Physiological Chemistry of Training and Detraining

Medicine and Sport Science
Vol. 17

Series Editors
E. Jokl, Lexington, Ky.
M. Hebbelinck, Brussels

KARGER


2nd International Course on Physiology and Biochemistry of Exercise and Detraining, Nice, October 29-November 1, 1982

Physiological Chemistry of Training and Detraining

Volume Editors
P. Marconnet, Nice
J. Poortmans, Brussels
L. Hermansen, Oslo

94 figures and 20 tables, 1984

KARGER


Medicine and Sport Science
Published on behalf of the Research Committee of the International Council of Sport Sciences and Physical Education

National Library of Medicine, Cataloging in Publication
International Course on Physiology and Biochemistry of Exercise and Detraining (2nd: 1982: Nice, France)
Physiological chemistry of training and detraining/
2nd International Course on Physiology and Biochemistry of Exercise and Detraining, Nice, October 29-November 1, 1982;
Drug Dosage
The authors and the publisher have exerted every effort to ensure that drug selection and dosage set forth in this texture in accord with current recommendations and practice at the time of publication. However, in view of ongoing research, changes in government regulations, and the constant flow of information relating to drug therapy and drug reactions, the reader is urged to check the package insert for each drug for any change in indications and dosage and for added warnings and precautions. This is particularly important when the recommended agent in a new and/or infrequently employed drug.

All rights reserved.
No part of this publication may be translated into other languages, reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, microcopying, or by any information storage and retrieval system, without permission in writing from the publisher.

Copyright 1984 by S. Karger AG, P.O. Box, CH-4009 Basel (Switzerland)
Printed in Switzerland by Boehm-Hutler AG, Reinach BL
ISBN 3-8055-3764-6

Contents

Obituary .................................................................................................................. VII
In memoriam .......................................................................................................... IX
Foreword ................................................................................................................ XI

Introduction

Newsholme. E.A. (Oxford): Metabolic Control and Its Importance in Sprinting and Endurance Running .............................................................................................................. 1
Methodology

Frminet, A.; Minaire, Y. (Lyon): On the Use of Isotopic Tracers for the Study of Lactate Metabolism in vivo ...............................................................................................25

Maximal Exercise of Short Duration

Sejersted, O.M.; Medb, J.I.; Orheim, A.; Hermansen, L: (Oslo): Relationship between Acid-Base Status and Electrolyte Balance after Maximal Work of Short Duration ..........................................................................................................................40
Hermansen, L.; Medb J.I. (Oslo): The Relative Significance of Aerobic and Anaerobic Processes during Maximal Exercise of Short Duration .........................................................................................................................56
Cerretelli, P. (Geneva): Oxygen Debt: Definition, Role and Significance .................................................................68

Prolonged Sustained Exercise

Nielsen, B. (Copenhagen): Dehydration, Rehydration and Thermoregulation .........................................................81
Galbo H. (Copenhagen); Gollnick, P.D. (Pullman, Wash.): Hormonal Changes during and after Exercise ..........................................................................................97

Contents VI

Holloszy, J.O. (St. Louis, Mo.): Regulation of Glucose Metabolism and Glycogen Resynthesis following Prolonged, Strenuous Exercise .................................................................111
Poortmans, J.R. (Bruxelles): Protein Turnover and Amino Acid Oxidation during and after Exercise .........................................................................................................................130

Acute Effects of Exercise on Neuro-Muscular System

Sjstrm, M.; Fridn, J. (Ume): Muscle Soreness and Muscle Structure .................................................................169
Komi, P.V. (Jyvskyl): Fatigue and Recovery of Neuromuscular Function .................................................................187

Detraining

Sjgaard, G. (Copenhagen): Changes in Skeletal Muscles Capillarity and Enzyme
With the death of Georg Haralambie on August 10th 1982, in his very early fifties, a restless scientist, full of search for fulfillment, full of ideas and achievement, has come to an untimely end. His unexpected death has been a great shock to all those who knew this man, outstanding in so many ways.

Georg Haralambie was born in Rumania and took his university degree in chemistry in 1953. He quickly became interested in sports activities and achieved his scientific research in that field. By 1956 he had published his first findings on the sweat pH during physical exercise. He entered the Higher School of Physical Education in Bucarest where he met and subsequently married a young athlete. When the Physical Education Research Institute was founded in 1967 the Rumanian authorities appointed him head of the Biochemical Department. Meanwhile, Georg Haralambie was endowed with an insatiable thirst for scientific progress. So, he accepted an invitation from the University of Freiburg to spend several months in the Department of Sports Medicine. There, he was bitten by the ‘freedom of opinion’ bug and decided to remain in Germany with his wife and daughter Daniela. Son was born, Robert, and the family acquired the German citizenship. His work soon came to the attention of the biology of exercise community, particularly his research on glycoproteins, ions, the catabolism of amino acids, the activity of plasma and muscle enzymes. His scientific output was prolific. He published over 120 research papers and
reviews, most of which in outstanding journals. Two monographs were devoted to the biochemistry of exercise. All those who met him or listened to him were struck by his fluency of language (French, German, English), his enthusiasm, his wittiness, his common sense, his encyclopedism, his steel-trap mind.

I knew Georg Haralambie since 1963. In addition to his scientific prowess, it was his exceptional intellectual curiosity which astounded those around him. He was a great history enthusiast of French medieval history in particular. He could recount myriads of details of the French revolution and discourse endlessly on the 16th century Pleiade writers or on the works of Victor Hugo. Georg Haralambie was an indefatigable scientist, a fervent advocate of social justice who could tolerate neither totalitarian dialectics nor sham democracy. He had too much integrity to remain indifferent to the tributes demanded by the so-called civilized world. Let us remember the words of Montesquieu who said: 'There can be no democracy without virtue'. The man he was and the example he set for us will remain alive in our memories.

Jacques Poortmans

In memoriam

As this book is leaving the printers, I have just learnt about the sad news of Lars Hermansen's death. Far from me be it to claim the right to speak his praises. Others than me are more qualified to do so. In the framework of this publication, I wish to pay tribute to Lars by laying particular stress on the decisive role he played in the preparation and outcome of the Nice Symposium and by linking his name to those of the report's publishers. I was honoured by his friendship and benefited from his advice. I was lucky enough to experience the warmth of his welcome, his great kindness, and his complete availability. I had the privilege of benefiting of his scientific rigor and knowledge. I am sure of speaking on behalf of all those whom he honoured with his friendship among the participants to this book. Let him rest in the assurance of our affection and our fidelity.

Pierre Marconnet

Foreword

It may be worthwhile to give some background information on the aims of the Research Group on Biochemistry of Exercise, sponsored by the International Council of Sport Science and Physical Education (at
The Group was established in the wake of the 1st International Symposium on the Biochemistry of Exercise held in Brussels in 1968. Since then, four other symposia were organized by the members of the group. They have brought together scientists from all over the world directly involved in research on the biochemical repercussions of physical exercise. Nobel Prize winners and world-renowned scientists have endowed these meetings with considerable prestige.

The members of the group felt the necessity to inform the scientific community, sports medicine circles as well as championship-level coaches and athletes of research findings in the field of physical exercise. It is a field where great strides are being made. The results of research frequently explain the fundamentals of physical exercise, correct the initial empirical approach and on some occasions demolish long-standing myths. This is the rationale for these courses. The first one was held in Fiuggi (Italy) 3 years ago. A synoptic report was published by S. Karger. The members of the group felt it inappropriate to confine the course to biochemistry alone as it is often inaccessible for the uninitiated. Thus, we decided to focus on physiological chemistry, an obsolete term perhaps but one that serves on the genuine issues. For the last 15 years - in fact since the pioneering work of John Holloszy in 1967 - we have advanced beyond the equation `an athlete = one heart and two lungs'. Fortunately for him, the athlete also has muscles and other organs. The various lecturers will underline the links between the biochemical mechanisms and the subsequent physiological manifestations. Any real understanding of the phenomena involved in physical exercise necessarily combines the two fields.

Foreword XII

The programme of this second course is devoted to the changes that occur during short-term and long-term intense exercise. Yet, we also felt it necessary to extend this approach by focussing on two areas which have received less attention in the standard textbook, namely the recovery phase and the detraining stage.

200 participants coming from 15 different countries attended the 4-day course. The members of the Research Group on Biochemistry of Exercise were responsible for the preparation of the scientific programme. Three workshops were devoted to practical implications concerning short-term and long-term exercise, detraining.

We are particularly indebted to the town of Nice and French Ministry of Sports for the opportunity which was given to our Group to organize this second course in Nice. Without their understanding, their financial support, their determination and dedication, this course could not have
taken place in Nice.

Pierre Marconnet  Jacques Poortmans
Secretary of the Course  Chairman of the Research Group
on Biochemistry of Exercise

Members of the Research Group on Biochemistry of Exercise:
J. Poortmans (Chairman, Belgium); P.E. di Prampero (Switzerland);
G. Haralambie* (FRG); J.O. Holloszy (USA); L. Hermansen* (Norway);
H. Howald (Switzerland); N. Jakovlev (USSR); J. Keul (FRG);
H. Knutgen (USA); G. Mtivier (Canada); E. Newsholme (England);
B. Saltin (Denmark).

* Deceased.