International Society of Biomechanics Newsletter

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Editorial

This issue is my first as the new ISB Newsletter Editor, a Council portfolio that I have inherited from Professor Jan Clarys. Jan, with the able assistance of his colleague Jan Cabri, has been at the helm of the society's Newsletter since 1983. However, any changes that you perceive should end with the Editor's name, for I felt no need to meddle with the presentational format of what I considered already to be a first-rate publication. For that I'm greatly indebted to Jan - indeed we all are - and I will endeavour to maintain his high standard during my term as editor.

Already though, this Editor has run into problems. Firstly, the seasonal naming of issues seemed a bit incongruous, given the realities of life in the Southern Hemisphere. However, rather than confuse the majority, but nevertheless ensure that some measure of sympathy will prevail when a pale face from "down under" appears at a conference in "Summer", I've decided to identify our quarterly issues as Feb/Mar, May/Jun, Aug/Sep, and Nov/Dec respectively.

Secondly, I've already used up all the material that Jan kindly forwarded to me for publication. So let's hear from you ! Whether it's a **Lab Feature**, **Thesis Abstract**, **Conference** or **Society Report**, or just an **Announcement** I'll publish it. I would also like to print at least one **Special Article** in each issue, like the one on Sports Biomechanics in the USSR contained here.

Material submitted for publication should be good quality type with black-and-white photos or artwork, but the layout is not overly important as the material will be scanned to computer disk for desktop publishing and laser printing of camera-ready copy. Alternatively you may wish to send in material by electronic mail or Fax, although the latter will generally need retyping. Whatever your preference, here's how you reach me:

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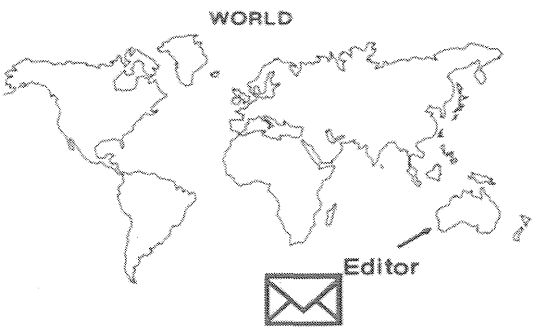

ISB news

COUNCIL SUBCOMMITTEES AND POSITIONS

Listed below are the various Council subcommittees and their respective membership. Some of these committees are standing committees; some are new and have arisen from ISB Council meetings as described in the minutes, or because the President perceives a need for them. Submissions from ISB members-at-large are, of course, always welcome and can be addressed to the relevant chairperson whose address will be found on the back cover of the last Newsletter.

1. Newsletter Committee: Wood (chair), Stein, Gagnon, Schneider.

2. Publications Committee: Cappozzo (chair), Komor, Paul, Zernicke.

3. Editorial Liaison Person: Zernicke.

4. Honours Awards Committees:
   A. Muybridge Medal: Komi (chair), Nigg, Paul, Grieve, Norman.
   B. New Investigator Awards: Schnieder (chair), Grieve, Wood.
   C. Emeritus Members of ISB: Nelson (chair), Hay, Paul.

5. Technology in Gait Research: Cavanagh (chair), Grieve, Paul, Winter.

6. XIIIth Congress Committee: Wood (chair), Komor, Zernicke, Rosendal, Schneider, Perth Organisers.

7. Affiliated Societies and International Members Committee: Hay (chair), Komor, Kumamoto, Zatsiorsky.

8. 1993 ISB Congress: Cappozzo.

9. ISB Congress Education Program: Rosendal (chair), Wood.

10. Membership Campaign Committee: Chaffin (chair), Gagnon, Nelson, Paul (member interests), Stein.

11. Constitution Committee: Chaffin (chair), Nelson, Norman, Paul.

12. Registration of the ISB Name: Cavanagh (chair), Chaffin, Nelson.

13. Long Range Planning Committee: Norman (chair), Cavanagh, Paul, Cappozzo, Chaffin.

14. Working Groups:
   A. Computer Simulation in Biomechanics: Komor (chair)
   B. World Commission on Sport Biomechanics: Clarys (chair).

15. Archives: Morehouse

GAIT TERMINOLOGY WORKING GROUP

Six years ago the ISB formed a Working Group on Standards and Terminology in Biomechanics and one of their objectives was to complete and publish a document entitled "Standardisation on Terminology in Gait Studies" originally drafted by Professor David Winter. Membership of the Working Group has included: G. Wood, D. Winter, D. Grieve, J. Paul, A. Cappozo and P. Cavanagh, and a preliminary version of the material was recently published by Professor David Winter in his book "Biomechanics of Motor Control of Human Gait" (University of Waterloo Press, Waterloo, Canada, 1987).

The Executive Council believe that the standardization of terminology regarding gait is an extremely difficult matter that needs continual review and collective effort of many. To facilitate such effort, the Working Group is continuing to function under the chairmanship of Professor Peter Cavanagh, and they are seeking additional members. For those interested in contributing to this important project, please contact:

Professor Peter Cavanagh, PhD
Center for Locomotion Studies
Penn. State University
University Park, PA 16802
USA

UPDATE: ABSTRACTS, PROCEEDINGS AND PAPERS OF THE XIIth CONGRESS OF ISB

The XIIth Congress of the ISB is now history, but the scientific information that was presented in Los Angeles persist. From the 235 oral presentations and 162 posters in areas ranging from sport biomechanics, simulation and modelling, orthopaedics, ergonomics, to motor control, a compilation of 'Short Abstracts' has already been published in the Journal of Biomechanics (22: 979-1114, 1989). In addition, the two-page abstracts of these papers are available as the "Proceedings of the XII Congress of the ISB" from the ISB Treasurer's office (see order form below). The extended manuscripts of nine of the keynote speakers have been accepted for publication in an upcoming special issue (supplement) of the Journal of Biomechanics. The scientific papers of the following biomechanists will be included: B. Nigg (Canada), R. Stein (Canada), P. Komi (Finland), M. Kaneko (Japan), T. McMahon (USA), T. Andriacchi (USA), V. Zatsiorsky (USSR), M. Raibert (USA), and C. Rubin (USA). The information presented by Dr. G. van Ingen Schenau (Netherlands), while not presented in the special issue of the Journal of Biomechanics, can be found in Vol. 8 (1989) of the Journal: Human Movement Science. The principle materials presented by Dr. D. Carter (USA) was published in another special issue of the Journal of Biomechanics (20: 1095-1110, 1987). All regular subscribers of the Journal of Biomechanics and all registrants at the XIIth Congress will automatically receive this special ISB issue. As of May, seven of the manuscripts have been sent to the printers, and the final two will follow in June. The papers that will appear underwent the normal review of process for the Journal of Biomechanics. Papers were sent to peers for critical comments and reviews. The special issue of the Journal of Biomechanics will have high-quality scientific papers that will serve as a testament to the quality of the hundreds of scientific papers that were presented at the XII Congress. Certainly, many of the other papers that were presented should soon be appearing as primary articles in scientific journals.

ISB CONGRESS PROCEEDINGS AVAILABLE

The Proceedings from the XIIth International Congress of Biomechanics held at UCLA in June, 1989 in Los Angeles, California USA are now available. The 850-page volume contains two-page abstracts of 413 free communications (oral and poster sessions) presented at the ISB Congress. Since the two-volume hardbound series will not be published as for previous ISB Congresses, these proceedings are an important literature source.

The cost of the Proceedings is as follows:

$30.00 (U.S.) for ISB members
$40.00 (U.S.) for non members

plus postage and handling:

$2.50 (U.S.) for US and Canada
$10.00 (U.S.) for all other countries

To order the Proceedings complete a copy of the form below and mail with payment and postage to:

Dr. Richard C. Nelson
ISB Treasurer
Penn State University
200 Biomechanics Laboratory
University Park, PA 16802
USA

Payment must be in U.S. dollars by check written on a bank in the United States; by international postal money order; or by international traveller's check. Please allow 6-8 weeks for delivery.

(Please type or print clearly)

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Address _____

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_____ Non-Member at $40.00 U.S./ea. _____

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_____ Other Countries $10.00 U.S./ea _____

TOTAL ENCLOSED = _____

Make checks payable to : International Society of Biomechanics

ORGANISATION OF THE XIVth INTERNATIONAL CONGRESS OF BIOMECHANICS

The XIVth Congress of our Society will be held in 1993. Members willing to organise it should send their proposals to the President-elect Aurelio Cappozzo (see address on cover page).

The deadline for submissions ....

Proposals should be accompanied by a detailed description of the hosting Institution, other sponsorships, funding, conference and accommodation arrangements, and transportation services. An estimate of subsistence expenses and Conference fees should also be included. Applicants may enclose suggestions concerning the scientific programme.

All proposals will be assessed by the Society Council and a decision made during its next meeting to be held in San Diego at the end of August, 1990.

MEMBERSHIP RENEWAL REMINDER!

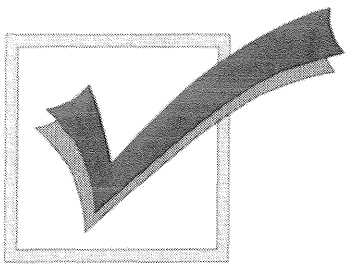
Have you mailed your 1990 membership dues and journal subscription fees to ISB Treasurer Richard C. Nelson yet ? Membership renewal information and forms were sent to all active Society members last November and fees were due by January 1, 1990.

If you have not submitted your 1990 renewal form and payment, please do so today !

Your participation in the ISB is highly valued but we must receive your renewal to keep your membership current.

Remember that all fees must be in U.S. dollars by check written on a bank in the United States, by international postal money order or international travellers check. Make checks payable to: International Society of Biomechanics. **Return completed forms and payment to:**

Richard C. Nelson
ISB Treasurer
200 Biomechanics Lab
Penn State University



Special article

SPORTS BIOMECHANICS IN THE USSR

I. P. Ratov

All-Union Research Institute of Physical Culture, Moscow, USSR

G. I. Popov

Central Research Institute "Sport", Moscow, USSR

A number of scientific teams working in different fields are involved in studies of sports biomechanics in the USSR.

Three research institutes have biomechanical labs, namely: Central Research Institute "Sport" - headed by Prof. G. I. Popov, All-Union Research Institute of Physical Culture - headed by I. P. Ratov, and Leningrad Research Institute of Physical Culture - headed by V. B. Issurin. There are also several chairs of biomechanics in the educational institutes of physical culture and sports.

Most of the investigations on sports biomechanics are coordinated by the USSR State Committee for Physical Culture and Sports. In addition, some scientists who are involved in biomechanics of physical fitness and sport partake in the studies of main problems of biomechanics coordinated by the Scientific Council of the USSR Academy of Science (commission on the problems of biomechanics is headed by Prof. V. M. Zatsiorsky).

The current state of the USSR sports biomechanics is governed by three factors, namely: demands of sport and physical culture; technical possibilities of institutes and laboratories; and qualified personnel.

Researchers of "Sport" focus on the problems of movement control in terms of oscillating and wave processes in the systems of control and execution of human body (G. I. Popov), mathematical simulation of movements (A. V. Voronov), analysis of sports technique of elite athletes and biomechanical foundation of conditions for optimization of sports equipment (G. I. Popov, V. V. Ivanov).

The researchers of the State Institute for Physical Culture (V. M. Zatsiorsky) study more advanced methods to solve the inverse problem of dynamics. The aim is to achieve a higher degree of accuracy through the stereophotogrammetric method and through creating and utilizing the unique radioisotope system for determination of body segment masses.

Researchers of the All-Union Research Institute of Physical Culture (I.P. Ratov), the chair of biomechanics and technical means of the Khabarovsk State Institute for Physical Culture (S.S. Dobrovolsky), the Lvov State Institute for Physical (M.A. Djafarov), and the chair of Biomechanics of the Moscow Regional State Institute for Physical Culture (G.G.

Demirchoglyan), have a traditional policy of scientific studies which focus on the biomechanical foundation for the structures of sports simulators.

Methodology for the development of simulators is based on the concept of "artificial controlling environment" (I.P. Ratov). This determines the selection of the properties of the controlled interrelation with exterior objects through flexible connections, or by applying artificial energy recuperators (G.I. Popov), as well as through creation of original variants for "artificial environment" whose joint characteristics are established when designing operation modes of corresponding simulators stands and which are utilized by athletes to achieve certain results (I.P. Ratov, V.D. Kryazhen).

The chair of Biomechanics of the Belcrussian State Institute of Physical Culture concentrates all efforts, since V.T. Nazarov headed it up, on two fundamental problems - search for the peculiarities of biomechanical stimulation, and substations for the synthesis of sports movement.

The problems of synthesis of sports movements based on computer simulation constitute the ultimate goal of the studies carried out by the public biomechanical laboratory of the Leningrad Polytechnical Institute named after M.I. Kalinin. The laboratory is headed by A.V. Zinkovsky.

As a rule the formation process of biomechanical departments takes place simultaneously with development of experimental complexes within such departments. The complexes help to carry out systematic studies in certain trends.

The researchers of the Omsk State Institute for Physical Culture, having perfected the technique of dynamography, carried out longitudinal studies of the peculiarities of the motoric development among children (V.K. Balsevich).

The researchers of the Kiev State Institute for Physical Culture (A.N. Laputin) made a tangible contribution into the application of the accelerometric method utilizing it in combination with other methods in the process of movement teaching.

Accelerometry was a principle method in the studies of gymnastic and jumping exercise used by the researchers of the Tartu University (A. Vine).

Perfecting the traditional methods of cinematography in motion analysis and video technique, and applying computer techniques for processing of video data are the principle trend in the studies carried out by the staff of the Tallinn State Pedagogical Institute named after E. Vilde. The head of the research team concentrates his efforts on the utilization of instrumental investigation means for the analysis of the level of technical perfection in cyclic sports such as skiing and swimming (H.H. Gross).

Side by side with the problem approach to the activity of the main biomechanical department a very distinctive and permanent specialization in certain kinds of sports is well seen in the works of a number noted researchers. Thus, V.B. Issurin focuses his main efforts on the biomechanical analysis of movements applied in canoe rowing. The research work carried out by A.N. Mishin is mainly focused on figure skating. The works of L.Z. Gorokhovsky shed light on the problems pertaining to diving.

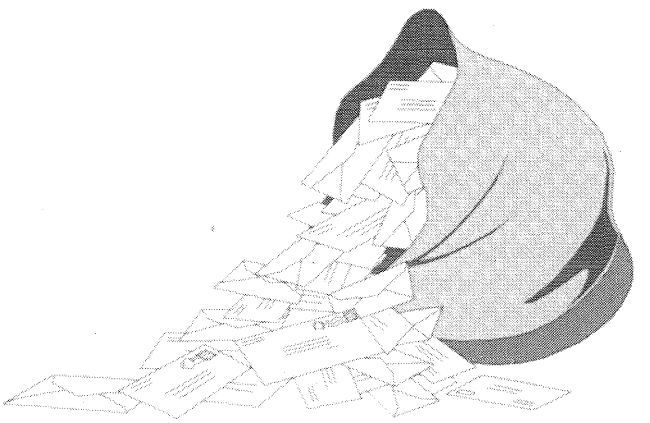
A large group of scientists are permanently studying the problems of gymnastics and thus solving the most important problems applying the model given. Thus, V.B. Korenberg (MRSIPhC) explored the problems of reliability and conditions of qualitative biomechanical analysis; B.T. Nazarov (BSIPhC) developed a new trend in the movement control; and Yu.A. Ippolitov explores the problems of simulation of gymnastic exercises. The works of U.K. Gaverdovsky deal with the analysis of complex gymnastics exercises, while N.G. Suchilin studies the conditions of progressive complexity in gymnastics exercises, and creates algorithms for prognostic programming of complexes of teaching technique.

A number of scientists have developed a distinctive approach for a wide problem generalization. V.L. Utkin was involved for a long time in the studies of the problems related to the optimization of regimes of practically all cyclic exercises, and now I.M. Kozlov explores traditionally the processes of motor control.

The mechanisms and phenomenology of impact movements are studied by G.I. Ivanova (Lukirskaya). The wave oscillating properties of impact movements are studied by F.K. Agashin (VISTI). An original scientific approach is applied by G.G. Demirchoglyan (MRIPhC) in the studies of the role played by the vision in motor control.

In 1986 biomechanics was included in the list of PhD specialities. Nowadays it is possible to receive a PhD degree if the dissertation deals with biomechanical aspects of physics, mathematics, biology, medicine, pedagogy and technical sciences.

The present review of the Soviet scientific trends of sports biomechanics does not naturally hold possibilities to show even briefly the complete scope of work done by individual scientists. Practically we managed to show only the most distinctive and stable trends of scientific studies in this particular field.



Let's hear from you!

Announcements

Biomechanics Positions Available

SPORTS SCIENCE DIVISION OF THE UNITED STATES OLYMPIC COMMITTEE

The Sports Science Division of the United States Olympic Committee is seeking applications for a sports biomechanist. Please share this information with persons you feel are qualified.
Position: Sports Biomechanist
Primary Responsibilities: Involved significantly in the clinical and applied sports biomechanics programs; present lecture and professional programs for athletes, coaches and peers; develop and maintain a record of scholarly activity; contribute to the multi-disciplinary activities within the Division.
Minimum Qualifications and Requirements:
Earned doctorate in biomechanics; demonstrated capability of scholarly productivity and involvement in applied sports biomechanics.
Application Requirements: Please submit letter of interest, resumé, work and related experience; list of professional references and salary requirements to Jay T. Hearney, PhD., Sports Science Division, United States Olympic Committee, 1750 East Boulder Street, Colorado Springs, CO 80909-5760. (719) 578-4516.
Application Deadline: Application requirements must be met and applications received no later than March 30, 1990 to be assured of full consideration.

SCHOOL OF KINESIOLOGY
SIMON FRASER UNIVERSITY

The School of Kinesiology at Simon Fraser University invites applications for a tenure track position in the general area of Biomechanics. A Ph.D in the area of Biomechanics or related areas is essential. Research experience in Human, Rehabilitation or Occupational Biomechanics is desirable.

Simon Fraser University offers equal employment opportunities to qualified applicants. This advertisement is directed to people who are eligible for employment in Canada at the time of application. Others are encouraged to apply but they are not eligible for appointment until a Canadian search is completed and no appointment made.

All appointments are subject to budgetary authorization.

The application should include a C.V. and the names and addresses of three individuals to whom reference can be made. Send applications to:

Dr. J. Dickinson,
School of Kinesiology,
Simon Fraser University,
Burnaby, British Columbia,
Canada, V5A 1S6.

CUMBERLAND COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF SYDNEY

Lecturer in Biomechanics (Tenured)

A position exists in the Department of Biological Sciences for a lecturer in biomechanics from January, 1991.

Duties: In addition to the routine administrative duties of such a position, the successful applicant will be required to lecture to undergraduate students in Occupational Therapy and Physiotherapy as well as to post graduate students in Exercise and Sports Sciences.

A major responsibility of the successful applicant will be to provide strong leadership to the post-graduate program in Exercise and Sports Sciences through independent research and supervision of post graduate students.

Applicants should have graduate qualifications in Biomechanics/Ergonomics and a strong research background.

The biomechanics teaching laboratories are well equipped, with a separate research laboratory for academic staff in biomechanics. Permanent technical support is provided to the academic staff research laboratory by a fulltime electronic engineer and a technical officer.

The Biomechanics Division of the Department of Biological Sciences is involved in joint projects with the College's Centre for Occupational Health with an occupational biomechanics component as well as collaborating with the Schools of Occupational Therapy and Physiotherapy and the Sports Science and Research Centre.

Cumberland College of Health Sciences, a World Health Organisation Collaborating Centre for Rehabilitation, is situated in the western suburbs of Sydney.

Further information relating to the academic/research program may be obtained from:

Richard Smith, Cumberland College of Health Sciences
Phone: (02) 646-6462.

Salary:

Lecturer: $32,197 - 41,841

Interested applicants should write to:

The Director,
Personnel and Staff Services,
Cumberland College of Health Sciences,
University of Sydney
P.O. Box 170, Lidcombe, NSW 2141,
AUSTRALIA.

TRAVELLING TO PERTH FOR THE XIIIth CONGRESS OF ISB ?

ORBA Travel Brokers are offering a full travel service to delegates who will be attending the XIIIth Congress of ISB.

Preferred rates for Accommodation, Air Fares, Car Hire, and Tours are available upon request for both delegates and their families.

Enquiries should be directed to:

ORBA (Travel Brokers)
11 Preston Street — Telephone: (09) 474 1655
Como, WA 6152 — Toll Free: (09) 199 292
AUSTRALIA — Fax: (09) 368 2288

DEPARTMENT OF HEALTH AND PHYSICAL EDUCATION, CALIFORNIA STATE UNIVERSITY SACRAMENTO

Doctorate with specialization in Biomechanics or related field required or tenure-track appointment. ABD candidates will be considered for non-tenure track position that may be converted to tenure track if Doctorate is completed during term of appointment. Completion of doctorate required for tenure and/or promotion.

Experience: Sufficient to teach undergraduate and graduate courses in biomechanics of motion. Demonstrated expertise in computer technology is essential. Ability to utilize computer technology in a practical manner for research and laboratory experiences. Preference given to candidates with experience in college/university teaching, research and grant writing.

Assignment: Teach in areas related to movement analysis including courses with laboratory experiences. Advise undergraduate and graduate students. Direct thesis research. Write research grants. Conduct research, serve on Department committees.

Salary: $28,884 - $55,452, rank depending on qualifications.

Review of applications to begin February 2, 1990 submit vita, names and phone numbers of 3-5 references and college transcripts with letter of application to:

James Bosco,
Chair, HPE Department,
6000 J Street,
Sacramento, CA 95819.

An equal opportunity affirmative action employer. Preference will be given to candidates who meet the diversity needs of the Department.

THE VOLVO AWARDS FOR LOW BACK PAIN RESEARCH 1991

In order to encourage research in low back pain, the Volvo Company of Goteborg, Sweden, also this year has sponsored three prizes of US$ 9.000 each. Awards will be made competitively on the basis of scientific merit in one or more of the following three areas:

1. Clinical studies
2. Bioengineering studies
3. Studies in other basic science areas

Papers submitted for the contest must contain original material, not previously published or submitted for publication. A multiple authorship is acceptable. The manuscripts should be in the form of a complete report, including original illustrations, not exceeding 30 typewritten pages, double-spaced, and in a form suitable for submission to a scientific journal. **One original and 5 copies** of each paper submitted in full should reach the address given below **not later than November 30, 1990**. One of the authors should be prepared, at his own expense, to come to Heidelberg, West Germany, at the time of the meeting of the International Society for the Study of the Lumbar Spine, May 13-16,1991, to present the paper and to receive the award.

The board of referees will be chaired by the undersigned and will contain members from the fields of clinical medicine, bioengineering and biochemistry.

Please direct all correspondence to:

Professor Alf Nachemson
Department of Orthopaedics
Sahlgren Hospital
S-413 45 Goteborg, Sweden

1991 WORLD STUDENT GAMES BIOMECHANICS RESEARCH PROJECT

This project will take place at the World Student Games in Sheffield, England from July 14th - 25th, 1991 and will comprise a limited number of individual research studies, coordinated under the aegis of the British Association of Sports Sciences and the National Coaching Foundation. Proposals for research studies are now invited from sports scientists, preferably working in conjunction with national coaches/governing bodies.

It is anticipated that the studies will involve high speed cinematography or video recording plus computer analysis of the techniques used in specific events. The proposals should indicate how the results will be of direct benefit to both sports scientists and coaches.

Each research proposal should contain the following details:

* Introduction and brief literature review;

* Statement of the research problem;

* Methodology to be used;

* Equipment to be used; Numbers and type of cameras and required placements (the latter will need to be inconspicuous);

* Value to, and implications for, the sport;

* Budget and funding; film requirements; funding available; funding requested;

* Full details of personnel involved and their duties;

* Curriculum Vitae including research and related publications in the area;

* Letter of support from relevant sporting body.

Research proposals should be submitted to arrive no later than 31st October, 1990 to:

Drs R M Bartlett & M R Yeadon
WSG Biomechanics Research Project
c/o National Coaching Foundation
4 College Close
Beckett Park
LEEDS, England

If any further information is required researchers should write to the above address.

Conferences

THE EAST-COAST CONFERENCE ON BIOMECHANICS

August 26th-28th, 1990

Professor H.S. Ranu, Dept. of Biomechanics
Nycom, New York Institute of Technology
Old Westbury, New York 11568, USA
Tel: 516-626-6926 - Fax: 516-626-1306

* Please note the new dates

The conference will cover all aspects of biomechanics including basic biomechanical research, modelling, rehabilitation engineering, soft and hard tissue characterization, medical instrumentation, application of lasers, ultrasound and carbon fibres in medicine, spine biomechanics, human motion analysis, biomaterials, electrical stimulation, cardio-vascular and dental biomechanics, sports biomechanics, biomechanics of trauma, biotechnology, imaging in medicine, resurfacing of articular cartilage, biorheology, orthopaedic biomechanics, clinical engineering, artificial organs, micro-gravity and medicine, bone remodelling etc... Oral and Poster presentations
Special Session on Liability of Medical Devices and Orthopaedic Implants.

Accepted papers will be published in conference proceedings. Selected papers may be published in a journal.

ISB Working Group on Computer Simulation

Third International Symposium on COMPUTER SIMULATION IN BIOMECHANICS

Perth, Western Australia, 5-6 December, 1991

The University of Western Australia's Departments of Human Movement and Mathematics will host the 3rd International Symposium on Computer Simulation in Biomechanics on December 5 and 6, 1991. The symposium will include a keynote speaker, oral presentations of original research, and workshop/demonstration sessions with symposium participant's software. A Young Investigator Award has been donated by the ISB Working Group on Computer Simulation, and will be awarded for the first time in Perth. The Proceedings, consisting of two page manuscripts of all free communications will be available in bound form at the time of the Symposium.

Further details and authors' instructions will be available in October 1990, and interested persons are asked to contact:
Ms. Rosemary Ingham
3rd WGCS Symposium Secretariat
Department of Human Movement
The University of Western Australia
Nedlands, WA 6009
AUSTRALIA
Phone: 61-9-380 236
Fax: 61-9-380 1039
Telex: AA92992

Thesis abstract corner

EVIDENCE OF BIOMECHANICAL FUNCTION SYMMETRY IN THE PRESENCE OF STRUCTURAL ASYMMETRY OF THE LOWER EXTREMITY

by

M. McBride

A thesis submitted to the
School of Physical Education and Recreation
The University of British Columbia
in Partial Fulfillment of the requirements for the degree of
Masters of Physical Education

Supervisor: David J. Sanderson

The widely accepted assumption of biomechanical asymmetry was tested in two groups of five asymptomatic male runners. Members of the structurally symmetrical (SS) group were characterized by a measurable leg length difference (LLD) of less than 3 mm. The five runners classified as structurally asymmetrical (SA) presented with a LLD of greater than 10 mm. It was hypothesized that the assumption of functional symmetry in biomechanical measures would prove valid only in the group of runners classified as structurally symmetrical. In the SA group, it was expected that a LLD would be manifested as inequality in biomechanical measures. If evidence of left-right biomechanical inequality is found in the SA group, an attempt will be made to determine if runners with a LLD were characterized by common, systematic patterns of asymmetry in kinematic and kinetic variables. If universal compensation strategies are identified, insight into the etiology of overuse injuries in runners with a LLD may be possible.

Runners were filmed in the sagittal plane at 150 fps while running barefoot over a flush-mounted force platform at 4.88 m/s. Variables analyzed for each leg included the range of motion for each joint, vertical and anterior-posterior components of the ground reaction force, joint forces and muscle moments. Results for each runner were assessed for functional equality using a symmetry index which was defined as the absolute difference between the left and right leg for the SS runners and between the long and short leg for the SA subjects. Analysis of both experimental groups revealed biomechanical functional symmetry in the majority of variables analyzed. Analysis of data collected from several individual revealed evidence of biomechanical inequality regardless of the structural status of each runner. Based upon these results the following conclusions were made:

1. In a group of subjects demanding a LLD, biomechanical symmetry remained a valid assumption in the general assessment of gait.

2. Structural asymmetry in the form of a LLD is not necessarily manifested as inequality in kinematic of external kinetic measures.

3. Pooling of data to produce group results concealed bilateral asymmetries which existed in individual profiles.

4. As there was no evidence of biomechanical asymmetry in the group of subjects characterized by a LLD, insight into universal compensation strategies which may be linked to the etiology of injury was not possible for the group of SA runners.

5. Individual assessment of four subjects revealed bilateral inequalities in biomechanical measures for both structurally symmetrical and asymmetrical runners.

THE EFFECT OF MANIPULATION OF BLOOD LACTATE ON THE INTEGRATED EMG OF THE VASTUS LATERALIS DURING INCREMENTAL EXERCISE

by

K.L. Seburn

A thesis submitted to the
School of Physical Education and Recreation
The University of British Columbia
in partial fulfillment of the requirements for the degree of
Masters of Physical Education

Supervisor: David J. Sanderson

This study was designed to test the hypothesis that the electromyographic signal recorded from a working muscle reflects changes in blood lactate concentrations. A group of trained cyclists performed two incremental exercise tests on a cycle ergometer. The Control Trial was an incremental test with power increments of 23.5 watts per minute. Cadence was monitored and maintained at 90 $\pm$ 1 revolutions per minute. The Experimental Trial consisted of a high intensity arm exercise protocol designed to elevate blood lactate above 8 mmol/l. The arm protocol was followed by five minutes of rest and the Control Trial incremental exercise protocol. Expired gases were sampled continuously and calculated values for oxygen uptake, ventilation, excess CO_2, and R.Q. were averaged to give a mean value for each minute in both trials. Heart rate was recorded every minute for both trials. Electromyographic data were sampled from the Vastus lateralis of the right leg for the final eight seconds of each workload in both trials. The data were integrated for each pedal cycle and averaged to give a mean integrated value for each cycle (CIEMG) for each workload. Blood samples were drawn from the cephalic vein of the left arm during the last ten seconds of each workload for both trials. The anaerobic threshold (Tlac) was determined using a log-log transformation (Beaver et al., 1985). Control Trial lactate concentration showed a marked inflection point after an initial slow increase. The mean maximal lactate concentration was 18.21 $\pm$ 5.54 in the Control Trials. The inflection point occurred at a mean lactate concentration of 5.58 $\pm$ 1.05 mmol/l. The mean oxygen uptake at the inflection point was 2.28 $\pm$ 0. 37 l/min which represented a mean of 72.6 $\pm$ 7. 2% of maximum. Experimental Trial mean plasma lactate at the beginning of incremental exercise was 26.61 $\pm$ 8.86 mmol/l. The plasma lactate concentration decreased steadily for the initial loads to

a mean low concentration of 10.78 ± 5.78 mmol/l at Tlac and then increased to a mean of 19.08 ± 6.66 mmol/l at test completion. Plasma lactate concentration was greater in the Experimental Trial at all workloads though the values tended to converge once Tlac was surpassed. No visually identifiable inflection point in the plot of CIEMG vs Power could be determined in any of the plots. An analysis of the slope of the CIEMG vs Power relationship was therefore performed. An analysis of variance demonstrated no significant difference in the slope of the relationship within or between trials in three different comparisons. The slope of the line was not statistically different when compared over: (a) the entire sample (b) pre Tlac and (c) post Tlac. Correlations performed between plasma lactate concentrations and CIEMG were significant in five of six subjects during the Control Trial (r = 0.57 to 0.97). During the Experimental Trial only three of the six subjects showed significant correlations and they were in the opposite direction (r = -0.62 to -0.96). Correlations between power output and CIEMG were significant for all subjects in both trials (r = 0.92 to 0.99 Control; r = 0.91 to O.99 Experimental). The increase seen In CIEMG with increased power output reflects poorly the changes in blood lactate concentrations under the conditions of this investigation. Plasma lactate showed a dramatic increase in the Control Trial and a steady decrease from an initial high concentration followed by a marked increase in the final workloads of the Experimental Trial. In contrast the CIEMG increased in a near linear fashion for all subjects in both trials. The changes In CIEMG showed significant correlations with changes in $V0_2$ or power output in both trials for all subjects. These results indicate that changes in the surface electromyogram are highly related to changes in power output. However the surface electromyogram changes are not driven by changes in lactate concentration under the conditions of this investigation and may not be a sensitive enough indicator of these changes to be employed in the determination of Tlac.

KINETIC ANALYSIS OF THE V1 SKATING TECHNIQUE DURING ROLLER SKIING

by

Glenn Michael Street

A Thesis in Exercise and Sport Science
The Pennsylvania State University
The Graduate School
College of Health and Human Development

Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

August 1988

The sport of cross country skiing has recently undergone a major change with the advent of skating, a style that has resulted in a dramatic 15 to 23% increase in average race velocity. To date, little scientific information has been published on skating, particularly in the area of kinetics. Therefore, the purposes of the present study were to measure the poling and skating forces during the V1 skate, and to determine the effect of velocity and side of the body (strong versus weak side) on the patterns of force production.

Ski poles and a roller ski were instrumented with piezoelectric force transducers to measure the magnitudes of the poling and skating forces. Orientations of the force vectors were determined using three-dimensional cinematographic techniques. Data were collected on four collegiate male skiers who performed several trials of the V1 skate on instrumented equipment up a 7° hill at three target velocities of 2.5, 3.25 and 4 m s^{-1}. A repeated measures ANOVA was used to compare means. Parameters evaluated included temporal characteristics of the cycle (cycle velocity, duration, rate and length) and phases (poling and skating durations), and kinetic variables (peak, average and average cycle forces, and impulses) for both the resultant and component poling and skating forces.

The subjects skated faster by increasing cycle length (CL) and rate (CR). Across the casual to 30 km race paces, velocity was increased mainly by changes in CL. At faster speeds, CR became more important. At the sprinting speeds CL plateaued and CR was the dominant controlling factor. The major kinetic change accompanying the increased velocities was a greater contribution by the upper body to total force production. The average poling force and frequency of poling increased ($p<0.1$) which resulted in a significantly larger average cycle poling force (range=0.10 to 0.12 BW).

Several parameters indicated that the poles were used extensively during skating. The average peak strong and weak resultant poling forces were 0.49 and 0.40 body weights (BW's), respectively, which were 2 to 3.5 times larger than those reported for diagonal striding. Furthermore, the poling forces provided a larger component in the forward direction than the skating forces, even though the resultant cycle skating forces (avg.=0.775 BW) were seven times larger than the resultant poling forces (avg.=0.110 BW).

The component force data revealed that the major function of the skis was to support the weight of the subject. The poles contribution to weight support was one-fifth that of the skis. The skis also provided the major impulse for changing the lateral momentum of the skier.

The propulsive contribution of the strong pole was 1.4 times greater than that of the weak pole, thereby fitting of its name "strong pole." "Strong ski" on the other hand was found to be a misnomer in that the weak ski tended to produce larger resultant forces.

The results in the present study clearly demonstrated that the upper body plays a substantially more important role in skating than it does during traditional skiing. This fact supports the contention that skiers must be highly skilled in poling and well trained in the upper body if they are to be successful in the new skating techniques.

This project was funded in part by Reflex and Piezotronics Corporations, and the Sports Equipment and Technology Committee of the United States Olympic Committee.

THE EFFECT OF VELOCITY AND GRADE ON THE KINEMATICS AND KINETICS OF VI SKATING IN CROSS COUNTRY SKIING

by

Gerald A. Smith

A Thesis in Exercise and Sport Science
The Pennsylvania State University
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Submitted in Partial Fulfillment of the Requirements
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December 1989

Skating techniques in cross country skiing have recently revolutionized ski racing events, equipment and performance. Although many skating techniques are used, the VI skate is the predominant pattern used in racing. It involves an asymmetrical cycle with a double poling action associated with the skating motion of one side ("strong side"). The "weak side" is not accompanied by poling. While several kinematic analyses of the VI skate have been completed, little is known concerning the forces involved. To measure such forces, custom force plates were developed for placement between each ski and binding. Four piezoelectric force transducers were placed on the corners of each plate and used to measure the normal forces applied to the ski. Likewise, the poles were instrumented by insertion of a transducer in the shaft of the pole. Outputs of the transducers were sampled and stored in a small computerized data collection system carried by the skier. This 1.3 kg unit included a power supply for the transducers, signal conditioner, computer with BASIC language program, analog-to-digital convertor with 100 Hz sampling frequency, 128 kilobyte RAM and a receiver unit to trigger collection.

Simultaneous with the force collection, the skating patterns were recorded by two high speed video cameras. Direct linear transformation calibration and analysis techniques were used to determine three-dimensional motion. The 3D motion of ski and pole markers synchronized with the resultant force curves were used to determine the force components in three directions defined by the snow surface and the forward direction of motion. Analysis was completed of the VI skating technique of 6 skiers on 9 and 14% uphill grades at four freely chosen velocities (from training through sprinting pace). A repeated measures design and analysis of variance methods were used to compare mean values of selected kinematic and kinetic variables across the two factors.

Cycle times were found to consistently decrease as velocity increased while cycle proportions remained relatively constant across velocities and grades. Poling involved 47 and 43% of the cycle (strong and weak sides respectively). In contrast, the skating motions covered 62 and 66% of the cycle. Cycle lengths were relatively constant across the range of velocities and two grades but cycle rates increased with velocity. Center of mass motion tended to be oriented in a more forward direction at higher velocities and for the lower angled slope.

From the force components of the skis and poles, peak force, impulse and average cycle force were determined. The peak poling resultant force means were 0.58 and 0.50 BW (strong and weak sides), considerably greater values than reported for classic skiing techniques. Skating peak forces (1.48 and 1.27 BW) were similar to the forces observed with other techniques. Total propulsive force tended to increase with velocity and also with grade. Component forces in the lateral and normal directions were not significantly different across factors.

The pole and ski contributions to the total force in the normal and lateral directions were different from their relative contributions to the propulsive component of the force. The skis dominated the lateral and normal forces observed (> 80% of the total X and Z average force). In contrast, the poling forces generated by the upper extremity and the trunk accounted for 66% of the propulsive force (Y component). Thus, the function of the legs in VI skating appears to be primarily as support for the body and to induce lateral motion while the function of the arms is primarily propulsive.

KINEMATIC AND KINETIC ANALYSES OF DROP LANDINGS

by

Jill L. McNitt-Gray

A Thesis in Exercise and Sport Science
The Pennsylvania State University
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Department of Exercise and Sport Science

Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

May 1989

During a landing impact, large forces which create the potential for injury are applied to the human body. In particular, the risk to the lower extremities during gymnastics landings has been proven to be high. The forces experienced may be modified by the human by selectively controlling the joint motion. To determine the effect of impact velocity (2.5 to 5.0 m/s) and landing experience on the strategy selected, the preferred landing strategies used by six male collegiate gymnasts and six male recreational athletes from three drop heights (.32 to 1.28 m) were characterized using mechanical descriptors. Kinematic and kinetic 2D data were acquired simultaneously using high speed film (202.4 fps) and a force plate (1000 Hz). Reaction forces, net joint moments, lower extremity joint motion, joint work, and the generated momentum of each segment were used to characterize the strategies. Results indicated that statistically significant (ANOVA, $p<.05$) increases in joint flexion (with the exception of ankle joint flexion), angular velocity, net moments, work, and impact force resulted as impact velocity increased.

Gymnasts and recreational athletes demonstrated similar adjustment patterns to increases in landing impact velocities; however, significant differences in degree of joint flexion and total landing phase time over impact velocity conditions were found.

ANALYSIS OF MALE AND FEMALE OLYMPIC SWIMMERS IN THE lOO-METER EVENTS

by

Patrick W. Kennedy, Jr.

A Thesis in Biomechanics
The Pennsylvania State University
The Graduate School
Department of Exercise and Sport Science

Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science

December 1989

The kinematic analysis of competitive swimming typically focuses on the factors of stroke frequency, stroke length, and velocity. To date, however, studies concerning the interrelationships of these factors have been limited, involving small sample sizes and conducted in experimental, rather than competitive, situations. Also, little work has been done in which physical characteristics such as height and age have been correlated with the various swimming parameters. Accordingly, the aims of the present study were to determine the intercorrelations among five variables (age, height, stroke frequency, stroke length, and final time), develop a regression equation predicting final time, and determine differences of variable means between gender and across events. Data were gathered from videotapes of the 1988 Seoul Olympic Games swimming competition. The events analyzed were the backstroke, breaststroke, butterfly, and freestyle lOO-meter preliminary heats for both men and women.

Preliminary races were videotaped by panning a camera located at the top row of the spectator seats. For analysis, a computer was interfaced with a video playback unit. Each video frame was time coded which allowed the time between any two frames to be determined with an accuracy of 1/30th second. Average stroke frequency (SF) was calculated from the number of frames required to complete 4 full stroke cycles in the middle of the pool. Average stroke length (SL) were obtained for each swimmer by dividing velocity by SF for each length. Age, height, and final time data, taken from official Olympic Games documents, were also included in the analysis.

Final time (FT) vs. SL and FT vs. height correlations were significant ($p<.05$) for most events. FT vs. age and FT vs. SF correlations were not significant. SL and SF correlations were significant for all events, while age correlated significantly with other variables more for women's swimming than men's. Regression equations predicting FT used SF and SL as the dependent variables. Significant differences between male and female variable means were found. Comparisons across swimming event revealed that for both men and women the mean age and heights were not different, while FT's were different ($p<.05$).

DYNAMIC DISPLACEMENT AND PRESSURE DISTRIBUTION IN ALPINE SKI BOOTS

by

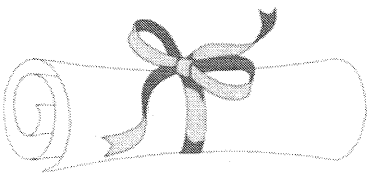
Barbara L. Hall

A Thesis in Exercise and Sport Science
The Pennsylvania State University
The Graduate School
Department of Exercise and Sport Science

Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science

May 1989

The frequency and type of injuries occurring during alpine skiing have changed over the last two decades in parallel with changes in ski boot design. The motion of the lower leg and the pressure at the interface between boot and lower leg were analyzed in both skiers and non-skiers to investigate how ski boot designs might affect the safety of the skier as well as the ability to improve alpine skiing technique. Sixteen subjects, 8 skiers and 8 non-skiers, were tested. Five boots, including traditional, rear entry, and mid entry designs, were studied. In each of the pairs of boots, subjects performed a series of rapid downward movements ("unweighting") on skis which were rigidly attached to a platform. Pressure data were collected using a capacitance measuring mat with six measuring points (each 2 cm_2) located 4 through 17 cm above the ankle along the anterior surface of the right lower leg. Displacement of the leg and boot were determined from two-dimensional video analysis. Results indicated that the pressure generated on the lower leg by experienced skiers was 1.6 times larger than pressure generated by non-skiers. The range of motion (flexion) of the boots was 1.4 times greater for the skiers. The ratio of pressure to angular displacement was consistent across groups but varied among boots, indicating that flexion characteristics are governed by the design of the individual boots. With this in mind, it is recommended that to achieve the range of motion necessary for proper performance of an alpine ski boot, beginning skiers should use a boot with a greater angular deflection for a given applied pressure.



A VALIDATION OF A STEREORADIOGRAPHIC METHOD FOR THE STUDY OF INTERVERTEBRAL MOTIONS

by

A. Plamondon
(M. Gagnon, Advisor)

Submitted in Partial Fulfillment of the
Requirements for the PhD Degree
September 1989

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The problem of low back pain is a tremendously complex one and in order to better understand its mechanics, it is necessary to study the intervertebral motions. The purpose of this study was to describe "in vivo" the lumbar intervertebral motions with a method of high precision and high accuracy.

First, the "Direct Linear Transformation" (DLT) method was used for 3D reconstruction of spine landmarks from two radiographic views. This method was validated and it was demonstrated that the position of two sources and x-ray films, in most of the cases studied, had not significantly affected the accuracy of the method which was in general below 0.2 mm. The error of precision was in general below 0.1 mm.

The major problem in this study was to identify the same anatomical landmark not only on the pair of radiographs used for the three-dimensional reconstruction but also on all the pairs used to analyse the displacement. To minimize the error due to the incorrect identification of anatomical landmarks, a least squares method to resolve the parameters of Euler's angles was validated with simulation studies and by means of measurements made on a spine obtained from a cadaver. The simulation studies demonstrated that the error of accuracy was significantly affected by the distribution of the markers on the rigid body. Using a rigid body representing the size of a vertebra with six landmarks, the error of the displacements should be around 2° in rotation and 1 mm in translation when the landmarks were submitted to an error of $\pm$ 2 mm. The error of accuracy obtained with the cadaver spine varied between 0.69° and 1.71° in rotation and between 0.28 mm and 0.77 mm in translation. In addition, the Euler's angles method used with a least squares method, significantly corrected the position of the anatomical landmarks. The error of position decreased, in general, from 1.19 mm to 0.73 mm and the maximum error was reduced by half.

The helical axis method was also evaluated for the purpose of describing the intervertebral motions. However the results indicated that the helical axis method was very sensitive to landmarks errors. Therefore it is not advisable to describe the intervertebral motions with this method particularly when anatomical landmarks are used.

Finally, the DLT method and the Euler's angles method (with a least squares) were used to evaluate the intervertebral motions of living subjects. Altogether, subjects took part in the experiment. Each subject was radiographed in an upright standing position, and in one of the following positions: flexion, extension, lateral bending and axial rotation. The body position was the maximum for the axial rotation and almost the maximum for the others. The results of the three-dimensional reconstruction procedures and the correction of anatomical landmarks showed an adequate level of accuracy for experiment with living subjects. The mean relative displacements of lumbar vertebrae in rotation were 10° of flexion, 3° of extension, 5° of lateral bending, and 1° of axial rotation.

Euler's angles, used with a least squares estimate, can provide accurate and precise results. This tool can be used to evaluate the lumbar spine displacements.

CORRECTION

The 1989 Winter issue of this Newsletter (No. 37) included a thesis abstract entitled "Biomechanical analysis of the gleno-humeral joint in ergonomic aspects". This was the PhD work of Mrs K. Gielo-Perczak and her supervisor was Professor A. Morecki. It was not a joint dissertation as the heading implied.

EDITOR'S NOTE

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.

Abstracts should not be more than 500 words in length, and any complex equations or graphics must be in good quality black and white form for ease of reproduction.

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Calendar of scientific events

June 7-9, 1990
Techniques in Athletics - The First International Conference.
Institut fur Leichtathletik und Turnen, Deutsche Sporthochschule Koln, Carl-Diem-Weg 6, D-5000 Koln 41, Federal Republic of Germany. Tel: 0221/4982-418/419; Telefax: 0221/4973531.

July 8-11, 1990
Seventh Meeting of the European Society for Biomechanics, in cooperation with the European Society of Biomaterials, Aarhus, Denmark. Congress Secretariat: Aarhus Convention Bureau, Raadhuset, 8000 Aarhus C, Denmark. Tel: +45 8612 1177.

July 9-13, 1990
First World Scientific Congress of Golf. University of St. Andrews, Scotland. Secretary: Dr M.R. Farrally, Director of Physical Education, University of St. Andrews, St. Andrews, Fife KY16 9DY, Scotland, UK. Tel: 0334-75560; Fax: 0334-74322.

July 15-19, 1990
Third International Conference on Equine Exercise Physiology, Uppsala, Sweden. c/o Uppsala Turist och Kongress AB, 'ICEEP III', Box 216, S-751 04 Uppsala, Sweden.

August 30-September 4, 1990
First World Congress of Biomechanics. Secretary General: Dr. Geert W. Schmid-Schonbein, First World Congress of Biomechanics, AMES-Bioengineering R-102, University of California, San Diego, La Jolla, CA 92093, USA. Tel: (612) 534-4272; Fax: (619) 534-5722.

September 7-11, 1990
Sixth International Symposium on Biomechanics and Medicine in Swimming. The Liverpool Polytechnic (UK). Congress Convenor: Don MacLaren, Centre for Sport and Exercise Sciences, Liverpool Polytechnic, Byrom Street, Liverpool L3 3AF, England. Tel: 051-207 3581; Fax 051-709 0172.

November 5-8, 1990
European Conference on the Advancement of Rehabilitation Technology (ECART), in cooperation with The International Society for Prosthetics and Orthotics (ISPO), The International Society for Augmentative and Alternative Communication (ISAAC) and The International Society of Electromyographic Kinesiology (ISEK). Information: ECART, Congress Organization Services, Van Namen & Westerlaken, P.O. Box 1558, 6501 BN Nijmegen, The Netherlands.

November 15-16, 1990
14th Meeting of the American Society of Biomechanics. University of Miami, Coral Cables, Florida. Meeting Chairperson: Tarek Khalil, Industrial Engineering, University of Miami, P.O. Box 248294, Coral Gables, FL 33124. Tel: (305) 284-2344.

November 19-22, 1990
North Sea Conference Biomedical Engineering 90. Regional meeting of The International Federation for Medical and Biological Engineering (IFMBE), University of Antwerp, Universiteitsplein 1, B-2610 Wilrijk (Antwerp), Belgium.

April 8-13, 1991
Second World Congress of Science and Football, Maastricht, The Netherlands. c/o Prof. J.M. Greep, Dept. of Surgery, Academic Hospital St. Annadel, Maastricht, The Netherlands.

July 28-August 2, 1991
11th International Congress of the World Confederation for Physical Therapy, Barbican Centre, London. Congress Secretariat: Conference Association WCPT, 27 A Medway Street, London SW1P 2BD, England. Tel: 01-222-9493.

December 9-13, 1991
XIIIth ISB Congress on Biomechanics, Perth, Western Australia. Congress Secretariat: Ms Rosemary Ingham, Department of Human Movement Studies, The University of Western Australia, Nedlands, WA 6009, Australia. Tel: 61-9-380 2360; Fax: 61-9-380 1039.

ISB membership news

CAN YOU HELP US FIND THESE MEMBERS ?

The following addresses are no longer correct for these four active members and we have not been able to locate them.

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