



International Series on Biomechanics,  
Volume 2A

# BIOMECHANICS VI-A

Edited by  
**Erling Asmussen**  
and  
**Kurt Jørgensen**

University Park Press Baltimore



**International Series  
on Biomechanics, Volume 2A**

# **BIOMECHANICS VI-A**

Proceedings of the Sixth International Congress of Biomechanics,  
Copenhagen, Denmark

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## **Biomechanics VI-A**

## International Series on Biomechanics

This series publishes the major biennial symposia on biomechanics, beginning with the Fifth International Congress of Biomechanics held at the University of Jyväskylä, and related seminars and congresses sponsored by the International Society on Biomechanics. Future volumes may also include monographs on special topics in the field of biomechanics, as determined by the International Society of Biomechanics.

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# Preface

The organizing committee of the Sixth International Congress of Biomechanics and the editors of *Biomechanics VI* had already decided at a very early stage of preparation and after intensive discussions with officers of International Society of Biomechanics and the editor of *Biomechanics V*, Paavo V. Komi, that they should try to keep the number of accepted and printed contributions within such limits that they could be contained in a maximum of two volumes of Proceedings. There were several reasons for this decision, one being that the cost of publication thus could be kept low enough for the congress fee—which traditionally includes the price of the proceedings—to be maintained at a reasonable level. Another was a wish to keep a high quality of the published papers by being able to select the very best among those submitted. We were well aware that this procedure might cause embarrassment to some potential participants seeking financial aid from public funds, etc. Therefore, we attempted to partly amend this situation by introducing poster sessions as a parallel to the oral presentations. Poster exhibitions have proved exceedingly successful as a means of communicating new findings and ideas to colleagues, and by including the abstracts of the poster exhibitors in the volume of proceedings we hope to have satisfied practically all participants.

The contents of the accepted papers and abstracts can roughly be divided into those that deal with the more general, basic aspects of biomechanics, and those that deal with the applied, practical aspects. We have attempted to place the first kind of contribution in *Biomechanics VI-A* and the second kind in *Biomechanics VI-B*.

In the interregnum between Congress V and Congress VI, the International Society of Biomechanics (ISB) and all concerned with the development and fate of this science were saddened by the news of Dr. Jürg Wartenweiler's death. Dr. Wartenweiler's role as international coordinator of biomechanics and as Founder and President of ISB is well known and is further dwelt upon by Richard C. Nelson in *Biomechanics VI*. We have found it appropriate to dedicate *Biomechanics VI* to Jürg Wartenweiler's memory. Our keynote address, delivered by Dr. G. Cavagna, was accordingly titled the "Jürg Wartenweiler Memorial Lecture." It is the stated intention of ISB to maintain a "Wartenweiler Memorial Lecture" as a fixed part of the program of coming international congresses.



As editors of Biomechanics VI we are indebted to all contributors who so loyally have followed our directions and suggestions, which we hope have been reasonable and have enhanced the value of the proceedings as books of useful, well-presented scientific papers. We could not have accomplished this without the help of numerous "co-editors" to whom we extend our sincere thanks, a few of whom deserve to be mentioned and thanked with special emphasis. They are: Paavo V. Komi, Richard C. Nelson, Chauncey A. Morehouse, and Howard G. Knuttgen. These four colleagues spent hours, day and night, before, during, and after the congress, correcting, proofreading and re-editing the more than 100 full papers and about 50 poster abstracts that are presented in Biomechanics VI. We owe them many thanks for this unselfish labor.

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