



International Society of Biomechanics Newsletter

ISSUE Number 58, MAY / JUNE, 1995

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AFFILIATE SOCIETIES OF ISB:

American Society of Biomechanics; British Association of Sports Science; Bulgarian Society of Biomechanics; Canadian Society of Biomechanics; China Sports Biomechanics Association; Czechoslovak Committee on Biomechanics; French Société de Biomécanique; Japanese Society of Biomechanics; Korean Society of Biomechanics; Polish Society of Biomechanics; Romanian Comisia de Biomecanica, Inginerie Si Informatica.

ISB News

FROM THE PRESIDENT - Ron Zernicke

As I'm writing this, it is almost the end of May, and spring is finally coming to the Rocky Mountains. Spring is always a re-vitalising time, for me. And, I believe that this year is a year of re-vitalisation for the ISB.

We are fast approaching the 2-6 July 1995 Congress of the ISB, in Jyväskylä. Hopefully, you will receive this issue of the Newsletter just as you are packing to travel to Finland; I'm sure it will make stimulating reading for the plane ride.

The ISB Executive Council members are diligently preparing for the two days of Council meetings on 1-2 July 1995. There have been many developments and new initiatives--particularly in the area of ISB support of biomechanists in economically developing countries and in the area of ISB Long-Range Planning. Your Council will be solidifying these ideas and proposals during our meetings, and we will report the progress at the Meeting of the General ISB Assembly, in Jyväskylä.

I most strongly urge you to attend the General Assembly meeting. We need your discussion and guidance, as the Council continues to work for YOU.

I have received numerous messages from Paavo Komi and his talented colleagues in Jyväskylä, and, from all indications, the Congress will be expertly organized. As well, the scientific program promises to be excellent--I'm looking forward to participating in the Congress.

This will be my last "President's Message", as Peter Cavanagh will assume his duties as the new ISB President at the General Assembly meeting in Jyväskylä.

First, I wish to thank all the members of ISB who have encouraged me and offered me advice, during my two years as President. Serving the members of ISB has been a privilege for me.

Second, I thank all the dedicated and hard-working members of your Executive Council. It has been a pleasure to work with this excellent group of biomechanists. I think that you will be impressed with the progress that has occurred in some areas, during the past two years. Further, I hope that you will be active in sharing the vision for the future of the ISB, as is being planned with the Long-Range Planning report.

Third, I congratulate Peter Cavanagh, as he assumes his role as President. I have every confidence that Peter will lead the ISB with vigour and vision. I will be pleased to work with him and the membership in my role as Past-President.

Until we meet in Jyväskylä, I wish you best personal regards,

Ron Zernicke

XVth CONGRESS UPDATE

XVTH CONGRESS OF THE INTERNATIONAL SOCIETY OF BIOMECHANICS

Hosted by the University of Jyväskylä
Finland, July 2-6, 1995.



The Book of Abstracts of the XVth Congress of the ISB containing more than 500 abstracts with 1043 pages is in print. The reference is as follows:

Book of Abstracts

The XVth Congress of the ISB

Editors: K. Hakkinen, KL Keskinen, PV Komi and A Mero

Gummerus Kirjapaino OY, Jyväskylä, Finland, 1995

Our internet home page includes more information about the congress itself. You may find the text at <http://www.jyu.fi/~tola/isb/index.html>

Komi PV, Congress Chairman

Häkkinen K, Vice-Chair

Keskinen KL, Secretary General

Multasuo T, Congress Secretariat

PRELIMINARY ANNOUNCEMENT OF XVth CONGRESS OF ISB

ISB President-Elect, Peter Cavanagh, has recently announced that Japan has successfully won the 'bid' to host the 1997 Congress of ISB. A 'First Announcement' will be mailed to all members shortly, but here are the key details.

Dates:

Monday August 25 to Friday August 29, 1997.

Location:

Komaba campus of the University of Tokyo.

ORGANIZING COMMITTEE

The Organizing Committee will be:

Congress Chair: Miyashita Mitsumasa, Ph.D.

Congress Chair: Tetsuo Fukunaga, Ph.D.

Congress Vice-Chair: Kando Kobayashi, Ph.D.

Congress Vice-Chair: Tatsuyuki Ohtsuki, Ph.D.

Secretary General: Yuichi Hirano, M.S.

Secretary General: Senshi Fukushima, Ph.D.

Scientific Committee:

- Fukunaga, Tetsuo (Muscle Function and Architecture: The Univ. of Tokyo)
Ae, Michiyoshi (Sport Biomechanics: Tsukuba Univ)
Doi, Takesumi (Computer graphics: The Univ. of Tokyo)
Ikegami, Yasuo (Computer simulation: Nagoya Univ.)
Ishii, Naokata (Muscle Cell Biomechanics: The Univ. of Tokyo)
Kaneko, Masahiro (Muscle Mechanics of Human Movement: Osaka College of P.E.)
Nagata, Akira (Motor Control of Human Movement: Waseda Univ.)
Ohhira, Yoshinobu (Muscle Cell Biomechanics: National Inst. Fitness & Sports)
Takeda, Takashi (Robot Biomechanics: Nagasaki Inst. of Appl. Sci.)
Watanabe, Kazuhiko (Motor Control and Sport Biomechanics: The Univ. of Hiroshima)
Yamamoto, Yoshiharu (Cardio-Resp. Biomechanics: The Univ. of Tokyo)
Yano, Hideo (Clinical Biomechanics: National Rehabilitation Center)

There will also be an International Advisory Group consisting principally of ISB Council members together with National representatives from Asian and Pacific Countries.

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.

ISB PUBLICATIONS

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

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

Price: 550 FF plus postage

Supplier: Professor S. Metral
Explorations Fonction. du Systeme Nerveux
C.H. Bicetre, 78 Avenue du General Leclerc
94275 Kremlin Bicetre, FRANCE
Fax: (33.1) 45.21.27.14

Vrije Universiteit
van de Boechorststraat 9
1081 BT Amsterdam
THE NETHERLANDS
Fax: +31-20-6442043

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

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

Price: \$AUS 65 plus postage (\$AUD 20 airmail)

Supplier: Graeme A. Wood (address as above)

SECOND WORLD CONGRESS OF BIOMECHANICS ABSTRACT BOOKS (Vols I & II)

Price: NLG 100 (both vols including postage)

Supplier: SWCB Office, Biomechanics Section, Institute of Orthopaedics
University of Nijmegen
P.O. Box 9101
NL-6500 HB Nijmegen
THE NETHERLANDS
Fax: +31-80-540555

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

Laboratory feature

ÉCOLE POLYTECHNIQUE de MONTREAL
Biomedical Engineering Institute
Montreal, Quebec, Canada

Leader: L'Hocine Yahia

Staff:

Professors and Researchers	18
Graduate Students	45
Postdoctoral Fellows	3
Research Assistants	4

Research Activities:

The Group's interests are related to the following subjects:

- a) Modelling of the human and scoliotic spine, 3D analysis of scoliosis surgery, development of a refined lumbar spine model allowing high levels of simulation;
- b) Design of a new 3D action brace for idiopathic scoliosis correction;
- c) Modelling of the knee joint and of the articular tissues;
- d) Muscular coordination and upper-limb movement control;
- e) Biomedical image segmentation and tomographic image resolution enhancement;
- f) Spectral and time-domain analysis of electromyographic signals (in normal as well as hemiplegic subjects); modeling of electromyographic signals;
- g) Design and manufacture of personalized prostheses;
- h) Imaging and 3D modeling of joints;
- i) Non-invasive generation of kinematic animations of knee movement;
- j) Biomaterials: shape memory alloys, biodegradable polymers, ceramics, surface treatment and surface analysis, enhanced corrosion resistance and biocompatibility;
- k) Tissue engineering and cell culture in porous substrates;
- l) Development of an apparatus for 3D spine and ribcage deformation evaluation based on stereo and/or multi-view radiographic approaches;
- m) Development of the first computer-assisted and designed prosthetic foot with 3D energy restitution capabilities;
- n) Production of a multifunctional myoelectric hand prosthesis featuring five independent articulated fingers;

- o) Development of a virtual-reality surgical planning system to improve accuracy and assist surgeons during bone-screw implant procedures;
- p) Investigation of mechanical and biochemical stimulation of wound healing and tissue regeneration;
- q) Investigation of the mechanical behavior of cartilage-like matrices and the influence of mechanical factors on cell and tissue behavior.

Specialized facilities

1. Cell culture apparatus
2. Servohydraulic testing machines (BIONIX-INSTRON)
3. Liveco V100 Vitrodyne
4. Silicon Graphics UNIX workstations
5. Spine model

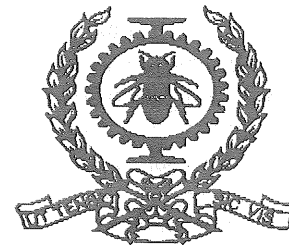
Selected publications:

- BUSCHMANN MD, Gluzband YA, Grodzinsky AJ and Hunziker EB, Mechanical Compression Modulates Matrix Biosynthesis in Chondrocyte/ Agarose Cultures., **J Cell Science**, 108: 1497-1508, 1995.
- BUSCHMANN MD and Grodzinsky AJ, A Molecular model of Proteoglycan-associated Electrostatic Forces in Cartilage Mechanics., **J Biomechanical Engineering**, 117: 179-192, 1995.
- BUSCHMANN MD, Gluzband YA, Grodzinsky AJ, Kimura JH and Hunziker EB, Chondrocytes in Agarose Culture Synthesize a Mechanically Functional Extracellular Matrix., **J Orthopaedic Research**, 10(6): 745-758, 1992.
- DANSEREAU J. et al., Rib cage asymmetry in scoliosis., **Journal of Orthopaedic Research**, Vol. 7, 1989, pp 599-606.
- DANSEREAU J., et al., Evaluation of the immediate effect of the Boston brace on scoliotic deformity by means of spinal and rib cage 3-D reconstructions., **Proceeding of the 37th meeting of the ORS**, Vol.2, 1991, p. 639.
- DANSEREAU J., Effect of radiographic landmark identification errors on the accuracy of 3-D reconstruction of human spine., **J. Med. Bio. Eng. Comput.** 1992.

- DE GUISE J.A. et al., Using structural and visual information in physiological modelling, **Medical progress through technology**, Vol. 15, Nos 3-4, pp. 217-225, 1989.
- DE GUISE, J.A. et al., A radiographic knowledge based system for the localization of scoliotic vertebral anatomical landmarks, **IVth Int. Symp. on Computer Simulation in Biomechanics**, Paris, France, July 1993, 4 pages.
- DE GUISE, J.A. et al., Development of a Stereoradiographic correspondence method for the 3D reconstruction of the scoliotic spine and rib cage, **Proceedings of the International Symposium on 3-D scoliotic Deformities**, Montréal, Canada, June 1992, pp. 376-380.
- DORÉ S., Experimental identification of X-ray CT system characteristics for an improved understanding of image processing., **Ph.D. thesis**, McGill University, May 1992.
- DORÉ S. et al., Coordinate transformation for isoplanatic representation of shift-variant CT point spread function., **Proceedings of the 17th Canadian Medical and Biological Engineering Society conference**, Banff, May 7-11, 1991, pp. 169-170.
- DORÉ S. et al., Variability of CT point spread function within the field of view., **Proceedings of the 12th annual international conference of the IEEE Engineering in Medicine and Biology Society**, Philadelphia, 1-4 November, 1990.
- FELDMAN, A.G. et al., The origin of electromyograms - explanation based on the equilibrium point hypothesis. In J. Winters, S. Woo(Eds.), **Multiple muscle systems: biomechanics of movement organization.**, Springer-Verlag, 1990.
- Flanagan, J.R., D.J. Ostry and A.G. FELDMAN, Control of trajectory modifications in target-directed reaching, **Journal of Motor Behavior**, Vol. 25, No 3, 1993.
- Flanagan, J.R., A.G. FELDMAN and D.J. Ostry, Equilibrium trajectories underlying rapid target - directed arm movements, In G.E. Stelmach, J. Requin (Eds), **Tutorials in Motor Behavior II**. Elsevier Science Publishers. 1992, p.661-675.
- MATHIEU P.A., et al., Computer simulation of the EMG., **Proc. Can. Conf. on Med. and Biol. Engn.**, Ottawa, pp. 374-375, 1993.
- MATHIEU, P.A. et al., Frequency characteristics of signals and instrumentation: implication for EMG biofeedback studies., **Biofeedback and Self-Regulation**, vol.15, no.4, 335-352, 1990.
- MATHIEU P.A. et al., EMG power spectrum as a measure of muscular fatigue at different levels of contraction., **Med. & Biol. Eng. & Comput.**, 28: 374-378, 1990.
- SHIRAZI-ADL, A. et al., Experimental determination of friction characteristics at the trabecular bone/porous-coated metal interface in cementless implants, **Journal of Biomedical Materials Research**, 27: 167-176, 1993.
- SHIRAZI-ADL, A. et al., Nonlinear response analysis of human ligamentous lumbar spine in compression on mechanisms affecting the postural stability, **Spine**, 18: 147-158, 1993.
- SHIRAZI-ADL, A., Forcone .A., Finite element stress analysis of a push-out test-part II Free interface with nonlinear friction properties, **ASME Journal of Biomedical Engineering** 114: 155-161, 1992.
- YAHIA, L'H. et al., Viscoelastic of the Human Lumbodorsal Fascia., **J. Biomed. Eng.**, 15: 425-429, 1993.
- YAHIA L'H. et al., In vitro Fatigue Testing of prosthetic Ligaments: A New Concept. **Bio-Medical Materials and Engineering.**, 1: 159-165, 1991.
- Yahia L'H., Immunohistochemical Study of Nerves in Lumbar Spine Ligaments. **Spine**, vol. 18 (2): 264-267, 1993.

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**ÉCOLE POLYTECHNIQUE
 de MONTRÉAL**

Thesis abstract

MANUAL LIFTING COORDINATION

Robin Burgess-Limerick, R.

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4072, AUSTRALIA

Ph.D. thesis (1994)

Supervisor: Prof. B. Abernethy

This thesis adopts an ecological approach to perception and action as a frame of reference within which to examine the coordination of manual lifting. The human neuromuscular system, qua lifter, is considered as a complex physical system which self-organises within the constraints of the environment to achieve task goals. Goal directed movement arises as a consequence of interaction between the lifter and environment guided by haptic, optic and vestibular perceptual information, and the form of movement is largely determined by the biomechanical properties of the neuromuscular system. The broad aim of this thesis is to explore the form and stability of symmetric bimanual lifting, and the changes in form and stability that occur in response to changes in the environment. This is achieved by describing (i) the patterns of movement which normally occur in the absence of specific instruction; (ii) how these vary as a function of selected environmental variables (load mass and starting height); and (iii) changes in stability of the patterns which occur in response to changes in task parameters.

In Experiment 1, 39 subjects lifted loads of varying mass from 9 cm above floor height. Angular motion in the sagittal plane of ankle, knee, hip and lumbar vertebral joints, and vertical movements of the load, were determined from two dimensional video images collected at 100 Hz while each subject performed a total of 100 lifts. Interpretation of the kinematic data was assisted by surface electromyography and estimation of changes in hamstring length. The majority of subjects adopted a semi-squat posture at the start of the lift and exhibited a pattern of coordination during lifting in which knee extension led hip extension, which in turn led extension of the lumbar vertebral joints. Early in the lifting movement, when load acceleration is greatest, the erectores spinae are thus relatively lengthened and shortening at low velocity. Both these factors result in greater back extensor strength. Rapid hamstring shortening is also delayed, which enhances their strength,

and coactivation of the monoarticular knee extensors and biarticular hamstrings early in the lifting movement suggests that the monoarticular knee extensors contribute to hip extensor torque through a tendinous action of the hamstrings. The pattern of interjoint coordination was exaggerated by increases in load mass.

An ideographic analysis of these data revealed modality in the postures adopted at the start of extension by 4 subjects. While semi-squat postures were usually adopted at the start of extension, on some trials a stooped posture was observed. The likelihood of a stooped posture being adopted was related to load mass in that both postures were observed when the load mass was lighter than a critical value (which varied between subjects). When the load mass was heavier, only a pattern of movement involving a semi-squat posture was recorded. The ratio of knee flexion to the sum of ankle, hip and lumbar vertebral flexion is proposed as a potential order parameter to distinguish between lifting techniques.

Analysis of anthropometric data revealed that taller subjects self-selected a foot position further from the load. These subjects were also heavier and thus lifted greater body mass. However, they were also the subjects with greatest knee, hip and trunk extensor strength. The average posture adopted at the start of extension was otherwise independent of subject anthropometry. The subjects who adopted a stooped posture at the start of extension on some or all trials were, on average, taller, heavier and stronger than the other subjects.

The relationship between the initial load height and self-selected manual lifting technique was explored in two subsequent experiments. In Experiment 2, 20 subjects lifted three different loads (2.5, 4.5 & 8.5 kg) from three different starting heights (9, 18 & 27 cm). In Experiment 3, 32 subjects lifted one of two loads (2.5 or 6.5 kg) from five different starting heights (9, 22, 36, 50 & 63 cm above floor height) in either ascending or descending order of starting heights. Flexion and extension duration,

and flexion of all joints at the start of extension, was reduced at higher starting heights, however, postural index was not reliably altered. Indications of modality were found for 1 subject in Experiment 2 and 4 subjects in Experiment 3. A third qualitatively different pattern of movement involving an extreme stooped posture (i.e., extension of the knee joint relative to normal standing) at the start of extension was observed. Lifting movements involving a semi-squat posture at the start of extension appeared to be relatively less stable when the initial position of the load was high and lifting from stooped or extreme stooped posture was more likely in this situation.

The human neuromuscular system habitually discover solutions to an infinitely diverse set of motor problems. It appears that the system qua lifter is guided by perceptual information to an interaction with the environment which reduces muscular effort. Further, the neuromuscular system is sufficiently sensitive to the muscular effort required that alterations in interjoint coordination occur in response to changes in load mass. If it can be assumed that muscular fatigue contributes to injuries suffered as a consequence of lifting, then a technique which reduces muscular effort may be preferred. If a relationship between muscular effort, fatigue and subsequent injury is accepted then it may be that attempts to alter employees' lifting technique should ensure that the normal coordination between knee, hip and lumbar vertebral joints is not disrupted. Education in general lifting principles or guidelines, and the use of exploratory learning techniques to assist employees to discover individually appropriate modes of coordination, may be more effective than prescriptive instruction of the best lifting technique.

Related Publications:

Burgess-Limerick, R., Abernethy, B., & Limerick, B. (1994). Identifying underlying assumptions is an integral part of research: An example from motor control. *Theory & Psychology*, 4, 139-146.

Abernethy, B., Burgess-Limerick, R., & Parks, S. (1994). Contrasting approaches to the study of motor expertise. *Quest*, 46, 186-198.

Burgess-Limerick, R., Abernethy, B., & Neal, R.J. (1993). Technical note: Relative phase quantifies interjoint coordination. *Journal of Biomechanics*, 26, 91-94.

Burgess-Limerick, R., Abernethy, B., & Neal, R.J. (1992). Letter to the Editor. *Spine*, 17, 1122-1124.

Burgess-Limerick, R., Abernethy, B., Neal, R.J., & Kippers, V. (in press, 1995). Self-selected manual lifting technique: Functional consequences of the interjoint coordination. *Human Factors*.

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Announcements

ANNOUNCEMENT AND CALL FOR PAPERS

FOURTH INTERNATIONAL SYMPOSIUM ON 3-D ANALYSIS OF HUMAN MOVEMENT July 1st - 3rd, 1996, Grenoble, FRANCE

combined with the

FIRST INTERNATIONAL SUMMER SCHOOL THREE-DIMENSIONAL ANALYSIS OF HUMAN MOVEMENT

June 29th - 30th, 1996, Lyon, FRANCE

FOURTH INTERNATIONAL SYMPOSIUM ON 3D ANALYSIS OF HUMAN MOVEMENT

The International Symposium on 3-D Analysis of Human Movement is a scientific and technical forum for investigators of human motion, whether their work is applied to the study of musculo-skeletal disability or disease, sport and elite performance, or basic studies of biomechanics. By generating further communication and contact between investigators in diverse areas, this meeting encourages discussions to cross the boundaries between scientific disciplines and specialities. The Symposium will be directed at sharing information and results relating to philosophies for solving problems of measurement and analysis, rather than only delivering recent research study findings.

SCIENTIFIC PROGRAM

The conference is spanned over three days. There will be keynote speakers in addition to oral presentations. Additional papers will be accepted in the form of poster presentation and a Hyde Park Speakers' Corner is also planned.

1. KEYNOTE SPEAKERS

Four or five keynote speakers will be invited to address issues from the field of computer vision, virtual reality, computer simulation and applied biomechanics.

2. THEMES

Data capture: New instrumentation, and specific hardware, accuracy and precision of various reconstruction techniques, interpolation and calibration, lens distortion correction, etc.

Joint motion: Location of markers, relation between external reference markers and joint movements, definition of local and global coordinate systems.

Modelling: 3-D kinematic and kinetic/dynamic joint models, finite element techniques, estimation of internal forces, model validation and sensitivity analysis. 3-D

Representation: Computer-aided-graphic techniques, animations, simulation, and virtual reality applied to human movement.

3-D Applications and interpretation: 3-D variables used in the analysis of human movement and their relation to conventional 2-D parameters.

3. SUBMISSION

The four-page manuscript is intended to be a complete mini-paper with figures and references. Each submission is to represent original work that has not been reported elsewhere. The paper may report significant results of current pilot studies that may be leading to a journal publication, and as such we do not claim any copyright privileges.

All papers are to be up to FOUR 8 1/2" by 11" or A4 pages in length. Title of paper, in capital letters, must be centred on the first page at about 2cm from the top. The character must be of 10 points Times type or equivalent and single spaced. This is an example. Name of author and co-authors, affiliation and address should be beneath each name, leaving a line in between. The text is to be written at about 7cm from the top of the first page and 2,5cm on the others. It must be within two columns 8cm wide and separated by a 1,5cm space leaving an equal margin on each side. Indent beginning of each paragraph by 4 spaces. Text must be justified to use maximum column width. Text ends 2,5cm from the bottom. Left justify and underline each heading in the column and use capital letters with one space above each heading. Figures may be full width if necessary. SI units are to be employed. The manuscript will be reproduced exactly as submitted so new black ribbon or laser quality are best.

Send the original and THREE copies of the manuscript to Professor Jean-Pierre BLANCHI, Grenoble, France. It must be postmarked before March 15th, 1996. The manuscript will be published in the proceedings of the Symposium.

4. PUBLICATION

About 15 abstracts from the proceedings will be selected by the Scientific Committee. The authors will be asked to submit a full length paper to be reviewed before publication in the journal Human Movement Science.

5. DEADLINES

Abstract submission: March 1st, 1996

Notification to authors: May 1st, 1996

Early bird registration: May 15th, 1996

TECHNICAL PROGRAM

As a complement to the scientific program, manufacturers of data capture systems will be given time during the meeting to inform the participants about their products. THERE WILL BE NO EXHIBITS. Those wishing to participate in the Technical Program are asked to communicate with the Permanent Secretariat.

SOCIAL PROGRAM

A welcoming reception will be held on the evening of the 30th of June, 1996. Some lunches and a banquet are also planned as well as other social gatherings.

SYMPOSIUM REGISTRATION

The fee for the Fourth International Symposium on 3-D Analysis of Human Movement is 1975FF (about 395.00 US\$) prior to May 15th 1996 and 2250FF (about 450.00 US\$) afterwards. The registration fee includes meeting material and all scientific and social activities. Checks, money orders or bank drafts drawn in French Francs (no credit cards) are made payable to the International Symposium on 3-D Analysis of Human Movement and Mailed to Professor Jean-Pierre BLANCHI, Grenoble, France.

LODGING

You must make your OWN hotel reservation. Prices and suggestions will follow.

FIRST INTERNATIONAL SUMMER SCHOOL 3-D ANALYSIS OF HUMAN MOVEMENT

A two-day International Summer School 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.

THEMES AND SPEAKERS

History and instrumentation; Photogrammetry; Signal processing; Bone and surface marker information; 3-D inverse dynamics; Robotics; Mechanical energy estimation; Applications.

REGISTRATION FEES FOR INTERNATIONAL SCHOOL AND LODGING

Fees for the First International Summer School are 1125FF about 225USD prior to May 15th, 1996 and 1500FF or 300.00US\$ 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 Joannhs DIMNET, Lyon, France. The participants will be lodged near the Universiti Claude Bernard. Those attending both the International Summer School and the Symposium will benefit from a reduction when making their full payment.

FURTHER INFORMATION

Contact either Professor Joannhs Dimnet or Dr. Paul Allard for further information on the International Summer School.

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 attending the SYMPOSIUM only and still arriving at Satolas, we suggest that you take TGV (Train 'Grande Vitesse') to Grenoble train station (30USD).

CANCELLATION POLICY

All cancellations received by June 1st 1996, will be assessed a 625FF non-refundable charge PER MEETING. After this date, there will be NO REFUNDS.

LANGUAGE

The official language at the Symposium and the International School is English. Simultaneous translation will not be available.

FURTHER INFORMATION

Professor Jean-Pierre BLANCHI

UFR.APS

Universiti Joseph Fourier

BP 53-X

38041 Grenoble, FRANCE

Tel: +33-76 51 46 94 Fax: +33-76 51 44 69

Professor Joannhs DIMNET

Laboratoire de biomécanique du mouvement

Centre de mécanique

Universiti Claude Bernard

43, Bd du 11 Novembre 1918

69622 Villeurbanne cedex, FRANCE

Tel: + 33 72 44 80 87 Fax: + 33 72 44 80 54

Dr. Paul ALLARD, Ph.D, P.Eng.

Permanent Secretariat

International Symposium on Three-Dimensional

Analysis of Human Movement

Research Center

Sainte-Justine Hospital

3175 Cote Ste-Catherine

Montreal, PQ, H3T 1C5, CANADA

Tel: + 1 514 345 4740 Fax: + 1 514 345 4801

Biomechanics positions available

ASSISTANT PROFESSOR

Division of Physical Therapy
University of North Carolina at Chapel Hill
Chapel Hill, NC, USA

A faculty position as Assistant Professor, or a more senior position, is available with responsibilities for teaching kinesiology/biomechanics in an entry level Master's program and an advanced Master's program, conducting research, and guiding student research projects. Qualifications for this tenure track position are a doctoral degree and expertise in kinesiology/biomechanics. Previous academic teaching experience, and evidence of grantsmanship and publication are preferred. Eligibility for Physical Therapy licensure in North Carolina is preferred, but not required. The proposed starting date is January 1, 1996.

Equipment available for research includes: Peak Performance motion analysis system, force plate, EMG, Biodex dynamometry, and elgons and switches. Instrumentation also is available for motor control studies (reaction time, rotor pursuit, etc.). We have just recently received approval to plan a collaborative PhD program in Human Movement Science. Contributing faculty for this program will come from the Department of Biomedical Engineering; faculty in exercise physiology from the Department of Physical Education, Exercise, and Sport Science; Biostatistics; Physical Therapy; and other programs on campus.

The closing date for acceptance of applications is August 1, 1995. Send a letter of application, C.V., and names of three professional references to:

Michael T. Gross, PT, PhD
Division of Physical Therapy
CB #7135 Medical School Wing E
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-7135
Phone: 919-966-4709
Fax: 919-966-3678
E-Mail: Mike=Gross%pt%mah@css.unc.edu

RESEARCH POSITION

Research Center for Safety & Health
Liberty Mutual Insurance Group
MA, USA

An immediate vacancy exists for a doctorally-qualified biomechanic analyst to join the Liberty Mutual Research Center for Safety and Health. The ideal candidate will have a broad biomechanical capability and skills that can be applied to the investigation of the mechanics of the upper extremities (CTD), the lower

back (LBP), and the lower extremities (Gait analysis). The successful candidate will be a part of a major effort, based upon a multidisciplinary, team approach to problems of workplace safety and health.

Liberty Mutual is committed to preventing losses by reducing and treating workplace injuries and illnesses. We take that commitment further by publishing our findings in the international peer-reviewed scientific literature and thus make a contribution to the safety and health of all American workplaces.

Research domains include:

- occupational safety
- automotive/vehicular safety
- slips and falls
- musculoskeletal disorders

The Research Center is located on 80+ acres of woodland 25 miles west of Boston, Massachusetts.

Send curriculum vitae to:

Liberty Mutual Insurance Group
Research Center for Safety & Health
71 Frankland Road
Hopkinton, MA 01748
Attention: Stover Snook, Ph.D.
Phone 508 435-9061
Fax 508 435-8136

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LECTURER IN BIOMECHANICS

Department of Movement Science
Faculty of Medicine
University of Liverpool

Outline of the post:

The Department of Movement Science is part of the School of Health Sciences in the Faculty of Medicine and there are excellent research links and cooperation with other departments such as Physiotherapy, Orthopaedics, Human Anatomy, Radiography, Clinical Engineering, Computer Science etc. There are fully equipped Biomechanics, Exercise Physiology/Kinanthropometry and Motor Control laboratories. The Biomechanics laboratory includes a gait analysis centre and is equipped with a force plate system, an automatic optoelectronic kinematic analysis system, electromyography systems, passive and active isokinetic dynamometers and video systems with associated computer/software for data collection and analysis. The Department of Movement Science achieved a rating of 3 in the 1992 Research Assessment Exercise conducted by the Higher Education Funding Council, placing it within the top six British University Departments for research in this area.

The courses offered include a BSc in Movement Science, full and part-time research degrees (MPhil/Phd) and part-time taught MSc in Movement Science and MSc in Health Sciences courses.

The person appointed will be expected to teach under- and postgraduate courses in Biomechanics and contribute to Research Methods and Information Technology modules. The Biomechanics Lecturer will be expected to develop a significant research programme, publish high quality papers in relevant peer refereed journals, generate external research income and supervise postgraduate students.

Qualifications-Experience:

The successful applicant will have a good publication record, biomechanics teaching/supervision experience at both under- and postgraduate level and successful research grant applications.

Salary Range:

The starting salary will be in the Lecturer A/B scale depending on qualifications and experience.

Appointment Date:

1 September 1995

For an informal discussion about the post and further information, please contact or sent a recent CV to:

Dr V. Baltzopoulos
Department of Movement Science
University of Liverpool
Liverpool L69 3BX, U.K.
Tel: +44 151 794 3223
Fax: +44 151 794 3229
Email: baltz@liverpool.ac.uk

BIOMECHANIST
GEO-CENTERS, Inc.
Natick, MA, USA

GEO-CENTERS, Inc., a high-technology, research and development firm has an opening for a Master's level Biomechanist to work at our Natick, MA location. Qualified applicants will have an M.S. degree in Biomechanics, Mechanical Engineering, or related Human Movement Science discipline. The successful applicant will have experience including 3D video motion analysis; ground reaction force plates; and human movement analysis software development. A thorough understanding of human anatomy, physiology, and biostatistics is required. Responsibilities will include conception and implementation of innovative research designs; participation in collaborative research projects; and collection and analysis of biomechanical data.

The GEO-CENTERS, INC. Biomechanics Group supports the Center for Military Biomechanics Research at the U.S. Army Natick Research, Development, and Engineering Center in Natick, MA. The Biomechanics

Program conducts basic and applied human movement research to support the ergonomic design and sizing of personal protective clothing, equipment, and workstation/crewstation geometries.

GEO-CENTERS, INC. offers competitive salaries and an excellent benefits package. Qualified applicants should submit a curriculum vitae and the names of three references to:

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For more information contact Mr. Bob Woods at (508) 651-1080.

BIOMECHANICS ENGINEER
Failure Analysis Associates
Menlo Park, CA, USA

Failure Analysis Associates, Inc., an international engineering and scientific services firm specializing in the analysis and prevention of engineering system and product failures, is seeking Biomechanical Engineers for several openings in our Phoenix and San Francisco offices.

These positions require a Ph.D. or M.S. with 1-10 years' experience. Demonstrated capabilities in the areas of analytical, computational, and experimental mechanics, along with research experience in the field of injury biomechanics, are highly desirable.

Our biomechanics group is equipped with a research library and state-of-the-art computer facilities for performing accident simulations to study the injury resulting from dynamic interactions of vehicle and occupants. Furthermore, group members gain access to extensive experimental facilities and are exposed to a broad range of technical expertise within other groups at FaAA.

Failure Analysis Associates, Inc., offers a comprehensive compensation and benefits package. For confidential consideration, please contact:

#011# Tara Khatua, Ph.D., P.E.
Failure Analysis Associates
149 Commonwealth Drive
Menlo Park, CA 94025, USA
Phone: (415) 688-7150
Fax: (415) 326-8072
Email: kha@fail.com

FaAA believes in a safe work environment and requires a preemployment physical. EOE. On the World Wide Web, more information about FaAA is available on our Home Page at <http://www.fail.com>.

ASSISTANT / ASSOCIATE PROFESSOR

University of Wisconsin-Madison
Department of Kinesiology

The Department of Kinesiology is seeking to hire a faculty member at the Assistant or Associate Professor level in the area of Physical Therapy.

Beginning date: August 28, 1995. This is a full-time, nine-month appointment.

Responsibilities: 1. Teach undergraduate and graduate courses in area of expertise. 2. Establish independent research program. 3. Fulfill service expectations.

Qualifications: 1. PhD or other earned doctorate. 2. Demonstrated ability or potential for obtaining extramural research funding. 3. Eligibility for Wisconsin physical therapy licensure. 4. Clinical experience in physical therapy.

Salary: \$35,000 or Commensurate with qualifications and experience.

Application procedure: Applications are encouraged from women, members of minority groups, and persons with disabilities. Please submit the following information to:

Barbara Morgan, Chair
Physical Therapy Search Committee
5175 Medical Sciences Center
1300 University Avenue
Madison, WI 53706-1532
Phone: 608/262-0013
Fax: 608/263-6434

1. Letter of application, including description of research program 2. Curriculum vitae 3. Names and addresses of 3 references 4. Reprints of 3 representative publications.

Note: Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

Deadline: July 15, 1995

The University of Wisconsin-Madison is an equal opportunity and affirmative action employer.

RESEARCH ASSISTANTSHIP IN REHABILITATION ROBOTICS

Drexel University, PA, USA

We are seeking candidates to fill one slot of a Research Assistantship or a combined Teaching/Research Assistantship, starting in the fall of 1995. The research involved is a part of a collaborative effort in Rehabilitation Robotics, between Drexel University in Philadelphia and the Alfred I. duPont Institute in Wilmington, Delaware. The qualifications required are:

1. Prior engineering degrees from a well recognized academic institutions. Preference will be given to individuals who have already earned their master's degree. However, outstanding candidates without master's degrees will also be seriously considered;

2. Qualification for admission to the Drexel's Doctoral Program;

3. High GPA;

4. Strong interest and some background in biomedical systems;

5. Candidates must have a valid permit to work in the United States (student visa is not sufficient).

Individuals who feel that they qualify should respond immediately and send a brief statement of qualifications (no more than 150 words) to either the author of this message, or to Dr. T. Rahman at: Rahman@ASEL.UDEL.EDU. Please respond by E-mail if you can. After initial screening, candidates will be encouraged to send a full resume, transcripts and names of references.

Rami Seliktar, Ph.D.
Professor
Mechanical and Biomedical Engineering
Drexel University
32nd & Chestnut Streets
Philadelphia, PA 19104
USA

Tel: Drexel University (215) 895-2357
A.I. duPont Institute (302) 651 6833
Fax: (610) 649-1464
E-Mail: seliktar@cbis.ece.drexel.edu

RESEARCH ASSISTANT

University of Texas Medical Branch

The Orthopaedic Biomechanics Lab of the University of Texas Medical Branch is seeking two Research Assistants to work in a multidisciplinary team environment. Job elements include fabrication of measurement systems for the study of joint mechanics, conducting biomechanics and laboratory research experiments, data analysis using spreadsheet and database software, and assisting in technical writing for research grant proposals and medical/technical publications. Each position serves as primary assistant for one or more projects with orthopaedic surgeons who serve as project medical directors. Minimum requirement is a bachelor of science in a basic science field or equivalent.

Interested candidates contact:

William L. Buford, Jr., PhD.
Director, Orthopaedic Biomechanics Lab
University of Texas Medical Branch
Galveston TX 77553-0353, USA
email: wlbuford@beach.utmb.edu

TECHNICAL SUPPORT ENGINEER

Peak Performance Technologies, Inc.
Colorado, USA

Peak Performance Technologies, Inc., an international leader in motion measurement systems, is seeking a career minded individual to join our staff as a Technical Support Engineer.

Responsibilities include answering customer technical and application questions, on-site customer training, software and hardware testing, and performing other functions related to product and customer support.

Applicants must have a technical B.S. or M.S. degree, good interpersonal and verbal skills, a solid working knowledge of PC computers, MS-DOS, MS-Windows, as well as statistics and spreadsheet software. Experience in the fields of Biomechanics, Sports Science, Physical Therapy, Human Factors, or Behavioral Sciences, etc. is desired. Previous experience with Peak products is a big plus.

We offer a competitive salary, a generous benefits package and unique challenges in a smoke free workplace. Send letter, resume, and salary requirements to:

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Fax: 303-799-8690
E-Mail: 76244.3047@CompuServe.com

POSTDOCTORAL POSITION - ORTHOPAEDIC BIOMECHANICS

Musculoskeletal Research Laboratory
Department of Orthopaedics
Pennsylvania State University College of Medicine
The Milton S. Hershey Medical Center, PA, USA

This position which will be available in September 1995, has an emphasis on experimental investigations (tissue characterization and structural testing), directed at current issues in basic and clinical science. Successful applicant will be responsible for a 500 sq. ft. lab., design and fabrication of fixturing and other support equipment, and expected to use commercial design and analysis software on workstation-class computers. We prefer applicant with experience in orthopaedic biomechanics, but will consider highly motivated applicants with experimental mechanics background. Send curriculum vitae to:

Dr. Christopher Jacobs
Musculoskeletal Research Laboratory
Department of Orthopaedics
Pennsylvania State University College of Medicine
500 University Drive, Hershey, PA 17033
Tel: (717) 531-4819

We are an Equal Opportunity/Affirmative Action Employer and encourage minority and female applicants.

DIRECTOR, MOTION ANALYSIS LABORATORY

Southern Illinois University
School of Medicine
Springfield, ILLINOIS USA

The Division of Orthopaedics and Rehabilitation at Southern Illinois University School of Medicine in Springfield is seeking a qualified, self-motivated individual to become an Instructor and the Director of our Motion Analysis Laboratory.

This facility employs a computerized system of 5 VICON CCD near-infrared cameras, with PC AMASS motion analysis software and Helen Hayes Hospital gait analysis software, 10 channels of electromyography (Motion Lab Systems) and 2 AMTI tri-axial force platforms to record, process and analyze kinematic, electromyographic and force data of pathological gait. The information gathered assists in the diagnosis and treatment of patients with movement disorders.

The successful applicant will plan and conduct all aspects of each gait study including scheduling and billing, calibration of camera system and force plates, attachment of surface electrodes and reflective markers to the body, and the collection, processing, analysis and interpretation of data in comparison to normal, discussing the data with the consulting physician and producing a report on each patient detailing the data analyzed which provides the referring physician with a detailed description of patient's gait pattern to assist with treatment or surgery recommendations.

The successful applicant will continue gait initiation and postural sway research as part of an on-going National Institute of Aging grant with the Regional Alzheimer Center. There is also opportunity to initiate research projects with the faculty and residents of the Division of Orthopaedics and Rehabilitation, the Orthotics & Prosthetics Section, and the Departments of Neurology, and Internal Medicine.

Minimum requirements:

- Bachelor's Degree in one of the Life Sciences, preferably Kinesiology, Biomechanics, or Bioengineering
- experience or internship in a Motion Analysis Laboratory
- good working knowledge of computer equipment, including PC s, MS-Windows, MS-DOS
- previous research experience
- the ability to work independently

Interested applicants should submit resumes to:

John R. Fisk, M.D.
Medical Director,
Motion Analysis Laboratory
Department of Surgery
Southern Illinois University School of Medicine
P.O. Box 19230
Springfield, Illinois, U.S.A. 62794-1312

Calendar of scientific events

July 12-14, 1995

Third International Conference on Sport, Leisure and Ergonomics, Cheshire, England. Contact: Dr Greg Atkinson, Centre for Sport and Exercise Sciences, Liverpool John Moores University, Byrom Street, Liverpool, L3 3AF, England. Tel: 051 231 2157; Fax: 051 298 1261.

July 18-22, 1995

XIII International Symposium on Biomechanics in Sports, Lakehead University, Thunder Bay, ON Canada. Contact: Tony Bauer, Chairperson, Department of Kinesiology, Lakehead University, 955 Oliver Rd., Thunderbay, ON Canada. Tel: (807) 343-8654; Fax: (807) 343-8944; E-mail: Tony.Bauer@Lakeheadu.ca.

August 24-26, 1995

19th Annual Meeting of the American Society of Biomechanics, Stanford University, CA, USA. Contact: Keith Williams, PhD, Department of Physical Education, University of California, Davis, CA 95616, USA. Tel: (916) 752-3337; Fax: (916) 752-6681; E-mail: krwilliams@ucdavis.edu

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.

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 1-5, 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.

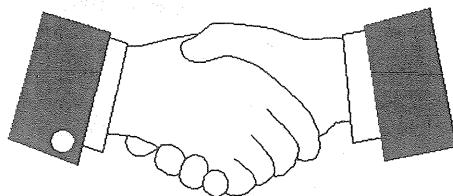
August 28-31, 1996

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 Fukushima, 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.

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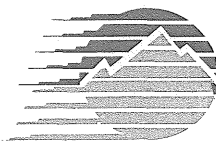
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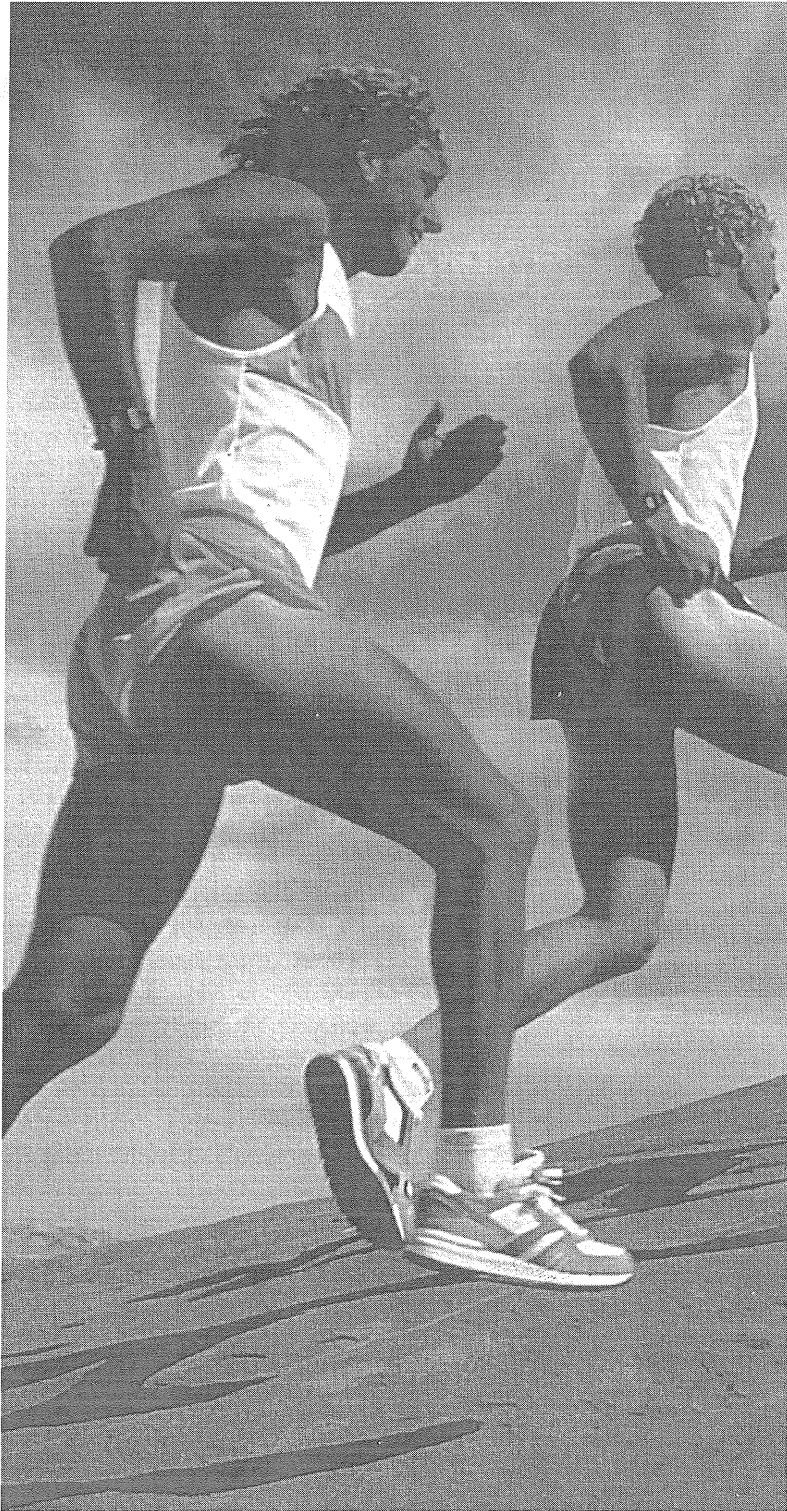
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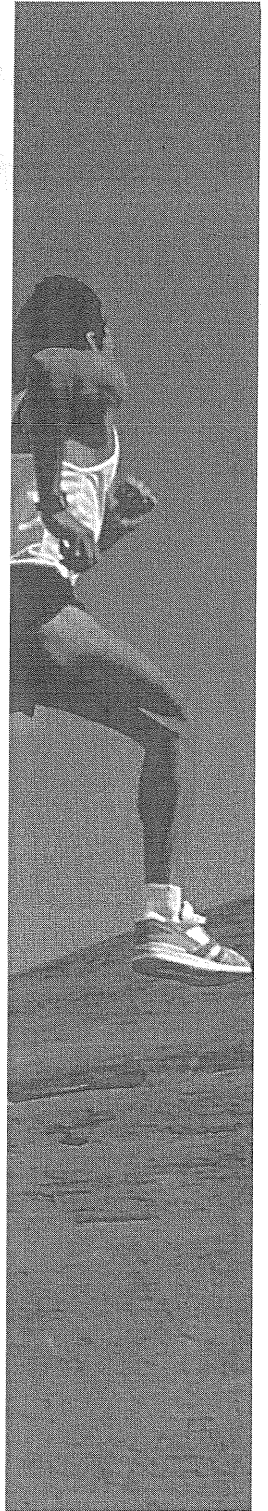
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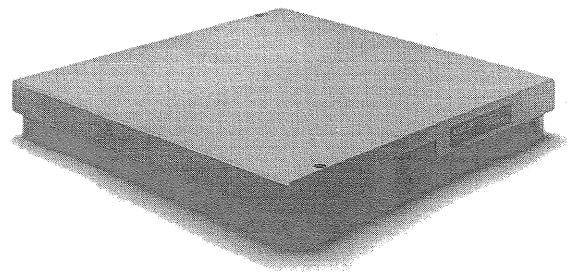
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