ANNUAL REPORT 1986

LABORATORY FOR
HUMAN PERFORMANCE STUDIES

THE UNIVERSITY OF CALGARY,
CALGARY, ALBERTA
CANADA

1986 OVERVIEW

(a) GENERAL COMMENTS

This is the last annual report to come from the confines of our “old” laboratory as we will be moving to our new facilities by the end of June, 1987. As construction proceeds on schedule, we are delighted to watch the speed skating oval and physical education expansion rapidly take shape. As our research continues, final building plans are being discussed and new equipment evaluated and ordered in eager preparation for moving day. To celebrate the opening of our new facilities, the Faculty of Physical Education will be hosting the 20th annual meeting of the Canadian Association of Sport Sciences (CASS) October 6-10 1987. This conference has received official recognition as the Winter Olympic Sport Science Conference and will have the appropriate theme of Science In Winter Sport. Keynote speakers from around the world have been invited to address the theme from the fields of Biomechanics, Exercise Physiology, Kinanthropometry, Sport Medicine and Sport Psychology. The conference will provide an excellent opportunity for intellectual stimulation as well as the chance to visit the Olympic venues, observe elite athletes in training and of course to visit our new facilities. We hope to see you here.

This past year has been one of the most productive since our laboratory has been in operation, as many goals have been realized. Time spent on administrative duties has decreased allowing for more time to pursue our research interests. However the most important accomplishment in 1986 was the increased number of projects that were completed for publication, mostly in refereed journals. We hope this trend will continue throughout the next year despite the welcome Interruption of our move into the new laboratory.

(b) BIOMECHANICS (Benno M. Nigg)

Research determining load on and in the human body was again one of the major topics under investigation in our laboratory. A pilot study on the etiology of running injuries, using 150 runners, is about to be completed and will serve as the basis for a larger study which is planned to begin in the summer of 1987. Research on sport shoes continued in various projects, however, more time was devoted to examining sport surfaces. This resulted in the development of a new method for assessing the biomechanical characteristics of area-elastic surfaces, developed by Dr. Fred Yeadon.

The research program in biomechanics gained a new "twist" through the analysis of airborne movements, a specialty of Dr. Fred Yeadon. He received recognition for his simulation model by winning the Borelli award of the American Society of Biomechanics and now works on improving the twisting techniques of elite springboard and platform divers. Another new addition to our research is the work done in muscle mechanics directed by Dr. Walter Herzog. His muscle model is an important contribution to the field of muscle mechanics, and his findings for in vivo length tension relations of the rectus femoris are, to say the least, very interesting.

Gait analysis has been a key area of study in our laboratory over the past years. We have been attempting to use gait analysis as a quantitative technique for assessing the effects of chiropractic treatment of low back problems. We also are in the process of establishing a data base of gait variable norms for different age, sex and fitness groups. A long-term goal of this is to determine whether physical activity and movement are related.

Preparations for the research projects during the 1988 Winter Olympics in Calgary are well under way, as testing of the installations will begin in the next few months. The personnel from our laboratory responsible for the different venues are:

- Ski Jumping, film:	Dr. Fred Yeadon
- Acrobatic Skiing, Aerials:	Dr. Fred Yeadon
- Ski Jumping, force:	Mr. Ross Beatty
- Cross Country Skiing:	Dr. Walter Herzog
- Bobsled:	Mr. Michael Morlock
- Speed Skating:	Dr. Ruud de Boer

Dr. Ruud de Boer is a new post doctoral fellow, who has just recently arrived from the Free University of Amsterdam where he did his Ph. D. on a project in speed skating.

(c) EXERCISE PHYSIOLOGY (David Smith)

Throughout the past year, the Alberta winter sports program was continued for alpine skiing, biathlon, speed skating and luge. The national teams of speed skating and men's volleyball were once again closely monitored for physiological and biochemical changes during training and competition, and pre and post training camp examinations were performed on players of the Calgary Flames Hockey Club. This involved on-site monitoring and dose involvement with these teams in the planning and execution of training. In addition, members of the National Speed Swimming Team and the National Synchronized Swimming Team were monitored over a six-month period leading up to the Commonwealth Games and World Championships in Madrid, Spain. A comparison between the biochemical aspects of training adaptations for elite athletes and the normal population is currently under investigation.

(d) GROWTH AND DEVELOPMENT: SPORT ANTHROPOLOGY GROUP (Michael Hawes)

The Sport Anthropology Group looks back on 1986 with satisfaction as a year of growth and accomplishment. We have been able to welcome several research assistants to our group and, as a consequence, made great strides in our productivity, A study of the shape of the foot involving 2200 subjects has been completed; we continue our anthropometric assessment of national team members in volleyball, speed skating, swimming, diving and acrobatic gymnastics; and we are prepared to commence a study of the potential of ultrasound as a viable method of body composition analysis. We look forward to the coming year with great anticipation - moving into a new laboratory in June1987, the opening of the Olympic facilities with the attendant opportunities to further our work in the applied sport science field, and the hosting of a major international conference. As the years end approaches we would like to take the time to thank our colleagues from other institutions around the world for their interest, cooperation and constructive advice.

(e) MOTOR LEARNING AND CONTROL (Barry Kerr)

In recent months we have been assessing and monitoring selected physiological and psychological variables of members of the Alberta Bowhunters and Archers Association in their Talent

Identification Program. With the anticipated opening of the new laboratory, we are planning experiments in new areas of research in the learning and performance of motor skills.

(f) ACKNOWLEDGEMENTS

Again we would like to use this opportunity to thank everyone who contributed to the development of our research group, the Human Performance Laboratory. Our thanks is extended to all institutions and groups that have provided financial support; these include:

The University of Calgary
The Faculty of Physical Education
The Faculty of Engineering
The Faculty of Medicine
The Faculty of Graduate Studies
The City of Calgary
AHFMR (Alberta Heritage Foundation for Medical Research)
ACRH (Alberta Chiropractic Research for Health)
NSERC (Natural Science and Engineering Research Council of Canada)
Fitness Canada
Sport Canada
ADIDAS Sport Shoe Company
The IOC (International Olympic Committee)

This thank-you also extends to everyone who supports our work or is interested in it Analysis of human movement is fascinating, and we are glad to be able to work in this field.

Calgary, at the end of 1986

Benno M. Nigg
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Calgary, Alberta, CANADA
T2N1N4
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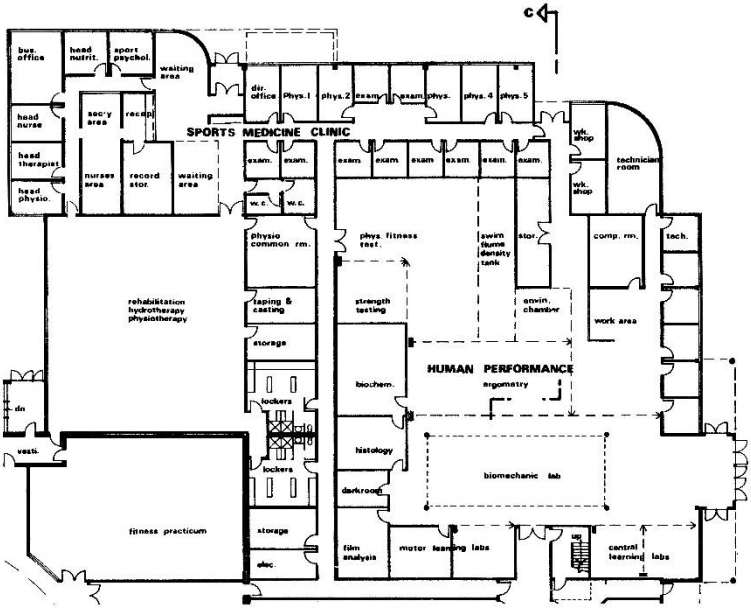
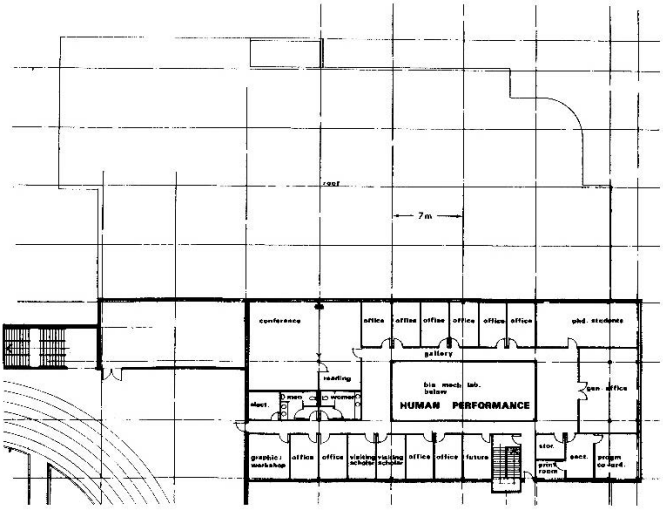
BUILDING PLANS OF THE HUMAN PERFORMANCE LABORATORY AND ADJOINING SPORTS MEDICINE CLINIC



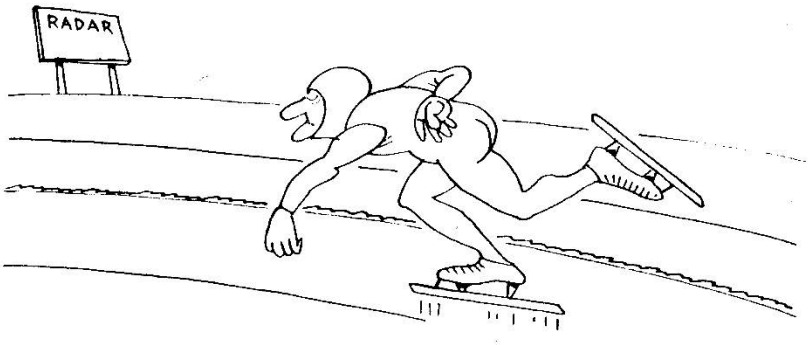


STAFF

DIRECTOR:			
NIGG, Benno M.	Dr. sc. nat. Professor	Biomechanics	
ASSOCIATES:			
HAWES, Michael	Ph.D. Assoc. Professor	Human Growth: Sport Anthropology	
KERR, Barry	Ph.D. Assoc. Professor	Biomechanics, Motor Learning	
SMITH, David	Ph.D. Assoc. Professor	Exercise Physiology	
YEADON, M.R. (Fred)	Ph.D. Asst. Professor	Biomechanics	
VISITING PROFESSORS:			
CAMPAGNA, Phil	Ph.D. Asst. Professor	Exercise Physiology Dalhousie University. Halifax, Canada.	Sept. to Nov.
DRAPER, Julie	M.Phil. Lecturer	Biomechanics Canberra College of Advanced Education, Canberra, Australia.	Oct. to Dec.
SECRETARIES:			
LEES, Barbara			
DAVIS, Wanda			
TECHNICIANS:			
BEATTY, Ross	B.Sc..		
FISHER, Veronica	BA (P.E.)		
FLANAGAN, Colin			part time
SWITYK, Glenda	B.Sc.		from July
SKLERYK, Blaine	M.Sc.		
STOKES, Shelley	B.P.E.		to Sept.
TORY, Byron			
WALL, Joanne	B.P.E.		
RESEARCH ASSISTANTS:			
DUNN, Eileen	M.Sc.	Biomechanics	from sept. to
GLOVER, Robert	B.P.E.	Biomechanics	July
MOON, Cathy	B.P.E.	Sport Anthropology	to November
NEIL, Rosie	B.P.E.	Physiology	part time
OLSSON, Ewa	P.T.	Biomechanics	Sept. to Dec.

STAFF

RESEARCH ASSISTANTS:			
RAMBOUSEN, Sheila	B.P.E.	Sport Anthropology	from Sept.
READ, Lynda		Biomechanics	June to Sept.
ROBINSON, Robert	D.C.	Biomechanics	from Sept.
SIMPSON, Wayne		Sport Anthropology	from Sept.
WILLCOX, Brad		Sport Anthropology	from June
WOO, Helen		Biomechanics	June to Sept.
GRADUATE STUDENTS:			
BAHLSEN, Alexander	Mechanical Eng.	Biomechanics	
MORLOCK, Michael	Medical Sciences	Biomechanics	
MOTRIUK, Halina	Mechanical Eng.	Biomechanics	
ROBERTS, Delia	Physical Education	Physiology	
ROBINSON, Robert	Medical Sciences	Biomechanics	to September
SCHLAEPFER, Fridl	Mechanical Eng.	Biomechanics	
VERMEULEN, Stephen	Mechanical Eng.	Biomechanics	
POST-DOCTORAL FELLOWS:			
de BOER, Ruud	Ph.D.	Biomechanics	from October
HERZOG, Walter	Ph.D.	Biomechanics	
SOVAK, Daniela	Dr. sc.nat.	Sport Anthropology	



HIGHLIGHTS

EVENT	DETAILS
	Schlaepfer, Fridl
Ph.D. Examination	"Development of a technique to estimate the in vivo spinal load". Thesis accepted by the Department of Mechanical Engineering, Calgary, November 1988
	Yeadon, Maurice R. (Fred)
International Award	“The biomechanics of twisting somersaults”. Borelli award of the American Society for Biomechanics, Montreal, August 1986
	Nigg, Benno M.
International Award	“Running shoe construction and prevention of running injuries". Michael Jaeger award of the Society for Orthopaedie and Traumatology in Sports (GOTS), Munich, June 1988

PUBLICATIONS

AUTHOR	TITLE	SOURCE
Atha, J. Yeadon, M.R. Sandover, J. Parsons, K.C.	The damaging punch	British Medical Journal 291, 1756-1757.
Hawes, M.R.	Coach education at the Master's level: A Canadian experience	In: Coach Education, Preparation for a Profession. Proceedings of the VIII Commonwealth and International Conference on Sport, Physical Education, Dance, Recreation and Health, E. & F.H. Spon, London, 1986.
Herzog, W.	Influence of the amount of information about muscle properties in the cost function on the estimate of individual muscle forces	In: Proceedings of the North American Congress on Biomechanics, Montreal, 59-60. 1986.
Herzog, W.	Postural control in the flight phase of long jumping	Medicine and Science in Sports and Exercise, 18: 231-241.
Kerr, B.A.	Enhancing learning: A review of the use of knowledge of results	The Runner, Dec., 1986.
Morlock, M. Yeadon, M.R.	Regression equations for segmental inertia parameters	In: Proceedings of the North American Congress on Biomechanics, Montreal, 231-232, 1986.
Motriuk, H.	A technique for normalizing center of pressure paths	In: Proceedings of the North American Congress on Biomechanics, Montreal, 203-204, 1986.
Nigg, B.M.	Biomechanics of Running Shoes (book)	Human Kinetics Publishers, Champaign, Illinois, 1986.
Nigg, B.M.	Biomechanical aspects of running	In: Biomechanics of Running Shoes, B.M. Nigg (ed.), Human Kinetics Publishers, Illinois: 1-25,1986.
Nigg, B.M.	Experimental techniques used in running shoe research	In: Biomechanics of Running Shoes, B.M. Nigg (ed.), Human Kinetics Publishers, Illinois: 27-61,1986.

PUBLICATIONS

AUTHOR	TITLE	SOURCE
Nigg, B.M. Bahlsen, A.H. Denoth, J. Luethi, S.M. Stacoff, A.	Factors influencing kinetic and kinematic variables in running	In: Biomechanics of Running Shoes, B.M. Nigg (ed.). Human Kinetics Publishers, Illinois: 139-158, 1986.
Nigg, B. M.	Some comments for runners	In: Biomechanics of Running Shoes, B.M. Nigg (ed.), Human Kinetics Publishers, Illinois: 161-165, 1986.
Nigg, B.M.	Biomechanical aspects of running injuries	In: Proceedings of Nordic Congress on Sports Traumatology, Turku, Finland, pp. 52-56, 1986.
Nigg, B.M.	Biomechanical aspects of orthotic devices and shoe alterations in treatment and/or prevention of running injuries	In: Proceedings of Nordic Congress on Sports Traumatology, Turku, Finland, pp.157-170, 1986.
Nigg, B.M. Denoth, J. Glover, R.	Influence of lateral heel flare on pronation and impact forces	In: Proceedings of the North American Congress on Biomechanics, Montreal, 193-194, 1986.
Nigg, B.M. Frederick, E.C. Hawes, M.R. Luethi, S.M.	Factors influencing short-term pain and Injuries in tennis	International Journal of Sport Biomechanics, 2(3): 156-165, 1986.
Luethi, S.M. Frederick, E.C. Hawes, M.R. Nigg, B.M.	Influence of shoe construction on lower extremity kinematics and load during lateral movements in tennis	International Journal of Sport Biomechanics, 2(3): 166-174, 1986.
Yeadon, M.R.	The biomechanics of twisting somersaults	In: Proceedings of the North American Congress on Biomechanics, Montreal, 33-34, 1986.

PUBLICATIONS ACCEPTED AND/OR IN PRESS

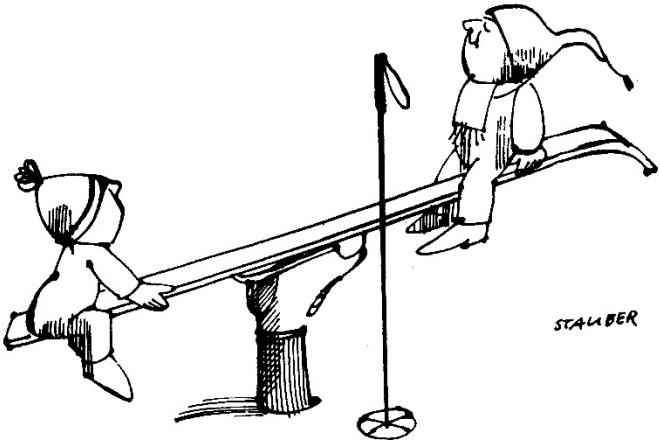
AUTHOR	TITLE	SUBMITTED TO
Bahlsen, A.H. Nigg, B.M.	Estimation of impact forces using the idea of an effective mass	In: B. Jonsson (ed.). Biomechanics X. Human Kinetics Publishers.
Nigg, B.M.	Biomechanical analysis of ankle and foot movement in sports and exercise	In: R.J. Shephard and J. Taunton (eds.), Ankle in Sport and Exercise. Karger, Basel.
Nigg, B.M. Bahlsen, A.H Luethi, S.M. Stokes, S.	The influence of running velocity and midsole hardness on external impact forces in heel-toe running	Journal of Biomechanics.
Nigg, B.M. Luethi. S.M. Segesser, B.	Biomechanische Ueberlegungen zu Fibulaeren Insuffizienzen im Spruggelenk (Biomechanical considerations on insufficiencies in the ankle and subtalar Joint)	In: B. Segesser (ed.),Proceedings of the First Symposium for Sports Medicine, Basel.
Nigg, B.M.	The assessment of loads acting on the locomotor system in running and other activities	Japanese Journal of Sport Science.
Nigg, B.M. Morlock, M.	The influence of lateral heel fare of running shoes on pronation and impact forces	Medical Sciences in Sports and Exercise.
Nigg, B.M. Segesser, B.	Der Laufschuh, ein Mittel zur Praevention von Laufbeschwerden (The running shoe, a possibility to prevent running Injuries)	Z. fuer Orthopaedie.
Yeadon, M.R. Smith, D.J.	Theoretical models and their application to aerial movement	In: J. Atha and B. Van Ghleuwe (eds.), Sports Biomechanics. Karger, Basel.
Smith, D.J. Stokes, S. Kilb, B.	The relationship between anaerobic power and isokinetic torque outputs	Canadian Journal of Applied Sports Sciences.

PUBLICATIONS SUBMITTED

AUTHOR	TITLE	SUBMITTED TO
Herzog, W.	Consideration for predicting individual muscle forces in athletic movements	International Journal of Sports Biomechanics.
Herzog, W.	Muscle force predictions using a nonlinear optimal design	Journal of Neurosciences Methods.
Herzog, W.	Torques measured using a strength testing machine vs. the actual joint torques	Journal of Biomechanics.
Nigg, B.M. Herzog, W. Read, L.J.	Effect of visco-elastic shoe insoles on vertical impact forces In heel-toe running	American Journal of Sports Medicine.
Nigg. B.M.	Biomechanical aspects of playing surfaces	Journal of Sport Sciences.
Nigg, B.M. Skleryk, B.N.	Gait characteristics of the elderly	Journal of Gerontology.
Robinson, R. Nigg, B.M. Herzog, W.	The use of force platform variables to quantify the effects of chiropractic manipulation In gait symmetry	The Journal of Manipulative and Physiological Therapeutics.
Sovak, D. Hawes, M.R.	Quantification of masculine structural characteristics in elite female volleyball and basketball players	Journal of Sport Sciences.
Yeadon, M.R.	The simulation of aerial movement. Part I: The determination of orientation angles from film data	Journal of Biomechanics.
Yeadon, M.R.	The simulation of aerial movement Part II: The estimation of segmental inertia parameters from anthropometric measurements	Journal of Biomechanics.

PUBLICATIONS SUBMITTED

AUTHOR	TITLE	SUBMITTED TO
Yeadon, M.R.	The simulation of aerial movement Part III: The determination of the angular momentum of the human body	Journal of Biomechanics.
Yeadon, M.R. Atha, J. Hales, F.D.	The simulation of aerial movement. Part IV: A computer simulation model	Journal of Biomechanics.
Roberts, D. Smith, D.J.	Biochemical aspects of muscle fatigue.	Sports Medicine, New Zealand.



PRESENTATIONS

MONTH	TOPIC AND LOCATION	AUTHOR
January	Load on the Locomotor System During Sports Activities. Gatorade Symposium, Phoenix, Arizona.	Nigg, B.M.
February	Functional Anatomy and Biomechanical Considerations for Racing Cyclists. Alberta Bicycle Association Conference, Calgary, Alberta	Hawes, M.R.
March	Biomechanics of Sport Shoes. International Symposium in Sportsmedicine, St. Christoph, Austria.	Nigg, B.M.
March	Linear vs. Nonlinear Optimization Algorithms in Individual Muscle Force Predictions. Neurosciences Journal Club, Calgary, Alberta	Herzog, W.
March	Quantitative Assessment of Motion Palpation Treatments on Patients with Chronic Idiopathic Low Back Pain. Annual Meeting of the Alberta Chiropractic Association, Calgary, Alberta	Herzog, W.
April	Biomechanical Aspects of Running Injuries, and Biomechanical Aspects of Orthotic Devices and Shoe Alterations in Treatment and/or Prevention of Running injuries. Nordic Conference on Sports Traumatology, Turku, Finland.	Nigg, B.M.
April	1988 Winter Olympics in Calgary. Panathlon, Zurich.	Nigg, B.M.
April	The Effects of Motion Palpation Treatments on Patients with a Unilateral Chronic Sacroiliac Syndrome. Research Council of the Alberta Chiropractic Association, Calgary, Alberta.	Herzog, W.
May	Gait Analysis of Patients with Idiopathic Low Back Pain. Musculoskeletal Research Group, Calgary, Alberta.	Herzog, W.
June	Running Shoe Construction and Prevention of Running Injuries, international Conference on Sports Traumatology, Munich, West Germany.	Nigg, B.M.
June	The Physiological Effects of Muscle Training. Canadian Physiotherapy Association Conference, Banff, Alberta.	Smith, D.J.
July	Coach Education at the Master's Level: A Canadian Experience. VIII Commonwealth and International Conference on Sport, Physical Education, Dance, Recreation and Health, Glasgow, Scotland.	Hawes, M.R.

PRESENTATIONS

MONTH	TOPIC AND LOCATION	AUTHOR
July	Muscle Force Predictions using a Nonlinear Optimal Design. Novel Approaches on the Study of Motor Systems Banff, Alberta.	Herzog, W.
August	A Technique for Normalizing Center of Pressure Paths. North American Congress on Biomechanics, Montreal, Quebec.	Motriuk, H.
August	Possibilities of Estimating the Validity of Nonlinear Optimal Designs in the Prediction of Individual Muscle Forces. North American Congress on Biomechanics,	Herzog, W.
August	Regression Equations for Sequential Movement of Inertia Parameters. North American Congress on Biomechanics, Montreal, Quebec.	Morlock, M. Yeadon, M.R.
August	The Biomechanics of Twisting Somersaults. North American Congress on Biomechanics, Montreal, Quebec.	Yeadon, M.R.
August	The Influence of Flare on Pronation and Impact Forces in Running Shoes. North American Congress on Biomechanics, Montreal, Quebec.	Nigg, B.M.
September	Anaerobic and Aerobic Power Tests. 1986 Asian Games Scientific Congress, Seoul, South Korea.	Miyashita, M. Taniguchi, Y. Stokes, S.
October	Response of Serum Iron and Alpha-Antitrypsin to a Single Bout of High Intensity Exercise in Trained and Untrained Individuals. 3rd International Course on Physiology and Biochemistry of Exercise and Training, Athens, Greece.	Roberts, D. Smith, D.
October	Serum CPK Activity During Training and Competition in Elite Speed Skating and Volleyball Players. 3rd International Course on Physiology and Biochemistry of	Smith, D. Roberts, D.
October	The Anthropological Status of National Caliber Male Volleyball Players. Annual Meeting of the Canadian Association of Sport Sciences, Ottawa. Ontario.	Hawes, M.R. Sovak, D.

PRESENTATIONS

MONTH	TOPIC AND LOCATION	AUTHOR
October	Changes in Blood Lactate and Ammonia During Incremented Treadmill Exercise. Annual Meeting of the Canadian Association of Sport Sciences, Ottawa,	Smith, D.J. Roberts, D. Stokes, S.
December	Load Aspects of Area-elastic Surfaces. Indoor Sport Surfaces, Denmark.	Nigg, B.M.
December	Biomechanical Aspects of Running Shoes. Free University of Amsterdam, The Netherlands.	Nigg, B.M.
December	Video: Fit For The Final - The Training	Smith, D.J. Maxwell, T. Bratton, R.

CONFERENCES ATTENDED (without presentations)

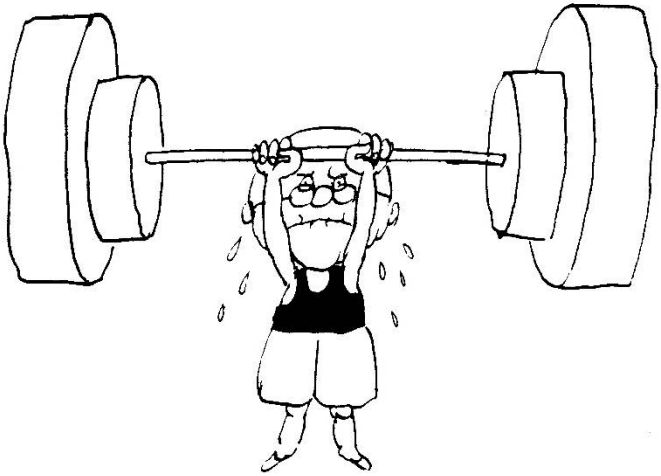
MONTH	LOCATION	ATTENDING
February	Coaching Association of Canada Seminar Series, Calgary, Alberta.	Smith, D.J. Roberts, D.
June	North American Diabetes Association Conference, Aneheim, California.	Motriuk, H.
July	Commonwealth Games Sport Sciences Conference, Glasgow, Scotland	Kerr, B.A.
August	North American Congress on Biomechanics, Montreal, Quebec.	Skleryk, B.N.
October	Canadian Society for Psychomotor Learning and Sports Psychology (SCAPPS), Ottawa, Ontario.	Kerr, B.A.

INTERNAL REPORTS

MONTH	TITLE	AUTHOR
Hawes, M.R. Sovak, D.	Anthropological status of Men's National Volleyball Team. Report #1.	Men's National Volleyball Team
Hawes, M.R. Sovak, D.	Anthropological status of Men's National Volleyball Team. Report #2.	Men’s National Volleyball Team
Hawes, M.R. Sovak, D.	Anthropological status of Men's National Speed skating Team. Report #2.	Men's National Speed skating Team
Hawes, M.R. Sovak, D.	Anthropological status of Men's National Speed skating Team. Report #3.	Men's National Speed skating Team
Hawes, M.R. Sovak, D.	Anthropological status of Women's National Speed skating Team. Report #1.	Women's National Speed skating Team
Hawes, M.R. Sovak, D.	Anthropological status of Women's National Speed skating Team. Report #2.	Women's National Speed skating Team
Hawes, M.R. Sovak, D.	Anthropological status of National Acrobatic Gymnastic Team. Report #1.	National Acrobatic Gymnastic Team
Nigg, B.M.	Biomechanics of tennis shoes: A synthesis.	ADIDAS, Sport Shoe Company
Nigg, B.M.	A research report for The University of Calgary, Campus Development Department, assessing two sets of surfaces for the Olympic Speed skating Oval.	The University of Calgary, Campus Development Department
Nigg, B.M.	A research report for The University of Calgary, Campus Development Department, assessing thirty-four surfaces for the Physical Education Expansion.	The University of Calgary, Campus Development Department
Nigg, B.M. Bahlsen, A.H. Woo, H.	Heel flare, midsole construction and heel stabilizers in running shoes.	ADIDAS, Sport Shoe Company
Nigg, B.M. Fisher, V.	Comparison of movement patterns generated by Polytech and Silverstar.	ADIDAS U.S.A. Sport Shoe Company
Nigg, B.M.	Running injuries and the wear of running shoes.	ADIDAS Germany/U.S.A, Sport Shoe Company
Nigg, B.M. Herzog, W. Read, L.	Visco-elastic insoles.	ADIDAS, Sport Shoe Company

INTERNAL REPORTS

MONTH	TITLE	AUTHOR
Nigg, B.M. Morlock.M.	Data base for the construction of football shoes.	ADIDAS, Sport Shoe Company
Nigg, B.M. Yeadon, M.R.	Area-elastic surfaces for Lindsay Park.	Lindsay Park Sports Complex
Sovak, D. Hawes, M.R.	Anthropological status of Commonwealth Games team members in swimming and diving.	National Team Coaches
Sovak, D. Hawes, M.R.	Anthropological status of Junior Hockey Team. Report #1.	Properties Junior Hockey Team



ANTHROPOMETRICAL, PHYSIOLOGICAL AND BIOCHEMICAL ASSESSMENTS

INVESTIGATORS	TEAM
Hawes, M.R. Sovak, D.	Canadian National Volleyball Team, Men; Anthropometric.
Roberts, D.	Canadian Speed Skating Team, Inzell, West Germany; Physiological.
Smith, D.J.	Canadian Speed Skating Team, St. Foy, Quebec; Physiological.
Smith, D.J. Wall, J. Roberts, D.	Calgary Flames Hockey Club; Physiological.
Smith, D.J. Roberts, D.	Canadian Men's and Women's Speed Skating Team; Physiological, Biochemical.
Smith, D.J. Roberts, D.	World Swimming, Synchronized Swimming and Diving Championships, Madrid, Spain; Physiological.
Smith, D.J. Stokes, S. Roberts, D. Wall, J.	Canadian Western National Biathlon Team; Physiological.
Smith, D.J. Wall, J. Roberts, D. Stokes, S.	Canadian National Volleyball Team, Men; Physiological.
Sovak, D. Hawes, M.R.	Canadian National Speed Skating Team, Men and Women; Anthropometric.
Sovak, D. Hawes, M.R.	Members of Canadian National Diving Team; Anthropometric.
Sovak, D. Hawes, M.R.	Members of National Acrobatic Gymnastics Team; Anthropometric.
Sovak, D. Hawes, M.R.	Properties Junior Ice Hockey Team; Anthropometric.
Stokes, S. Wall, J. Smith, D.J.	Alberta Winter Olympic Teams; Physiological.
Stokes, S.	Canadian Synchronized Swimming Championships; Physiological.
Wall, J.	Canadian National Vollyball Team European Tour, Sweden, Czechoslovakia; Physiological.

OFFICIAL FUNCTIONS

NAME	FUNCTION
Hawes. M.R.	Canadian Association of Sport Sciences, Board Member
Hawes, M.R.	Co-Chairperson, Pre-Olympic Conference and the 20th Annual Meeting of the Canadian Association of Sport Sciences
Hawes, M.R.	Graduate Coordinator for Faculty of Physical Education, U of C
Hawes, M.R.	Faculty Council, Faculty of Graduate Studies, U of C
Kerr, B.A.	General Faculties Council, Striking Committee, U of C
Kerr. B.A.	Faculty Council, Faculty of Social Sciences, U of C
Kerr, B.A.	Consultant to Alberta Bow Hunters and Archers Association
Nigg, B.M.	Past President of the International Society of Biomechanics, since June 1985.
Nigg, B.M.	Faculty Council, Faculty of Medicine, U of C
Nigg, B.M.	Corresponding Fellow, the American Academy of Physical Education
Nigg. B.M.	Member of the Commission "Biomechanics and Sports Physiology" of the IOC Medical Commission
Smith, D.J.	Board Member, Alberta Fitness Appraisal and Certification Program
Smith, DJ.	Member of the OCO '88 Drug Testing Committee
Smith, DJ.	Member of the Canadian Association of Sport Science Committee on High Performance Sport
Smith, D J.	Member of the Sports Science Committee of the Canadian Volleyball Association
Smith. D .J.	Member of the Sports Science Committee of Synchro Canada
Smith, D .J.	Member of the Advisory Committee to Mount Royal College Fitness Centre
Smith, DJ.	Member of the Sports Medicine Council of Alberta
Smith, D .J.	President of the Sports Science Association of Alberta
Yeadon, M.R.	Faculty Council, Faculty of Social Welfare, U of C
Yeadon, M.R.	Conjoint Areas Ethics Committee, U of C

LABORATORY PROJECTS (ongoing)

INVESTIGATORS	TITLE
Hawes, M.R. Sovak, D. Moon, K. Willcox.B.	Morphology of the North American Foot
Hawes, M.R. Sovak, D. Rambousek, S.	Ultrasound assessment of muscle, bone and fat volumes in the limbs of athletes
Hawes, M.R. Sovak, D.	Anthropometric assessment of factors contributing to pain and injury in running
Hawes, M.R. Sovak. D.	Anthropometric factors in the early prediction of athletic performance
Herzog, W. terKeurs, –H.E.	Determination of in vivo length-tension relationships of human skeletal muscle
Herzog, W.	Determination of the effects of changes in muscle model variables on the estimate of individual muscle forces
Herzog, W.	Validation of optimization model for the estimation of individual muscle forces
Herzog, W. Tory, B..	Three-dimensional film analysis of human movement
Herzog, W	Development of a model of the whole human body to estimate individual muscle forces for any movement
Nigg, B.M. Olsson, E.	Determination of asymmetries in walking for normal subjects
Herzog, W. Shaw, L Conway, P.M.	Assessment of the repeatability and inter-subject variability of clinical diagnosis of low back problems
Herzog, W. Nigg, B.M. Robinson, R.O. Read, L J.	Determination of the effects of chiropractic manipulations on the gait of patients with idiopathic low back pain
Morlock, M. Nigg, B.M.	Determination of lateral stability of tennis shoes with the point of application

LABORATORY PROJECTS (ongoing)

INVESTIGATORS	TITLE
Motriuk, H. V. Zuiden, L. Nigg, BM.	Hemophilia; experimental analysis for evaluation of gait variables for hemophiliacs
Nigg. B.M. Bahlsen, A.H. Woo, H	Influence of flare on cushioning and pronation in running
Nigg, B.M. Bahlsen, A.H. Fisher, V. Flanagan, C.	Etiology of running injuries, a pilot study with 150 runners
Nigg, B.M. Fisher, V.	Influence of mileage on load and injuries in running
Nigg, BM Herzog, W. Read, L.J.	Influence of various insoles on impact absorption in running
Nigg, B.M. Skleryk, B.N.	Assessment of gait characteristics for the elderly
Nigg, B.M. Yeadon, M.R. Beatty, R. Dunn, E. Swityk, G.	Influence of various construction methods of area-elastic surfaces on deformation and performance
Nigg, B.M. Beatty, R. Yeadon, M.R.	Sport surfaces: to test the various proposed surfaces for the Speed Skating Oval and the Physical Education expansion with material and subject tests
Nigg, BM. Yeadon, MR.	Influence of sport surface construction on the load on the human locomotor system
Smith, D.J. Roberts, D.	Ion metabolism
Robinson, R. Nigg, B.M.	Quantifying the effects of prosthetic alterations on the gait of Fibular Hemimelia patients
Schlaepfer, F.	Development of a method to estimate the in vivo spinal load (thesis)
Smith, D.J. Roberts, D. Campagna, P. Wall, J.	Effect of weight training on selected blood parameters

LABORATORY PROJECTS (ongoing)

INVESTIGATORS	TITLE
Vermeulen, S. Nigg, B.M.	Determination of strain of the ligaments of the knee joint
Yeadon, M.R. Dunn, E. Draper, J.	Contribution of segmental twisting techniques to the twisting produced by springboard divers
Yeadon, M.R. Dunn, E. Draper, J.	Application of computer simulation for the modification of twisting techniques of high performance divers
Draper, J. Yeadon, M.R. Dunn, E.	A comparison of direct anthropometric measurements with digitized film data for the determination of segmental inertia parameters
Draper, J. Yeadon, M.R. Dunn, E.	Normalized angular momentum values for elite performances of selected non-twisting backward and reverse springboard dives
Yeadon, M.R. Draper, J. Dunn, E.	The production of somersault momentum during the take-off phase of non-twisting dives
Yeadon, M.R. Nigg, B.M. Dunn, E. Morlock, M.	Three-dimensional film analysis of ski jumping using pan and tilt cameras
Yeadon, M.R. Nigg, B.M. Dunn, E.	Techniques used in the aerial phase of ski jumping
Yeadon, M.R.	Techniques used in aerials in acrobatic skiing
Vermeulen, S. Yeadon, M.R.	The determination of derivatives of displacement data using a Fourier series technique with endpoint corrections
Morlock, M. Yeadon, M.R.	A comparison of two techniques for the determination of segmental inertia parameters

ACADEMIC GUESTS

GUEST	FROM	CONTACT PERSON
Bobert, M.	University of Amsterdam	Nigg, B.M.
Bunnik, Dr. B.S.J.	Netherlands Organization for Applied Scientific Research	Smith, D.J.
Carter, Dr. R.	Alberta Chiropractic Association, Calgary, Alberta	Herzog, W. Robinson, R. Nigg, B.M.
Challis, Dr. B.	Member of the Medical Commission, IOC, Calgary, Alberta	Jackson, R. Nigg, B.M
Coolen, L.	The Netherlands	Hawes, M.
Dilman, Dr. C.	U.S.A. Olympic Training Center, Colorado Springs, U.SA.	Nigg, B.M. Herzog, W.
Doige, Dr. A.	Dept. of Mechanical Engineering, University of Calgary, Calgary, Alberta	Nigg, B.M.
Frank, Dr. C.	Faculty of Medicine, University of Calgary, Calgary, Alberta	Nigg, B.M.
Gipone, N.	University of Moncton	Smith, D J.
Gregor, Dr. R.J.	U.C.L.A., Los Angeles, U.SA	Herzog, W. Nigg, B.M.
Hay, Dr. J.G.	Iowa State University, Iowa. U.S.A.	Nigg, B.M.
Johnson, Dr. E.	Dept. of Mechanical Engineering, University of Calgary, Calgary, Alberta	Nigg, B.M.
Luethi, Dr. S.	E.T.H., Zurich, Switzerland	Nigg, B.M. Herzog, W.
Montanaro, F.	Mondo Rubber Inc., Laval, Quebec	Nigg, B.M.
Morander, Dr. K.	President, Remplir AB. Stenkullen, Sweden	Nigg, B.M.
Nelson, Dr. R.	Pennsylvania State University Pennsylvania, U.S.A.	Nigg, B.M.

ACADEMIC GUESTS

GUEST	FROM	CONTACT PERSON
Norman, Dr. R.	Department of Kinesiology, University of Waterloo, Waterloo, Ontario	Nigg, B.M.
Rau, Dr. G.	Institute for Biomedical Engineering, Aachen, West Germany	Nigg, B.M.
Shrive, Dr. N.	Dept. of Civil Engineering, University of Calgary, Calgary, Alberta	Nigg, B.M.
ter Keurs, Dr. H.	Faculty of Medicine, University of Calgary, Calgary, Alberta	Herzog, W.

NEW EQUIPMENT

6	2 kW lighting units
3	heavy duty telescopic light standards with dollies
2	heavy duty camera tripods with dollies
1	3-D flm reference frame
2	light tables
1	right angle lens for 35mm slide projection
1	Tokina 28-85mm wide angle/zoom lens for 35mm camera
1	Synchronized millisecond timing light system for Locam cameras
2	Mac Plus micro computers
1	20 Mbyte hard disk for Macintosh computers
1	Laser writer plus laser printer
1	RA-81 456 Mbyte hard disk for PDP11/44 computer
1	Selanar Graphics treminal
1	2400 baud modem
18	Sport Tester computerized heart rate monitors
1	Siber-Hegner GPM Anthropometer
2	Volume displacement tanks for upper & lower extremities
1	Scanascope ultrasound unit

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