Body fixed anatomical frame of the tibia/fibula - XYZ

(Note: the definition is for a right leg)

- O1 - The origin is located midway between the medial and lateral malleolii.
- X - The line connecting the medial and lateral malleolii (M1 and M2). Positive X is in the direction from the medial malleolus to the lateral malleolus.
- Y - Line perpendicular to the frontal plane of the tibia at the origin - O1. Positive Y is in the direction from posterior to anterior.
- Z - The common perpendicular forming a right handed Cartesian frame.

(Note: for the left leg, the positive X-axis is in the direction from lateral to medial. All other directions remain the same as for the right leg).

c. Definition of body fixed anatomical frame for the calcaneus - xyz

(Note: the definition is for a right leg)

The Origin coincides with that of the tibia/fibula frame (O1) in the neutral configuration. (definition of neutral configuration follows).

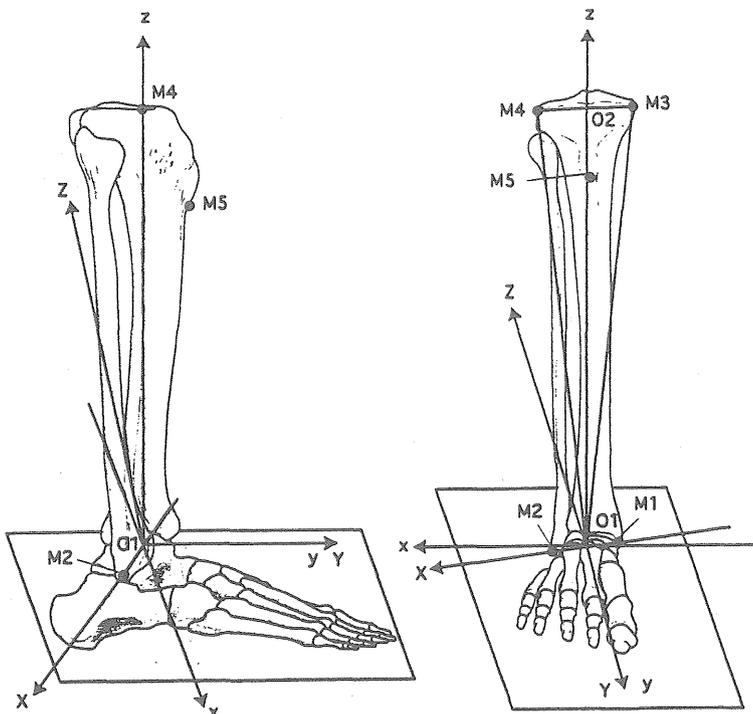


Figure 1: Definition of the Body Fixed Reference Frames for the Tibia/Fibula and for the Calcaneus.

- z - With the ankle complex in the neutral configuration, this axis coincides with the long axis of the tibia/fibula (i.e. - The line connecting points O1 and O2). Positive z is from O1 to O2.
- y - With the ankle complex in its neutral configuration this axis is perpendicular to the frontal plane of the tibia/fibula. Positive y is from posterior to anterior.
- x - The common perpendicular to y and z and forming a right-handed Cartesian frame.

(Note: the definition is the same for a left leg. However, the x-axis will be pointing from lateral to medial).

DEFINITION OF JOINT COORDINATE SYSTEM AXES AND DESCRIPTION OF RELATIVE ANGULAR AND LINEAR DISPLACEMENTS.

(Figure 2)

- e1 - is the axis fixed to the tibia/fibula and coincides with the X-axis of the tibia/fibula frame. Rotation about it - α , correspond to dorsiflexion/plantarflexion. (α positive - dorsiflexion). Displacement along it - $q1$ is the medial/lateral shift ($q1$ positive - lateral shift).
- e2 - The floating axis. The common perpendicular to e1 and e3. Rotation about it - β , is defined as inversion/eversion (β positive - inversion). Displacement along it - $q2$ is the anterior/posterior drawer ($q2$ positive - anterior drawer).

- e3 - is the axis fixed to the calcaneus and coincides with the z-axis of the calcaneal frame. Rotation about it - γ correspond to internal rotation/external rotation (γ positive - internal rotation). Displacement along it - $q3$ correspond to compression/distraction ($q3$ positive - compression).

Note: the definitions above are for a right leg. Since it is important that the standard does not result in different signs for the same motion in the two feet, the following data conversion is required for a left leg: $q1$ should be multiplied by -1 to result in lateral shift; β should be multiplied by -1 to result in inversion; γ should be multiplied by -1 to result in internal rotation.

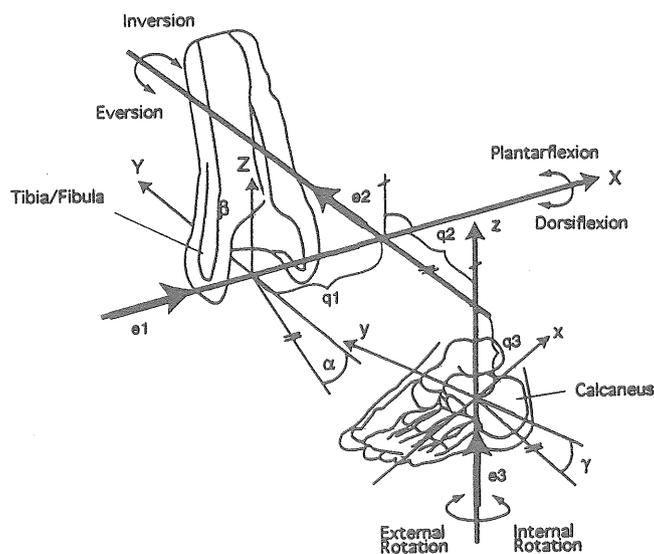


Figure 2: Definition of the Joint Coordinate System for the Ankle Joint Complex.

DEFINITION OF THE NEUTRAL CONFIGURATION OF THE ANKLE JOINT COMPLEX.

Neutral dorsiflexion/plantarflexion is defined as zero degrees between the projections in the sagittal plane of the tibia of a line connecting the lateral malleolus - M1 with the lateral tibial condyle M4 and the line perpendicular to the plantar aspect of the foot.

Neutral inversion/eversion is defined as zero degrees between the projections in the frontal plane of the long axis of the tibia/fibula and the line perpendicular to the plantar aspect of the foot.

Neutral internal rotation/external rotation is defined as zero degrees between the projections onto the transverse plane of a line going through the second metatarsal and the line connecting the tibial tuberosity M5 with the mid-point between M1 and M2 - O1.

Committee membership:

Dr. Paul Allard
Research Center
Laboratoire d'Etude du Mouvement
Sainte-Justine Hospital
Montreal, CANADA

Dr. Chris Kirtley
School of Physiotherapy
Curtin University of Technology
Perth, WESTERN AUSTRALIA

Dr. Dieter Rosenbaum
Abteilung Unfallchirurgische
Forschung und Biomechanik
Universitaet Ulm
Ulm, GERMANY

Dr. Sorin Siegler, Committee Chairman
Dept. of Mech. Engineering and Mechanics
Drexel University and The Hahnemann/Drexel
Biomechanics Research Laboratory
Philadelphia PA, USA

Dr. Mike Whittle
Cline Chair of Rehabilitation Technology
The University of Tennessee at Chattanooga
Chattanooga, TN, USA

EDITOR'S NOTE

This Newsletter is published quarterly: February-March (Spring); May-June (Summer); August-September (Autumn), and November-December (Winter). Deadlines for material and articles are the first day of each first named month, and the Newsletter is mailed to members early in the second named month.

Members can submit *Letters, Special Articles, Affiliate Society News, Laboratory Features, Reports, or Announcements of Meetings, Conferences, and Jobs Available*. Also, *Short Abstracts* from biomechanics society meetings and *Thesis Abstracts* can be published. In special circumstances a complete edition of the Newsletter can be devoted to the publishing of a Society's "Proceedings".

Submitted material must be in letter-quality print and computer scannable, or on a computer disk as a text-only file, and in English. Graphics or complex equations must be in camera-ready art form, and photographs must be black and white.

Society abstracts should not be more than 250 words in length. They should be submitted with full details of the conference, and accompanied by any conference or society logos which could be printed as well.

Thesis abstracts should be submitted with full details of:
Title, Student's Name, Department, Name of Degree and Conferring Institution, together with Supervisor's Name.

Thesis abstracts should not be more than one Newsletter page in length.

DIRECTORY of ISB EXECUTIVE COUNCIL MEMBERS

(Officers are listed on the cover)

Brian L. Davis
Department of Biomedical Engineering / Wb3
The Cleveland Clinic Foundation
Cleveland, Ohio 44106
U.S.A.
Tel: +1-216-444-1805
Fax: +1-216-444-9198
E-Mail: davis@bme.ri.cc

Bruce C. Elliott
Department of Human Movement
The University of Western Australia
Nedlands, Perth, AUSTRALIA 6009
Ph Office: +61 9 380 2374
Fax: +61 9 380 1039
E-Mail: bellio@uniwa.uwa.edu.au

Mont Hubbard
Dept. Mechanical, Aeronautical and Materials,
Dynamic Systems and Controls
University of California
Davis, CA, USA 95616
Ph. Office: +1 916 752 6450
Fax: +1 916 752 4158
E-Mail: mhubbard@ucdavis.edu

Toshio Moritani
Lab. for Applied Physiology
Graduate School of Human &
Environmental Studies
Kyoto University
Sakyo-ku, Kyoto 606, JAPAN
Ph. Office: +81 75 753 6888

Sandra J. Olney
School of Rehabilitation
Queen's University, Kingston, ON
CANADA K7L 3N6
Ph. Office: +1 613 545 6726
Fax: +1 613 545 6776
E-Mail: olney@qucdn.queensu.ca

Alf Thorstensson
Biomechanics and Motor Control Lab.
Department of Neuroscience
Karolinska Institute
Box 5626, S-11486 Stockholm
SWEDEN
Ph. Office: +46 8 4022246
Fax: +46 8 4022287
E-Mail: alf.thorstensson@neuro.ki.se

Savio L-Y. Woo
Department of Orthopaedic Surgery
Musculoskeletal Research Lab.
University of Pittsburg, M272 Scaife Hall
Pittsburg, PA 15261, U.S.A.
Ph. Office: +1 412 687 5913
Fax: +1 412 687 0802

M.R. (Fred) Yeadon
Department of Sports Science
Loughborough University
Loughborough, Leics LE11 3TU
UNITED KINGDOM
Ph. Office: +05 09 223264
Fax: +05 09 231776
E-Mail: m.r.yeadon@lut.ac.uk

Anton J. (Ton) van den Bogert
Human Performance Laboratory
The University of Calgary
Calgary, Alberta T2N 1N4
CANADA
Ph. Office: 403 220 3436
Fax: 403 284 353
E-Mail: bogert@acs.ucalgary.ca



Birdy's Corner

IV—Myth of Normalization

The biomechanics community is apparently infected by IV (infinite variance) and it is rapidly spreading. I hope this paper helps to stop the spread of IV which appears to be a highly contagious myth whose host is normalization of times series data (TS).

First, we ask QB *What does one mean by normalization of TS?*

TS normalization usually means that I divide each point in a trial (or TS) by a single non-zero real value. Some examples are: 1) the maximum value of one of my trials, 2) the range (maximum-minimum) of a trial, or 3) the value of a trial at a particular time.

But, *How can this cause the normalized TS to be infected by IV?*

First, this is measured data and thus the data being normalized as well as the divisor contain noise. Now, suppose we zoom-in on each sample and consider the value to be normalized as a random variable (RV) X , since it contains randomness in the form of measurement noise. Similarly, if we define the normalizing value (divisor) by the RV Y then TS normalization is just a simple function of these two RVs,

$$Z = X/Y. \quad (1)$$

Further, if the RVs X and Y are jointly normal with zero mean then the distribution of the normalized TS at each sample, Z , will have a Cauchy density with undefined moments. Thus, Z is said to have IV.

I see QB, when you normalize your TS data, you view this as a RV (at each sample) divided by another RV (the normalizer) and thus the distribution of this ratio (1) at each sample (normalized value) has IV. One more question, QB *Why do you normalize your TS?*

I often normalize TS when I am comparing different levels of output. These normalized TS allow me to produce nice comparison plots and can often reveal "significant" differences.

Well, QB the ratio of RVs has a long and colorful history which seems to have been first dealt with in detail by William Feller (1907-1970) – one of the giants in probability theory. However, I suggest that TS normalization, in practice, is not well represented by the ratio of RVs with zero mean; i.e. there is almost always an underlying additive non-zero deterministic component in both the numerator and denominator of (1).

Normalization Model

I model the TS data to be normalized as a collection of NY trials (sample functions) with NT samples in each,

$$Y(k, j) = a(k; j) + E(j) \quad (2)$$

$$k = 1, \dots, NY; \quad j = 1, \dots, NT$$

where, $a(k; j)$ = underlying (deterministic) signal for trial- k at sample- j , and $E(j)$ = noise (disturbances) in measurements with a mean of zero. Similarly, there are NX trials of normalizing TS data,

$$X(k; j) = b(k; j) + E(j) \quad (3)$$

$$k = 1, \dots, NX; \quad j = 1, \dots, NT$$

where, $b(k; j)$ = underlying (deterministic) signal for normalizing trial- k at sample- j . Suppose we consider the three normalization types which QB described in his answer to my first question, then we can write

$$Z(k; j) = Y(k; j)/N_i \quad (4)$$

$$k = 1, \dots, NY; \quad j = 1, \dots, NT$$

where, $i \in [1, 2, 3]$ and N_i is defined by

$$N_1 = \text{Max}\{X(k; j)\}, \quad \text{Maximum value} \quad (5)$$

$$N_2 = \text{Range}\{X(k; j)\}, \quad \text{Range} \quad (6)$$

$$N_3 = X(k; m), \quad \text{Value at } j = m \quad (7)$$

for $1 \leq k \leq NX, 1 \leq j \leq NT$. In addition, I impose the constraint that $N_i > 0 \forall i$. This last constraint is important and sensible since we do not wish to divide by zero nor change the sign of our normalized data. Now (finally), the normalized value at any sample can be computed from

$$Z = W/V \quad (8)$$

where, W = the value to be normalized and the normalizing value $V \in [N_1, N_2, N_3]$. If we compare (8) with the ratio of two RVs as given by (1), two important differences stand out: 1) the numerator and denominator of the ratio given by (8) will not necessarily have zero mean, and 2) the distributions for $V = N_1, N_2$ will be quite different from the distribution of the individual RVs $X(k; j)$ from which they are obtained (please check these differences for yourself if you have any doubts). It now seems that QB's answer to my second question (...normalization gives IV...) is suspect.

Monte Carlo Simulations

Monte Carlo simulation (MCS) refers to schemes which use pseudo-random numbers to solve stochastic or deterministic problems. The name "Monte Carlo" simulation or method seems to have originated during World War II, when special stochastic methods were developed for the study of events which can lead to nuclear fission. This has since become an extremely powerful technique that is often used for problems which are analytically intractable. For the curious who wish to know more about MCS, I can recommend the following technical journals which contain many examples

of MCS: *Communications in Statistics (Part B, Simulation and Computation)*, *Journal of Statistical Computation and Simulation*, and *Technometrics*.

Here, with the help of Merlin, I use MCS to study the statistical properties of TS normalization (Merlin is my 486-66MHz PC assistant). The idea is: generate many TS using pseudo-random numbers to simulate noise, apply (8) to any sample (time point) of interest with one of the normalization types (5-7) and then estimate the statistical parameters for the distribution of the normalized value — simple but effective. Note, this type of analysis is not practical without the assistance of a high-speed computer.

MCS with a minimum of 10,000 trials in each run using different noise distributions, signal waveforms, normalization types, lengths of TS, etc. showed that:

- Normalization will almost surely not give infinite variance in the normalized data.
- The distribution function at each point of the normalized data will almost surely not be of the same shape as in the unnormalized data.

Thus, QBs answer to my third question is also under attack. That is, if statistical inferences are based on the normalized TS data then the usual assumptions of normality (Gaussian distribution) are almost surely invalid.

Epilogue

There are other methods which can be used for TS normalization and obviously this is not the final word on normalization, nor was it intended to be. However, it does seem clear from the extensive MCS performed that TS normalization (as defined in this note) does not cause IV, at least for many of the signal types which are found in biomechanical data. *Warning — normalization of TS with very low signal-to-noise ratios (e.g. EEG signals) can give large variances!*

A comprehensive collection of procedures and functions for large-scale MCS has been implemented in PASCAL. These include code for: 1) parallel stochastic processes with separation of 100,000 (periods = 2,147,483,646), 2) uniform, Gaussian, and triangular distributions, 3) a set of predefined TS signals, and 4) estimation of probability density functions and cumulative distribution functions. This package is available via FTP (as usual) from [ftp.ki.se//pub/outgoing/ISB03.ZIP](ftp://pub.outgoing/ISB03.ZIP). I encourage you to try MCS for studying the effects of different transformations on your TS data—it might be enlightening. Finally, I would like to give special thanks to Dr. A. Cresswell for his useful comments on data normalization. *Th-th-tha-that's all folks!*

Announcements of forthcoming events

INTERNATIONAL SUMMER SCHOOL THREE-DIMENSIONAL ANALYSIS OF HUMAN MOVEMENT

Official event of the International Society of Biomechanics (ISB)

June 28th to June 30th, 1996
Universite Claude Bernard
Lyon, FRANCE

Prior to the fourth INTERNATIONAL SYMPOSIUM ON THREE-DIMENSIONAL ANALYSIS OF HUMAN MOVEMENT which will be held in Grenoble, France from July 1st to July 3rd, 1996, there will be an International Summer School.

This two-day International Summer School will be held in Lyon, France and will focus on the data capture systems, three-dimensional reconstruction techniques and modelization. It is addressed to doctoral and post-doctoral students having a good background in biomechanics.

LECTURES

Lectures will be given in English. Lectures from each speaker will be handed out at the welcoming reception prior to the course and at the first lecture.

SUGGESTED READING

Allard, P., Stokes, I.A.F. and Blanchi, J.P. (1994).
Three-Dimensional Analysis of Human Movement.
Human Kinetics.

Cappozzo, A., Marchetti, M. and Tosi, V. (1992).
Bioloocomotion: A Century of Research using Moving
Pictures. Promograph, Rome, Italia.

Duboy, J., Junqua, A. and Lacouture, P. (1994).
Mecanique Humaine. edition Revue APS, 11 Avenue
de Tremblay, 75012 Paris, Fr.

Vaughan, C.L., Davis, B.L. and O'Connor, J.C. (1992).
Dynamics of Human Gait. Human Kinetics, 137p
and software.

REGISTRATION FEES FOR INTERNATIONAL SCHOOL AND LODGING

Fees for the First International Summer School are 1125FF prior to May 15th, 1996 and 1500FF afterwards. The registration fee includes meeting material and all scientific and social activities. Checks, money orders or bank drafts drawn in FF (no credit cards) are made payable to the International Symposium on 3-D Analysis of Human Movement and Mailed to Professor Joannes Dimnet. The participants will be lodged at Hotel des Congres located near the Universite Claude Bernard. You

must make your own reservation. Special rates are available to those attending the International Summer School.

Those attending both the International Summer School and the Symposium will benefit from a reduction when making their full payment.

TRAVEL INFORMATION

For those attending the International Summer School and arriving at Satolas (Lyon) International Airport, we suggest that you take the bus to Lyon. Those also attending the SYMPOSIUM can take TGV (Train a Grande Vitesse) to Grenoble train station (30USD). Reservations are required to board the train.

CANCELLATION POLICY

All cancellations received by June 1st 1996, will be assessed a 500FF non-refundable charge PER MEETING. After this date, there will be NO REFUNDS.

FURTHER INFORMATION

Professor Joannes Dimnet
Laboratoire de biomecanique du mouvement
Centre de mecanique
Universite Claude Bernard
43, Bd du 11 Novembre 1918
69622 Villeurbanne cedex, FRANCE
Tel: +33-72 44 80 98
Fax: +33-72 44 80 54

Dr. Paul Allard, Ph.D., P.Eng.
Permanent Secretariat
International Symposium on
Three-Dimensional Analysis of Human Movement
Centre de recherche, Sainte-Justine Hospital
3175 Cote Ste-Catherine
Montreal, PQ, H3T 1C5 CANADA
Tel: +1 (514) 345-4740
Fax: +1 (514) 345-4801
E-mail: allardp@ere.Umontreal.Ca

SPONSORS

Centre Jacques Cartier, Lyon, France

FINAL ANNOUNCEMENT:

**International Conference on
CLINICAL MOVEMENT ANALYSIS**

Scientific Meeting ESMAC 1995
Enschede, The Netherlands
27 & 28 October 1995

The fourth annual conference of the ESMAC will be held on 27 & 28 October 1995 at the Best Western Dish Hotel in Enschede, The Netherlands.

The conference will address various aspects of Movement Analysis used for better understanding and treatment of movement disorders in children. It is intended for all professionals, such as physiotherapists, paediatricians, orthopaedic surgeons, rehabilitation physicians and biomedical engineers, who are involved in the treatment of locomotor disorders.

The scientific programme will include presentations on various themes as well as guest lectures. The invited speakers are:

Dr. David Sutherland, MD. Medical Director, Motion Analysis Laboratory, Children's Hospital & Health Center and Professor, Dept of Orthopaedic Surgery, U.C.S.D.

Mr G Evans, FRCS, FRCSOrth. Consultant Orthopaedic Surgeon, Director, Children's Orthopaedics, The Robert Jones & Agnes Hunt Orthopaedic Hospital, Oswestry, U.K.

Dr Yves Blanc, PhD. Hopital Cantonal Universitaire de Geneve, Dept de Chirurgie, Clinique d'Orthopedie et de Chirurgie de L'appareil, Laboratoire de Cinesiologie, Geneve, Switzerland.

GENERAL INFORMATION

Language

The conference language is English

Accommodation

The conference will take place at the Best Western Dish Hotel. It offers conference facilities as well as delegates accommodation. The venue is within walking distance of the city center with its comfortable cafes and restaurants. Alternative accommodation is available on request.

Social Programme

A welcome reception has been arranged on 26 October 1995. The conference dinner has been arranged on Friday, 27 October 1995 for the delegates (included in the registration fee) and accompanying persons (Dfl 55, payment to be made at the time of registration on 26 or 27 October 1995).

Commercial Exhibition

A commercial exhibition has been organised.

Registration

Registration can be made by returning the completed registration form to:

Secretariat ESMAC 1995 Conference
Roessingh Research and Development
c/o ACON Convention Services
PO Box 560, 7500 AN Enschede
THE NETHERLANDS
Tel: (+)(31)(0)53 335 800
Fax: (+)(31)(0)53 341 219

Conference Fee

The conference fee includes a welcome reception, accomodation for two nights, breakfast lunch, coffee/tea during conference and the conference dinner. The fee is: ESMAC Members Dfl. 590,- and non-members Dfl. 650,-. Excluding the accomodation the fee is Dfl. 355,- for ESMAC members, and for non-members fl. 415,-. All payments must be made free of transfer charges. Bankcosts, if incurred, will have to be paid by the delegates. The conference fee (net amount) can be paid by bank transfer to ING Bank, Enschede, The Netherlands, Account no. 66.48.58.201 made payable to Roessingh Research and Development, Enschede, stating your full name and indicating "ESMAC 1995".

THIRD IOC WORLD CONGRESS ON SPORT SCIENCES

September 16-22, 1995:

The Third International Olympic Committee World Congress on Sport Sciences; The Atlanta Committee for the Olympic Games will host the conference in cooperation with the US Olympic Committee and Parke-Davis. The Congress will be an international forum for sharing the most recent scientific knowledge and ideas in the field of Sport Sciences. It will also promote continued research and consolidate the link between the world scientific community and the Olympic Movement.

The Morehouse School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians. The Morehouse Scholl of Medicine designates this continuing medical education activity as meeting the criteria for up to 28 hours of Category I of the Physician's Recognition Award of the American Medical Association.

For more information, contact the Atlanta Committee for the Olympic Games, 250 Williams St., Ste. 6000, PO Box 1996, Atlanta, GA 30301-1996; FAX: 404-224-1997.

Brian Bergemann, Ph.D.
United States Sports Academy
One Academy Drive
Daphne, AL 36526, U.S.A.
E-mail: bwbergemann@ussa-sport.Ussa.Edu

**FIRST CONGRESS of the EUROPEAN
ASSOCIATION OF SPORTS MEDICINE**

Call for Papers

The "European Association of Sports Medicine - EURASM" is a European association which aims at promoting research and education in the field of sports medicine, physical activity, exercise and health. EURASM is a society of European sports medical professionals, and wants to provide its members with different services, educational programs, and aids for stimulating research in the field of sports medicine.

The first congress of EURASM will be held in Brussels on November 18 - 20, 1995.

For more information (on the congress, submitting an abstract, registration, and so on), please contact:

Prof. Dr. Kenny De Meirleir, MD
Vrije Universiteit Brussel
Faculty of Human Movement Studies
Human Physiology and Sports Medicine (MFYS)
Pleinlaan 2
B-1050 Brussels
BELGIUM
Tel: int + 32 2 629 2222
Fax: int + 32 2 629 2876
E-mail: jcabri@mfys.vub.ac.be

THE ENGINEERING OF SPORT

The University of Sheffield
Sheffield, England

2-4 July 1996

This major conference is intended to bridge the gap between Engineering and Biomechanics and should be of particular interest to Engineers, Physicists and Scientists working on Sports and Leisure related projects outside their "traditional" subject areas. Subject areas will include: Aerodynamics, Biomechanics, Dynamics, Equipment, Footwear, Impacts, Motion analysis, Sports surfaces.

All sports and leisure interests will be considered including Archery, Athletics, Bowling, Cricket, Cycling, Football, Golf, Gliding, Rock climbing, Motor Sports, Rugby, Soccer, Skiing, Squash, Swimming, Tennis and Tobogganing. Many other topics will be considered and the proceedings will be published.

Authors should submit a 200-300 word abstract using post or email by 1st December 1995 to:

Dr S. J. Haake,
Dept. of Mechanical and Process Engineering,
The University of Sheffield,
Mappin Street,
Sheffield S1 3JD, UK.
Tel: (0114) 282 5415

Fax: (0114) 275 3671

E-mail: S.J.Haake@sheffield.ac.uk

This meeting is organised by the Stress and Vibration Group of the Institute of Physics with the help of The University of Sheffield.

**PRELIMINARY ANNOUNCEMENT
THE THIRD WORLD CONGRESS OF
BIOMECHANICS (WCB'98)**

You are cordially invited to participate in the Third World Congress of Biomechanics which will be held in Sapporo, Japan, in August 1998. The First and Second Congresses were held in La Jolla, California, U.S.A., in 1990, and in Amsterdam, The Netherlands, in 1994, respectively. These past meetings were very successful and contributed much to the progress of biomechanics. As the past ones, the Third Congress is also authorised by the World Council for Biomechanics (formerly the World Committee for Biomechanics) which consists of experts from all biomechanics related fields and from all parts of the world.

The Third Congress will be held on the campus of Hokkaido University in Sapporo, Hokkaido. Hokkaido is known for its natural scenic beauty, and Sapporo is the political, economical, and educational center of Hokkaido. Sapporo is a new city, having the history of about a century and a quarter, and now has a population of 1.8 million. The city was laid out in the American plan, beautifully designed with boulevards intersecting each other at right angles. Sapporo is located about 900 km and 1200 km northeast from Tokyo and Osaka, respectively, and very comfortable in August.

Conference Site:

Hokkaido University, Sapporo, Japan

Date:

August 3-8, 1998

Congress Chairman:

Kozaburo Hayashi, Osaka University

World Council for Biomechanics (Officers)

Chair: Y.C. Fung, La Jolla

Vice Chair: Günter Rau, Aachen

Secretary: Kozaburo Hayashi, Osaka

Treasurer: Ronald Zernicke, Calgary

Congress Office:

Biomechanics Laboratory

Department of Mechanical Engineering

Faculty of Engineering Science

Osaka University

Toyonaka, Osaka 560, Japan

Phone: +81-8-850-8170

Fax: +81-8-850-6171

Biomechanics positions available

PROGRAMMER / BIOMECHANIST

The American Sports Medicine Institute (ASMI) is involved in the understanding and prevention of injuries in sports. Research at ASMI focusses on quantifying the motions and forces produced in athletic activities such as baseball, golf, and exercise. A full-time position is available for a biomechanist or computer programmer to help develop and write software for biomechanical research. Additional responsibilities include managing an in-house PC computer network. Applicants should have a B.S. or M.S. in engineering, biomechanics, or computer science, and must be able to program in C. If interested, send CV and cover letter to:

Glenn S. Fleisig, PhD.
Director of Research
American Sports Medicine Institute
1313 13th Street South
Birmingham, AL, 35205
Tel: (205) 918-2138

DISTINGUISHED PROFESSORSHIP IN BIOENGINEERING

The Department of Bioengineering, Clemson University and the Greenville Hospital System/Clemson University Biomedical Cooperative (a merger of South Carolina's land-grant research university with the largest tertiary care medical complex in the State), invites nominations and applications for a tenure track Distinguished Professorship in the area of Bioengineering with special competence in biomaterials research. The successful candidate must have a Ph.D., an outstanding research and teaching record, a strong history of grant support, and the ability to work in both a medical and academic setting. S/he will be expected to collaborate with hospital-based clinicians, develop a graduate program in medically related research, teach graduate and undergraduate courses, and play a leadership role in the evolving Cooperative. Review of applications will begin July 1, 1995 and continue until the position is filled. The Greenville/Clemson area is one of the most rapidly developing areas in the Southeast. Located in the foothills of the Blue Ridge Mountains, it offers an exceptional quality of life with a year-round moderate climate.

For more information contact:

Dr. R. Larry Dooley, Executive Secretary,
Search Committee
Tel: 803-656-5562
Fax: 803-656-4466
E-mail: dooley@eng.clemson.edu).

Send nominations or letters of application with curriculum vitae, a brief description of research plans and the names and addresses of five references to:

Bioengineering Distinguished Professorship
Search Committee
GHS/CU Biomedical Cooperative
445 Brackett Hall, Clemson University
Clemson, SC 26934-1912, USA

CU is an Equal Opportunity/ADA/Affirmative Action Employer and encourages applications from minorities and women.

LECTURESHIP IN BIOMECHANICS

Sports Science Programme
Division of Science & Technology - Tamaki Campus
The University of Auckland
Auckland, NEW ZEALAND

The Tamaki Campus is the rapidly expanding second campus of the University of Auckland. The Division of Science and Technology offers courses in Biological Sciences, Chemistry, Computer Science, Environmental Management, Environmental Science, Geography, Geology, Mathematics, Marine Science, Physics, Sports Science and Statistics.

The Sports Science programme leads to BSc (3 yr) or BSc(Hons) (4 yr) degrees. The successful applicant will be expected to contribute to the second and third year papers and to work with other staff to develop the fourth year papers. All papers include a laboratory component which focuses on the measurement, analysis and evaluation of human physical performance.

Applicants should have a Doctoral qualification with research and teaching strengths in biomechanics. An ability to contribute to courses in injury mechanics and rehabilitation would be an advantage, as would a record of publication in international refereed journals and a demonstrated ability to attract external research grants. Experience in working with coaches and athletes could also be an advantage.

Commencing salary will be established within the range \$NZ42,500-\$NZ51,500 per annum.

Further information, Conditions of Appointment and Method of Application, should be obtained from the Academic Appointments Office, The University of Auckland, Private Bag 92019, Auckland, New Zealand. Telephone +64-9-373 7599; Fax +64-9-373 7023. Three copies of applications should be forwarded to reach the Registrar by 25 September 1995. Please quote Vacancy Number UAC.633 in all correspondence. The University has an EEO policy.

SYSTEMS COORDINATOR

The Center for Locomotion Studies
Penn State University

A search is being conducted to fill the position of Systems Coordinator at the Center for Locomotion Studies (CELOS), The Pennsylvania State University, University Park, PA. CELOS is a biomechanics research laboratory conducting funded research on the topics of the foot in diabetes, locomotion in zero gravity, and posture, gait, and falls among the elderly. CELOS is located on the University Park campus of The Pennsylvania State University in central Pennsylvania. A complete description of the position and the associated responsibilities are provided below. Further details and application instructions may be obtained by contacting Dr. Lorraine Mulfinger at lxm14@psu.edu.

JOB TITLE: Systems Coordinator

LOCATION: Center for Locomotion Studies
Penn State University

PRINCIPAL DUTIES:

Identify software and hardware needs in areas of responsibility. Prepare short- and long-range plans for software and hardware integration and acquisition. Maintain and plan for upgrades of LAN hardware and software. Design electronic and mechanical equipment for specialized research applications. Consult with faculty, staff and students concerning their research requirements and technical projects needs. Discuss problems experienced by users. Develop solutions and/or suggest alternative approaches to problems. Supervise assigned personnel. Provide technical guidance and professional development. Provide informal instruction and training to users. Be responsible for the design, implementation and maintenance of a computer network. Keep abreast of current developments and trends in computing. Write virtual instruments in LabView.

MINIMUM QUALIFICATIONS:

Bachelor's degree or equivalent (preferably in an engineering field), and one to two years of work-related experience (preferably in the context of biomechanics research). A Master's degree or equivalent and at least two years of experience preferred. Familiarity with Macintosh applications and LabView essential. Must occasionally provide weekend or evening support for troubleshooting equipment failures and network problems.

The university is an equal opportunity employer and does not discriminate against any person because of age as defined by law, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation or veteran status.

POST DOCTORAL RESEARCH FELLOWSHIP

Massey University
Palmerston North, NEW ZEALAND

"Histological and Biomechanical Features of Normal and Abnormal Physis in Foals"

A position is available in the Department of Veterinary Clinical Sciences, under the leadership of Professor E. C. Firth.

Bone and cartilage tissue from foals fed on various nutritional regimes will be available for histological and biomechanical evaluation. The intention is to determine the amount of variation in biomechanical parameters with such factors as age, stage of development, nutritional regime, and anatomical site. The biomechanical data will be interpreted in the light of comparison of other features, including histology, immunocytochemistry, and bone mineral density. This is a collaborative study between the Department of Veterinary Clinical Sciences, Massey University and Ag. Research.

The annual emolument payable for Postdoctoral Research Fellowships is currently NZ\$39,500 and the Fellowship is tenable for a maximum period of two years. Informal enquiries may be directed to Professor E Firth, Department of Veterinary Clinical Sciences, 'phone 64 6 350-5061, or E-Mail E.C.Firth@massey.ac.nz.

Applications, including a full Curriculum Vitae and naming three referees, close with Ms L Hensman, Human Resources Section. Reference Number: Dept 52/95 must be quoted. Closing Date: 31 August 1995. The University reserves the right to make enquiries of any person regarding any candidate's suitability for appointment. It also reserves the right not to make an appointment or to appoint by invitation.

An information package including Conditions of Appointment are obtained by telephoning 06-350-5984. Applications, including a full curriculum vitae and the names, addresses and facsimile numbers of three referees should be sent to "Academic Vacancies", Human Resources Section before the closing date specified.

FACULTY POSITION IN ORTHOPAEDIC ENGINEERING

The Department of Orthopaedics at the University of Virginia School of Medicine is seeking candidates for a tenure track position at the Assistant or Associate Professor level. The position also carries the title of Engineering Director of the Motion Analysis Laboratory which is located in the Kluge Children's Rehabilitation Center, a satellite hospital of the University of Virginia. Suitable candidates will have the opportunity for a joint appointment in the School's Department of Biomedical Engineering. The position requires a strong, independent research program with some teaching responsibilities.

Collaboration with the department's clinical and research faculty particularly those working in the gait lab -- will be encouraged. The lab is a state-of-the-art facility, with a recently installed Vicon 370 six-camera kinematic system, two Kistler force plates and 16-channel EMG system.

For more information about the lab please see our homepage on the World Wide Web:

<http://www.med.virginia.edu/medcntr/gaitlab>

Candidates with a Ph.D. degree in Engineering and appropriate experience with human and pathologic gait (particularly cerebral palsy and gait analysis) should submit a cover letter, CV and three letters of recommendation sent separately to:

Dr. Mark F. Abel, Search Committee Chairman
Motion Analysis Laboratory
Kluge Children's Rehabilitation Center
2270 Ivy Road
Charlottesville, VA 22903
Tel: (804) 982-0893
Fax: (804) 982-1727
E-mail: scg3q@virginia.edu

The University of Virginia is an equal opportunity/affirmative action employer.

POST-DOCTORAL POSITION LOCOMOTION ANALYSIS

Exercise and Sports Science Programme
Auckland, New Zealand

Applications are invited for a Post-Doctoral position in the Biomechanics Laboratory of the Exercise and Sports Science Programme, The University of Auckland, Auckland, New Zealand.

Initial funding is available for 15 months from October 1995 to work in locomotion analysis (both walking and running). The starting salary level will be NZ\$35,000 p.a. Travel assistance is available.

Interested persons are encouraged to contact Bob Marshall, indicating their interests, skills and including a brief curriculum vitae.

Associate Professor R.N. Marshall
Exercise and Sports Science Programme
Tamaki Campus
The University of Auckland
Auckland, New Zealand
Tel: +64 9 373 7599 ext. 6630
Fax: +64 9 373 7043
E-mail: r.marshall@auckland.ac.nz

BIOMEDICAL ENGINEER

Krug Life Sciences Biotechnology Laboratory at the NASA Johnson Space Center invites applicants to fill the position, "Biomedical Engineer". Applicants must have a Ph. D. or equivalent experience in engineering or physical science with a strong engineering background. The successful candidate will develop significant research programs to deliver state-of-the-art sensor systems for detection of nutrients, waste products, and biomolecules in cell cultures grown in microgravity bioreactors. Excellent communication skills and the ability to work independently on multiple high visibility projects are required. The ideal candidate must be an extensive and original thinker able to identify, plan, and perform project ideas and to work within an interdisciplinary group of researchers and engineers.

Interested applicants should submit curriculum vitae, a description of career goals and research objectives, list of their references and their salary history. Indicating position # 95-122-33 to:

Krug Life Sciences Inc.
Human Resources Department
P. O. Box 58827, Houston, TX 77258-8827
or email to: jhoose@medics.jsc.nasa.gov

RESEARCH ENGINEER POSITION

The Musculoskeletal Research Center (MSRC) of the Department of Orthopaedic Surgery at the University of Pittsburgh is currently seeking an engineer specializing in soft tissue biomechanics research, with strong focus on experimentation.

A Master of Science degree or a Bachelor of Science with 1-2 years of laboratory experience in bioengineering, mechanical engineering, or a related discipline is required. Previous experience with cell culture, experimental animals and knowledge of statistics are desirable. Responsibilities include assisting in the development of research projects with graduate students, residents and medical research fellows.

Qualified applicants should forward a comprehensive resume or curriculum vitae and three letters of recommendation to:

Savio L-Y. Woo, Ph.D.
Ferguson Professor and
Vice Chairman of Research
Department of Orthopaedic Surgery
University of Pittsburgh
Suite 1010 Liliane Kaufmann Bldg.
3471 Fifth Avenue
Pittsburgh, PA 15213, USA

The University of Pittsburgh Medical Center is an equal opportunity and affirmative action employer. Women and minorities are encouraged to apply.

NIKE CONTRACT ENGINEERING POSITIONS

The Nike Advanced Technology Exploration (ATE) Department is a unit of Nike, Inc., that investigates new and emerging technologies which can impact the effectiveness of Nike's total business. The engineering, research, and program management staff in this department facilitate the development of new business opportunities for innovative products and services.

The department is a small and cohesive unit focused on corporate initiatives, and the operating environment promotes cross-divisional and departmental participation and cooperation. Departmental output consists of concept proposals, business plans, and functioning pilot programs to demonstrate and validate the proposed technologies. Full deployment by Nike's other resource groups may result after positive evaluations.

There is a current need for several additional staff members to join the ATE team. The exact nature of the work of this team needs to remain confidential until an appropriate non-disclosure form is executed. Each of these positions is a contract position, with participation ranging from half-time to full-time, as mutually agreed between Nike and the contractor. A portion of the work may be accomplished off-site, but considerable presence in Beaverton, Oregon, will be required and local candidates are thus preferred. Available positions are:

1. Mechanical Engineer / Industrial Engineer / Manufacturing Process Engineer - Seeking a generalist with broad experience suitable to working in a development environment - Experience with materials handling problems (rubber, polymers, EVA, PU) - Experience with process engineering - Experience with machine design for manufacturing - Familiarity or experience with robotics, automation systems - Work involves optimizing today's processes for lower cost, higher speed - Expected experience range: 10 - 15 years.
2. Mechanical Engineer / Biomechanical Engineer - Strong software literacy, including creation of application programs - Generalist background with significant lab or university research experience - Recent graduate plus research work (1-5 years) following BS/MS degree - Familiarity with biomechanics issues, particularly footwear development.

For more information, or to submit a letter of interest, please contact:

Harry M. Taxin or Juile Marquard
Program Manager Human Resources

Nike, Inc.
13630 SW Terman Road, Bldg. 16 97005
Beaverton, OR 97076

Phone: 503-671-1509 Phone: 503-671-2901

Fax: 503-671-1506

E-mail: harry.taxin@nike.com

PROFESSOR / SENIOR LECTURER IN SPORT SCIENCES

The Institute of Sports Sciences at the Karl-Franzens-University of Graz, Austria announces the coming vacancy of Professor/Senior Lecturer in Sports Science as of 1/10/1996. The applicants should be qualified to lecture at University level (Habilitation) or be otherwise suitably qualified. Applicants should possess particular knowledge and scientific qualification in the areas of humanities and natural sciences oriented around sports. Applicants with experience in sport as well as skills in scientific training studies and the teaching of sport are preferred.

Applications are to be sent with the corresponding documentation (Bibliography, Curriculum Vitae and a list of the seminars and lectures held), by 30/9/1995 to:

Dekanat der Geisteswissenschaftlichen
Fakultät der Karl-Franzens-Universität Graz
A-8010 Graz, Universitätsplatz 3
AUSTRIA

The Karl-Franzens-University of Graz wishes to increase the number of women in its scientific personnel and requests in particular that women apply for this post.

BIOMEDICAL ENGINEER

PA College of Podiatric Medicine is seeking a M.S. in Electrical Engineering, Biomedical Engineering or Bioengineering to serve as the Chief Engineer in the Gait Study Center of the Department of Orthopedics.

Successful candidate should have expertise in Biomedical Instrumentation, systems integration, calibration, maintenance, repair and design. Candidate should have experience and/or interests in contributing to the advancement of the state of the art in foot and ankle biomechanics.

We offer a comprehensive benefits package. Salary commensurate with experience. Candidates should send their curriculum vitae, salary requirements and the names of 3 referees to:

Howard J. Hillstrom, PhD
Director of the Gait Study Center
PA College of Podiatric Medicine
8th & Race Street, Philadelphia
PA 19107, USA

FACULTY POSITIONS (BIOMECHANICS AND EXERCISE PHYSIOLOGY)

Edith Cowan University (Joondalup Campus)
Faculty of Science, Technology and Engineering
School of Physical and Life Sciences
Department of Human Movement

Senior Lecturer (Level C) / Lecturer (Level B) -- Biomechanics

Three year fixed term contract commencing 1st January 1996 to 31st December 1998.

Applications are invited for the position of Senior Lecturer/Lecturer in Biomechanics in the Department of Human Movement.

Applicants must have a PhD and demonstrate a commitment to high quality teaching and to research supervision at the graduate level.

The successful applicant will teach Biomechanics at the undergraduate and postgraduate levels, undertake research, and will have the opportunity to supervise Honours, Masters and PhD students.

The ability to establish research and teaching links with other Sports Science disciplines such as Exercise Rehabilitation and Functional Anatomy would be an advantage.

Depending on experience and qualifications, the appointment will be made at Lecturer B (\$41,574 to \$49,370) or at Lecturer C (\$51,692 to \$59,605).

Lecturer (Level B) -- Exercise Physiology

Three year fixed term contract commencing 1st January 1996 to 1st December 1998.

Applications are invited for the position of Lecturer in Exercise Physiology in the Department of Human Movement.

Applicants must have a PhD and demonstrate a commitment to high quality teaching and to research supervision at the graduate level.

The successful applicant will teach Exercise Physiology at the undergraduate and postgraduate levels, undertake research, and will have the opportunity to supervise Honours, Masters and PhD students.

The ability to establish research and teaching links with other Sports Science disciplines such as Biomechanics and Functional Anatomy would be an advantage.

Salary for Lecturer B: \$41,574 to \$49,370

Applications for both positions should be made to:

Dr Barry Gibson, Chairperson
Department of Human Movement
Faculty of Science and Technology
Joondalup Drive, Joondalup
WA 6027, AUSTRALIA
Tel: +61-9-405 5578; Fax: +61-9-405 5717

Calendar of scientific events

September 10-11, 1995

Second Triennial International Hand and Wrist Biomechanics Symposium, San Francisco, California. Contact: David L. Nelson, M.D. Co-Chairman, Hand and Wrist Biomechanics Symposium, 56 Delmar Street San Francisco, CA 94117, USA.

September 16-22, 1995

Third IOC World Congress on Sports Sciences, Atlanta, USA. Contact: Mari Tollaksen, Congress Coordinator, The Atlanta Committee for the Olympic Games, 250 Williams Street, Suite 6000, Atlanta, GA, USA 30303. Tel: (404) 224-1952; Fax: (404) 224-1997.

September 20-25, 1995

17th Annual International Conference of the IEEE Engineering in Medicine and Biology Society & 21st Canadian Medical and Biological Engineering Conference, Montreal, QC, Canada. Conference secretariat: Coplanor Congres inc., 511 Place d'Armes, Suite 600, Montreal, QC, Canada H2Y 2W7. Tel: 514-848-1133; Fax: 514-288-6469; E-mail: embc95@coplanor.qc.ca. Up-to-date information on World Wide Web at <http://ralph.biomed.mcgill.ca/EMBC95>.

November 9-12, 1995

2nd Interdisciplinary World Congress on Low Back Pain: The Integrated Function of the Lumbar Spine and Sacroiliac Joints, La Jolla, USA. Contact: UCSD, Office of Continuing Medical Education, UC San Diego School of Medicine, La Jolla, CA 92093-0617, USA.

January 7-13, 1996

1st International Congress on Skiing and Science, St. Christoph a. Arlberg, Austria. Contact: Prof. Dr. Erich Müller, Congress-Chair, Institut für Sportwissenschaften, Der Universität Salzburg, Akademiestrasse 26, A-5020 Salzburg, Austria. Tel: 06 62-80 44-4852; Fax: 06 62-80 44-614.

February 1-2, 1996

Australian Biomechanics Conference, Sydney, Australia. Contact: Wendy Gilleard, Faculty of Health Sciences, The University of Sydney, East St., Lidcombe, NSW 2141, Australia. +61 2 646 6455.

May 20-23, 1996

Third International Workshop on Animal Locomotion.
Saumur, France. Contact: INRA, SGQA, Secretariat of
IWAL 3 - E. Barrey, 78352, Jouy-en-josas cedex,
France. Fax: +33-1-34-65 22 10; E-mail:
ugeneba@dgal.jouy.inra.fr.

June 25-29, 1996

**14th International Symposium of Biomechanics in
Sport**, Funchal, Madeira, Portugal. Contact: ISBS'96 -
Secretariat, R da Alfandega, 78-5, 9000 Funchal
Portugal. Tel. 351-91-233229; Fax. 351-91-233249;
E-mail: citma@dragoeiro.uma.pt

July 1-3, 1996

**Fourth International Symposium on 3-D Analysis of
Human Movement**, Grenoble, France. Contact: Paul
Allard, Secretariat, Research Center, Sainte-Justine
Hospital, 3175 Cote Ste-Catherine, Montreal, PQ,
H3T 1C5, Canada. Tel: +1-514-345-4740; Fax: +1-514-
345-4801.

July 1-5, 1996

**9th International Conference on Mechanics in
Medicine and Biology**, Ljubljana, Slovenija. Contact:
Mrs. A. Kregar, Cankarjev dom, Presernova 10, 61000
Ljubljana, Slovenia. Fax: +386 61 217 431.

August 28-31, 1996

**10th Conference of the European Society of
Biomechanics**, Leuven, Belgium. Contact: Dr J. Vander
Sloten, Katholieke Universiteit Leuven. Division of
Biomechanics and Engineering Design, Celestijnenlaan
200-A, B-3001 Heverlee, Belgium. Tel:
xx.32.16.20.70.96; Fax: xx.32.16.29.27.16; E-mail:
jos.vandersloten@mech.kuleuven.ac.be.

August 25-29, 1997

**XVIth Congress of the International Society of
Biomechanics**, Tokyo, Japan. Contact: Prof. Shenshi
Fukashiro, General Secretary, XVIth ISB Tokyo
Congress, Dept. Life. Sci., The University of Tokyo,
Komaba 3-8-1, Meguro 153, Japan. Tel/Fax: +81-3-
5454-9494; E-mail: ISB97@idaten.c.u-tokyo.ac.jp.

ISB membership news

NEW MEMBERS

MRACHACZ, Natalie (#1654)
Department of Human Movement
The University of Western Australia
Nedlands, WA 6907
AUSTRALIA

DESCHODT, Veronique (#1655)
Laboratoire de la Performance
Universite Claude Bernard Lyon 1
27-29 Bd du 11 Novembre 1918
Villeurbanne Cedex 69 622
FRANCE

BROSSAT, Laurent (#1656)
Laboratoire de la Performance Cris
Universite Claude Bernard Lyon I
Place de l'Eglise
Les Ollieres 07360
FRANCE

DENNERLEIN, Jack Tigh (#1657)
Department of Mechanical Engineering
University of California, Berkeley
2023 Channing Way #6
Berkeley, CA 94704
USA

SHOLUHA, Victor (#1658)
>Department of Applied Mathematics
>St. Petersburg Technical University
Svetlanovsky Ave., 38-1-104
St. Petersburg 195427
RUSSIA

ZINKOVSKY, Anatoly (#1659)
Department of Biomechanics
St. Petersburg State Technical
University
Bryantseva Str.
St. Petersburg 195269
RUSSIA

TREGOUBOV, Vladimir (#1660)
Institute of Mathematics & Mechanics
St. Petersburg State University
Bibliotechnaya, 2, Peterhof
St. Petersburg 198904
RUSSIA

ZOMMERS, Alfred (#1661)
Department of Education & Recreation
Victoria University
P.O. Box 474
Box Hill, VIC 3124
AUSTRALIA

BODEN, Anna (#1662)
Department of Agriculture
Swedish University of Agricultural
Sciences
P.O. Box 7033
Uppsala S-75007
SWEDEN

DIXON, Sharon Jane (#1663)
Department of P.E. & Sports Science
Loughborough University
Ashby Road
Loughborough, Leics LE11 3TU
UNITED KINGDOM

KING, Mark Arthur (#1664)
Dept. of P.E., Sports Sci. & Rec. Man.
Loughborough University
Ashby Road
Loughborough, Leics LE11 3TU
UNITED KINGDOM

BREWIN, Mark Adrian (#1665)
Dept. of P.E., Sport Sci. & Rec. Man.
Loughborough University
Ashby Road
Loughborough, Leics LE11 3TU
UNITED KINGDOM

BARTON, Gabor (#1666)
Centre for Sports & Exercise Sciences
School of Human Sciences
Liverpool John Moores University
Byrom Street, Mountford Building
Liverpool L3 3AF
UNITED KINGDOM

SIGURDERDOTTIE, Svandis (#1667)
Department of Physiotherapy
Faculty of Medicine
University of Iceland
Vitastig 8
101 Reykjavik
ICELAND

BURFORD, William L. (#1668)
Orthopaedic Biomechanics Lab.
University of Texas Medical Branch
MS 0353
Galveston, TX 77551-0353
USA

KLESHNEV, Valery (#1669)
Peak-Performance Training
Research Institute of Physical Culture
Dinamo, 2
St. Petersburg, 197042
RUSSIA

GOLDIE, Patricia (#1670)
School of Physiotherapy
LaTrobe University
Locked Bag 12
P.O. Carlton South, Vic 3053
AUSTRALIA

KESEL, Antonia (#1671)
Department of Zoology & Bionics
University of the Saarland
Gib. 6
D-66041 Scaarbruecken
GERMANY

YANAGI, Hitoshi (#1672)
Institute of Sports Medicine & Science
Usaka 49-9. Agui-Town
Chita, Aichi 470-22
JAPAN

VAIN, Arved (#1673)
Instit. of Experimental Physics & Tech.
University of Tartu
Tahe 4
Tartu EE2400
ESTONIA

RAPP, Walter (#1674)
Institute of Sports Science
University of Stuttgart
Allmandning 28
Stuttgart 70563
GERMANY

DE BRUIN, Eling Douwe (#1675)
Laboratorium fur Biomechanik
Technische Hochschule (ETH), Zurich
Wagistrasse 4
8952 Schlieren
SWITZERLAND

CAPELLO, Angelo (#1676)
Dept. of Elect., Comp. Sci. & Systems
University of Bologna
Viale Risorgimento, 2
Bologna 40136
ITALY

CASOLO, Federico (#1677)
D.S.T.M. - Azionamenti Meccanici
Politecnico di Milano
P.za Leonardo da Vinci 32
Milano 20133
ITALY

CORNWALL, G. Bryan (#1678)
Department of Mechanical Engineering
Queens University
McLaughlin Hall
Kingston, ON K7L 3NS
CANADA

BONIN, Veronica (#1679)
Arbeitsbereich Biomechanik
Technische Universitat Hamburg-Harburg
Denickestr. 15
Hamburg 21073
GERMANY

OHYAMA BYUN, Keigo (#1680)
Department of Health and Sport Sciences
University of Tsukuba
1-1-1 Ten-noudai
Tsukuba, Ibaraki 305
JAPAN

OKADA, Junichi (#1681)
School of Human Sciences
Waseda University
2-579-15 Mikajima
Tokorozawa, Saitama 359
JAPAN

HARLAND, Martin James (#1682)
Department of Biomedical Science
University of Wollongong
Northfields Avenue
Wollongong, NSW 2526
AUSTRALIA

MAHAR, Andrew T. (#1683)
Department of Exercise Science
University of Massachusetts, Amherst
9 Grove St. #2
Amherst, MA 01002
USA

DOROTICH, Paul Danilo (#1684)
Human Performance Laboratory
University of Calgary
Sports Medicine Centre
Calgary, Alberta T2N 1N4
CANADA

YASUI, Toshifumi (#1685)
Aoyama-Gakuin University
1-1 Morinosato
Atsugi, Kanagawa 243-01
JAPAN

HEINONEN, Ari Olavi (#1686)
Bone Research Group
UKK Institute for Health Promotion
Research
Kaupinpuistonkatui
Tampere FIN-33500
FINLAND

SIEVANEN, Harri (#1687)
Bone Research Group
The UKK Institute
Kaupinpuistonkatui
Tampere, FIN-33500
FINLAND

KAGA, Masaru (#1688)
Faculty of Education
Okayama University
3-1-1 Tsusima-naka
Okayama City, Okayama Pref. 700
JAPAN

SASAHARA, Hideo (#1689)
Department of General Education
Hiroshima University of Economics
5-33-1 Giom Asaminami
Hiroshima 731-01
JAPAN

LEE, Chee Pheng (#1690)
Pro Muscle Exercise Centre
37. Jln. Haji Eusoff, Housing Trust
Ipoh, Perak 30250
MALAYSIA

TSUNODA, Kazuhiko (#1691)
Hokusei Gakuen Women's Junior College
Minami 4th Nish 17th Chou-ku
Sapporo 064
JAPAN

KERSTING, Uwe G. (#1692)
Institute for Athletics and Gymnastics
German Sports University
Carl-Diem-Weg 6
Cologne 50939
GERMANY

ARNDT, Anton Nicholas (#1693)
Institute für Leichtathletik und Turnen
German Sport University, Cologne
Carl-Diem-Weg, 6
Cologne 50933
GERMANY

NIESSEN, Wolfgang (#1694)
Institute für Sportwissenschaften
Universität Salzburg
Akademiestr. 26
Salzburg 5020
AUSTRIA

SCHWAMEDER, Hermann (#1695)
Institut für Sportwissenschaften
Universität Salzburg
Akademiestr. 26
Salzburg 5020
AUSTRIA

SU, Fong-Chin (#1696)
Institute of Biomedical Engineering
National Cheng-Kung University
1 Dattsieh Road
Tainan 701
TAIWAN

SATO, Takeshi (#1697)
Human Performance Lab.
Waseda University
2-579-15 Mikajima
Tokorozawa, Saitama 359
JAPAN

SORENSEN, Henrik (#1698)
MAIC
University of Copenhagen
Panum Institute
Blegdamsvej 3
Copenhagen N 2200
DENMARK

MAKHSOUS, Mohsen (#1699)
Dept. PoF. Mat., Biomechanics
Chalmers University of Technology
Goteborg
S-41296
SWEDEN

MURPHY, Aron Joseph (#1700)
Centre for Exer. Sci. & Sport
Management
Southern Cross University
Military Road
Lismore NSW 2480
AUSTRALIA

FELL, Neil (#1701)
Centre for Sport and Exercise Sciences
Liverpool John Moores University
Mountford Building
Liverpool L3 3AF
UNITED KINGDOM

GRAHAM-SMITH, Philip (#1702)
Centre for Sport and Exercise Sciences
Liverpool John Moores University
Mountford Building
Liverpool L3 3AF
UNITED KINGDOM

EGAWA, Ken'ichi (#1703)
School of Human Sciences
Waseda University
2-579-15 Mikajima
Tokorozawa, Saitama 359
JAPAN

IMRAN, Ahmed (#1704)
> Department of Engineering Science
> University of Oxford
Wofson College, Linton Road
Oxford OX2 6UD
UNITED KINGDOM

ITO, Masamitsu (#1705)
Dept. of Life Sciences (Sports Science)
University of Tokyo
Komaba 3-8-1
Meguro, Tokyo 153
JAPAN

GARBUTT, Gerald (#1706)
School of Health Sciences
University of Sunderland
Chester Road
Sunderland, Tyne & Wear SR1 3SD
UNITED KINGDOM

SCHWIRTZ, Ansgar (#1707)
Institute of Sport and Sport Sciences
University of Freiburg
Schwarzwaldstr. 175
Freiburg 79199
GERMANY

STARITA, Antonina (#1708)
Department of Computer Science
University of Pisa - Italy
C.so Italia, 40
Pisa 56125
ITALY

LAHTINEN, Jukka (#1709)
Training and Coaching Centre
Pajulahti Sports College
Pajulahdentie 167
Nastola 15560
FINLAND

HAKKANEN, Marketta (#1710)
Musculoskeletal Research Unit
Finnish Institute of Occupational Health
Topeliuksenkatu 41 aA
FIN-00250 Helsinki
FINLAND

SATI, Marwan (#1711)
Biomedical Engineering Department
Ecole Polytechnique
P.O. Box 6079 Station "Down town"
Montreal, Quebec H3C 3A7
CANADA

ENRIQUE, Navarro (#1712)
Department of Biomechanics
Institute of Physical Education (Madrid)
Pasaje del Can Menor 10
Madrid 28007
SPAIN

ARTEAGA ORTIZ, Rafael (#1713)
Department of Physics
Ciencias Basicas
University of Las Palwas
Edificio Ciencias Basicas
Las Palwas Gran Canaria, 35017
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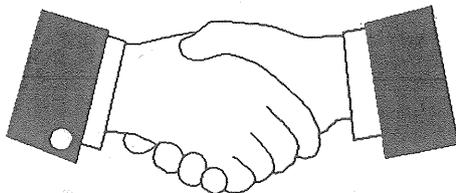
TSANG, Wai Nam (#1714)
> Surgical Division
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Flat A, 5/F, Block 10, Prestine Villa
To Fung Shan Road, Shatin
HONG KONG

YAMAMOTO, Shinichiro (#1715)
Research Institute
National Rehabilitation Centre for the
Disabled
Namiki 4-1
Tokorozawa 359
JAPAN

FU, Siu Ngor (#1716)
> Surgical Division
> The Chinese University of Hong Kong
Flat 2C, Ka Shing Lau, Ka Wai Cheun
Hung Ham
HONG KONG

KATO, Yoshinobu (#1717)
Department of Health and Welfare
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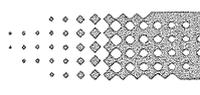
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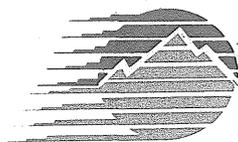
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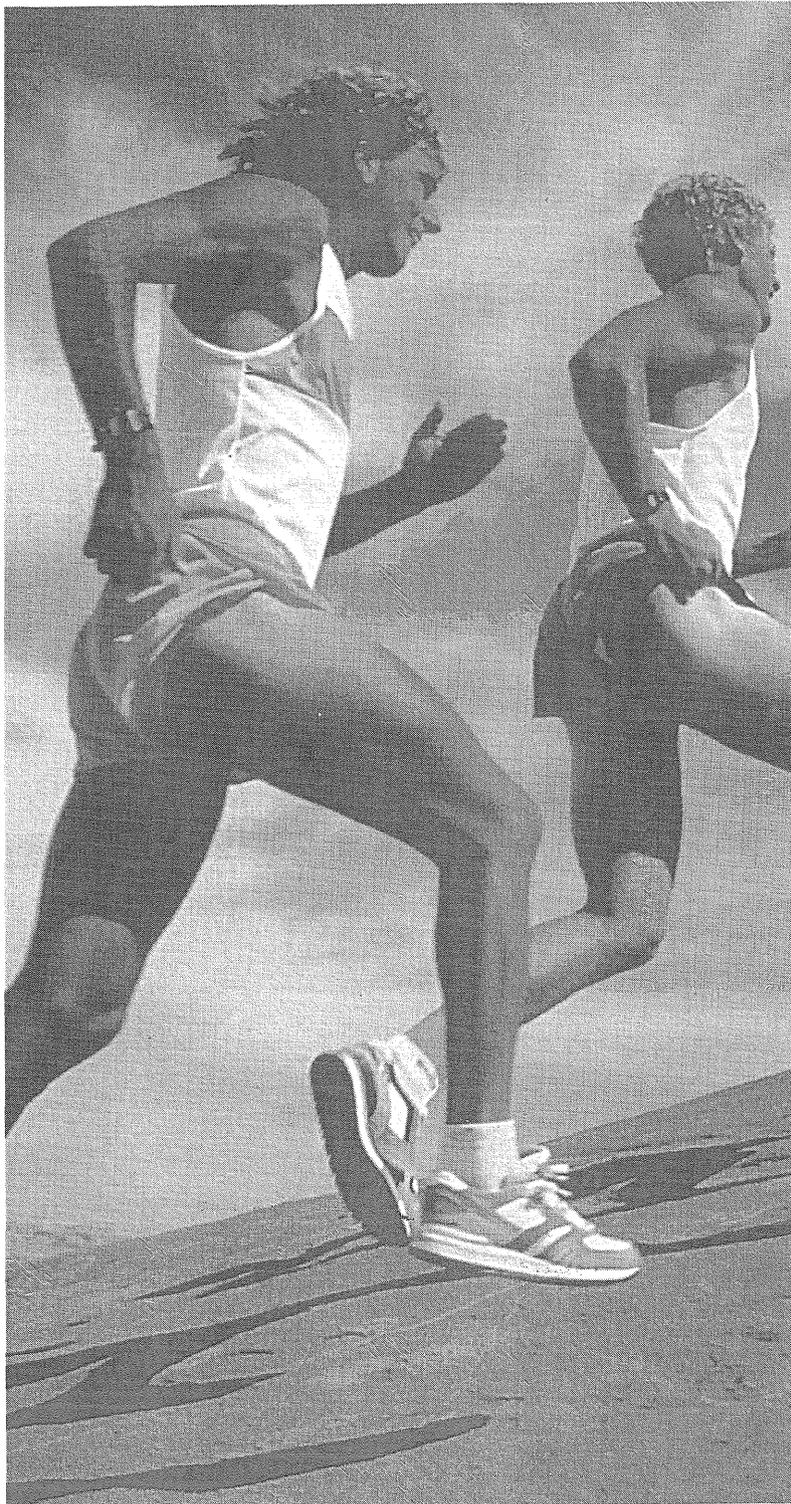
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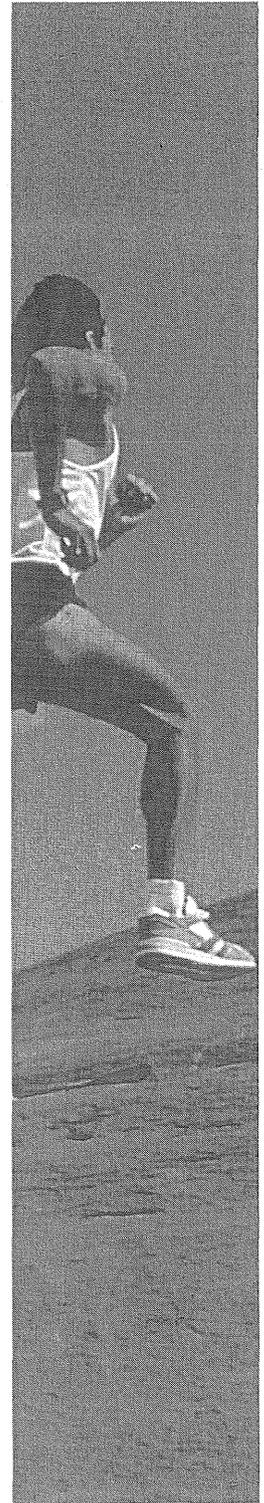
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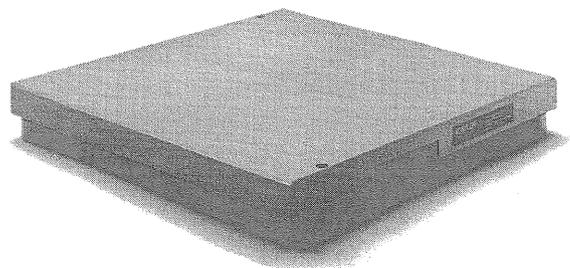
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