

54.549083  
4936

STUDIES IN ORGANIC CHEMISTRY 23

# **FLAVONIDS AND BIOFLAVONIDS, 1985**

PROCEEDINGS OF THE 7TH HUNGARIAN BIOFLAVONOID  
SYMPOSIUM

SZEGED, HUNGARY, MAY 16-18, 1985

**Edited by**

**L. FARKAS**

TECHNICAL UNIVERSITY, BUDAPEST, HUNGARY

**M. GÁBOR**

UNIVERSITY MEDICAL SCHOOL, SZEGED, HUNGARY

**F. KÁLLAY**

RESEARCH INSTITUTE FOR ORGANIC CHEMICAL INDUSTRY,  
BUDAPEST, HUNGARY



**ELSEVIER**

**AMSTERDAM — OXFORD — NEW YORK —/TOKYO 1986**

Joint edition published by  
Elsevier Science Publishers, Amsterdam, The Netherlands  
and  
Akadémiai Kiadó, The Publishing House of the Hungarian Academy of Sciences, Budapest,  
Hungary

*The distribution of this book is being handled by the following publishers:*

*for the U.S.A. and Canada*

Elsevier Science Publishing Co. Inc.  
52 Vanderbilt Avenue  
New York, New York 10017, U.S.A.

*for the East European Countries, Democratic People's Republic of Korea, People's Republic of Mongolia,  
Republic of Cuba and Socialist Republic of Vietnam*

Akadémiai Kiadó, The Publishing House of the Hungarian Academy of Sciences, Budapest,  
Hungary

*for all remaining areas*

Elsevier Science Publishers  
Sara Burgerhartstraat 25  
P. O. Box 211  
1000 AE Amsterdam, The Netherlands

**Library of Congress Cataloging-in-Publication Data**

Hungarian Bioflavonoid Symposium (7th, 1985: Szeged,  
Hungary)  
Flavonoids and bioflavonoids, 1985.

(Studies in organic chemistry; 23)

Bibliography: p.

Includes index.

I. Bioflavonoids—Congresses. 2. Flavonoids—Congresses.

I. Farkas, L. (Lóránd), 1914–

II. Gábor, M. (Miklós), 1918–

III. Kállay, F. (Ferenc), 1924–

IV. Title.

V. Series: Studies in organic chemistry  
(Elsevier Science Publishers); 23.

ISBN 0-444-99520-X (Vol. 23)

ISBN 0-444-41737-0 (Series)

© Akadémiai Kiadó, Budapest, 1986

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or  
transmitted in any form or by any means, mechanical, photocopying, recording, or otherwise, without the  
prior written permission of the publishers

Printed in Hungary

## PREFACE

As a new link in the chain of Hungarian Bioflavonoid Symposia, the 7th meeting was held in Szeged, Hungary, May 16-18, 1985. The aim of the Hungarian Bioflavonoid Symposia has traditionally been to establish an international forum for the exchange of ideas for scientists covering, in the widest possible sense, the special fields involving flavonoid research: chemistry, biochemistry, phytochemistry, plant physiology and taxonomy, pharmacology, and clinical practice. The lectures are never divided into sections, a principal aim of the symposia being to allow the participants also to become acquainted with the recent work and latest results obtained with flavonoids in fields other than their own. This interdisciplinary approach is believed to be highly stimulating.

The present meeting was attended by participants from 15 countries. The valuable contributions of 44 lectures covering different fields, yet all dealing with flavonoids or closely related compounds, are included in this book. The editors feel that the several newly discovered biological actions of flavonoid compounds, and the elucidation of the mechanisms of these actions by modern methods, might be of particular interest to the reader. Such readers may be engaged either in isolating, synthesising, or investigating the mode of action of flavonoids, or employing them as new medicinal agents. We hope this volume provides new information that will be found useful and interesting by chemists, botanists, pharmacologists, medical doctors and all those whose work is in any way concerned with the research and uses of flavonoid compounds.

It is the Editors' pleasant duty to acknowledge with gratitude the financial support of several pharmaceutical and chemical firms in Hungary, which materially assisted the organization of the 7th Hungarian Bioflavonoid Symposium.

*The Editors*

## LIST OF CONTRIBUTORS

AL-JEBOORY, A.A.

Institute of Pharmaceutical Biology, University of Munich,  
Karlstrasse 29, D-8000 München, FRG

ALTORJAY, I.

2nd Department of Medicine, University Medical School,  
Debrecen, Hungary

ANTON, R.

Laboratoire de Pharmacognosie, Faculté de Pharmacie, B.P.  
10, 67048 Strasbourg, France

ANTUS, S.

Research Group for Alkaloid Chemistry of the Hungarian  
Academy of Sciences, Gellért tér 4, H-1111 Budapest, Hungary

AUF'MKCLK, M.

Abteilung Klinische Endokrinologie, Medizinische Hochschule,  
D-3000 Hannover, FRG

BÁLINT, G.A.

First Department of Medicine, University Medical School,  
H-6701 Szeged, P.O.B. 121, Hungary

BÁLINT, J.

BIOGAL Pharmaceutical Works, Pallagi út 13, H-4042 Debrecen,  
Hungary

BAUER, R.

Institute of Pharmaceutical Biology, University of Munich,  
Karlstrasse 29, D-8000 München 2, FRG

BAUMANN, J.

Institut für Pharmakologie, Freie Universität Berlin,  
D-1000 Berlin West 33

BÉLÁDI, I.

Institute of Microbiology, University Medical School, Dóm  
tér 10, H-6720 Szeged, Hungary

BERETZ, A.

Laboratoire de Biologie et de Pharmacologie des Interactions  
du Sang avec les Vaisseaux et les Biomatériaux, Centre  
Régional de Transfusion Sanguine, 10 rue Spielmann,  
67085 Strasbourg, France

BOGNÁR, R.

Antibiotic Research Group of the Hungarian Academy of Sciences, H-4010 Debrecen, P.O.B. 20, Hungary

BONIFACE, R.

Laboratoire de Biochimie du Tissu Conjonctif, Faculté de Médecine, Université Paris XII, 8 rue du Général Serrail, 94010 CRETEIL cedex, France

BRAQUET, P.

Institut Henri Beaufour, (I.H.B.) IPSEN Institute for Therapeutic Research, 17 avenue Descartes, F-92350 Le Plessis, Robinson, France

CANNON, PETER G.M.

Department of Chemistry, University College Dublin, Belfield, Dublin 4, Ireland

CAZENAVE, J.-P.

Laboratoire de Biologie et de Pharmacologie des Interactions du Sang avec les Vaisseaux et les Biomatériaux, Centre Régional de Transfusion Sanguine, 10 rue Spielmann, 67085 Strasbourg, France

CODY, V.

Medical Foundation Buffalo, INC., Buffalo, New York, USA

COSIO, E.G.

Department of Botany, Miami University, Oxford, 45056 Ohio, USA

CRASTES DE PAULET, A.

Laboratoire de Biochimie A, Institut de Biologie, Bd Henri IV, 34000 Montpellier, France

DALMI, L.

2nd Department of Medicine, University Medical School, Debrecen, Hungary

DAMAS, J.

Laboratoire de Physiologie humaine, normale et pathologique, Université de Liège, Place Delcour, 17, B-4020 Liège, Belgium

DEBY, C.

Laboratoire de Biochimie et de Radiobiologie, Institut de Chimie, B6, Université de Liège, Sart-Tilman, B-4000 Liège I, Belgium

DINYA, Z.

Institute of Organic Chemistry, Kossuth Lajos University and Antibiotic Research Group of the Hungarian Academy of Sciences, H-4010 Debrecen, P.O.B. 20, Hungary

DONNELLY, D.M.X.

Department of Chemistry, University College Dublin, Belfield, Dublin 4, Ireland

DRIEU, K.

Institut Henri Beaufour, (I.H.B.) IPSEN Institute for Therapeutic Research, 17 avenue Descartes, F-92350 Le Plessis, Robinson, France

- ECK, C.-R.  
Biomeasure Inc., 11/15 E.avenue, Hopkinton Industrial Park,  
Hopkinton Mas. 01748, USA
- FIEDLER, E.  
Botanisches Institut der Tierärztlichen Hochschule, Bünteweg  
17d, D-3000 Hannover 71, FRG
- FOO, L.Y.  
DSIR, Chemistry Division, Private Bag Petone, New Zealand
- FÜRST, Zs.  
Department of Pharmacology, Semmelweis University Medical  
School, H-1445, Budapest, P.O.B. 370, Hungary
- GÁBOR, E.  
College of Food Industry, Marx tér 7, Szeged, Hungary
- GÁBOR, M.  
Institute of Pharmacodynamics, University Medical School,  
H-6701 Szeged, P.O.B. 121, Hungary
- GELLÉRT, M.  
Department of Pharmacognosy, University Medical School,  
H-6701 Szeged, P.O.B. 121, Hungary
- GOTTSEGEN, Á.  
Research Group for Alkaloid Chemistry of the Hungarian  
Academy of Sciences, Gellért tér 4, H-1111 Budapest, Hungary
- GOUTIER, R.  
Laboratoire de Biochimie et de Radiobiologie, Institut de  
Chimie, B6, Université de Liège, Sart-Tilman, B-4000 Liège I,  
Belgium
- GRIFFITHS, L.A.  
Department of Biochemistry, University of Birmingham,  
Birmingham B15 2TT, UK
- GROß, C.  
Botanisches Institut der Tierärztlichen Hochschule, Bünteweg  
17d 10-3000 Hannover 71, FRG
- GÜTTNER, J.  
Central Institute of Microbiology and Experimental Therapy,  
Academy of Sciences of the German Democratic Republic,  
6900 Jena, GDR
- HACKETT, A.M.  
Department of Metabolism and Pharmacokinetics, Huntingdon  
Research Centre, Huntingdon, UK
- HANS, P.  
Service d'Anesthésiologie, Hôpital de Bavière, Université  
de Liège, Bd de la Constitution, 66, B-4020 Liège, Belgium
- HÄRTL, A.  
Central Institute of Microbiology and Experimental Therapy,  
Academy of Sciences of the German Democratic Republic,  
6900 Jena, GDR
- HASLAM, E.  
Department of Chemistry, University of Sheffield, Sheffield  
S3 7HP, UK

- HEINECKE, H.  
Central Institute of Microbiology and Experimental Therapy,  
Academy of Sciences of the German Democratic Republic,  
6900 Jena, GDR
- HERCZEGH, O.  
College of Food Industry, Marx tér 7, Szeged, Hungary
- HESCH, R.D.  
Abteilung Klinische Endokrinologie, Medizinische Hochschule,  
D-3000 Hannover 61, FRG
- IYER, C.S. RUKMANI  
Department of Chemistry, Indian Institute of Technology,  
Powai, Bombay 76, India
- IYER, P.R.  
Department of Chemistry, Indian Institute of Technology,  
Powai, Bombay 76, India
- JUST, I.  
Institut für Pharmakologie, Freie Universität Berlin,  
D-1000 Berlin West 33
- KAZAKOV, A.L.  
Pharmaceutical Institute, Pyatigorsk, USSR
- KÉRY, A.  
Institute of Pharmacognosy, Semmelweis University Medical  
School, Üllői út 26, H-1085, Budapest, Hungary
- KHILYA, V.P.  
Pharmaceutical Institute, Pyatigorsk, USSR
- KISS, S.  
BIOGAL Pharmaceutical Works, Pallagi út 13, H-4042 Debrecen,  
Hungary
- KNOLL, J.  
Department of Pharmacology, Semmelweis University Medical  
School, H-1445, Budapest, P.O.B. 370, Hungary
- KOMPANTSEV, V.A.  
Pharmaceutical Institute, Pyatigorsk, USSR
- KORBONITS, D.  
Chinoin Pharmaceutical and Chemical Works, H-1325 Budapest,  
P.O.B. 110, Hungary
- KÖHRLE, J.  
Abteilung Klinische Endokrinologie, Medizinische Hochschule,  
D-3000 Hannover 61, FRG
- LECOMTE, J.  
Laboratoire de Physiologie humaine, normale et pathologique,  
Université de Liège, Place Delcour, 17, B-4020 Liège,  
Belgium
- LÉVAI, A.  
Institute of Organic Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 20, Hungary



- LILLEY, T.H.  
Department of Chemistry, University of Sheffield, Sheffield  
53, 7HF, UK
- LION, Y.  
Laboratoire de Physique, Institut de Physique, B5,  
Université de Liège, Sart-Tilman, B-4000 Liège I, Belgium
- LITKEI, Gy.  
Institute of Organic Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 20, Hungary
- LOTTER, H.  
Institute of Pharmaceutical Biology, University of Munich,  
Karlstrasse 29, D-8000 München, FRG
- MARCZAL, G.  
Institute of Pharmacognosy, Semmelweis University Medical  
School, Üllői út 26, H-1085 Budapest, Hungary
- MÁNDI, Y.  
Institute of Microbiology, University Medical School, Dóm  
tér 10, H-6720 Szeged, Hungary
- MCCABE, J.  
Biomeasure Inc., 11/15E.avenue, Hopkinton Industrial Park,  
Hopkinton Mas. 01748, USA
- MCCLURE, J.W.  
Department of Botany, Miami University, Oxford, 45056, USA
- MERCKLEIN, L.  
Laboratoire de Biochimie A, Institut de Biologie, Bd Henri  
IV, 34000 Montpellier, France
- MICHEL, F.  
Laboratoire de Biochimie A, Institut de Biologie, Bd. Henri  
IV, 34000 Montpellier, France
- MIDDLETON, E.Jr.  
State University of New York at Buffalo, Buffalo, N.Y.  
14203, USA
- MISKULIN, M.  
Laboratoire de Biochimie du Tissu Conjonctif, Faculté de  
Médecine, Université Paris, XII 8 rue du Général Sarrail,  
94010 CRETEIL cedex, France
- MOREAU, J.P.  
Biomeasure Inc., 11/15E.avenue, Hopkinton Industrial Park,  
Hopkinton Mas. 01748, USA
- MUCSI, I.  
Institute of Microbiology, University Medical School,  
Dóm tér 10, H-6720 Szeged, Hungary
- NAGY, É.  
Institute of Organic Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 20, Hungary
- NAGY, É.  
Institute of Pharmacognosy, Semmelweis University Medical  
School, Üllői út 26, H-1085 Budapest, Hungary

- NÁFRÁDI, J.  
First Department of Medicine, University Medical School,  
H-6701 Szeged, P.O.B. 121, Hungary
- NESZMÉLYI, A.  
Central Research Institute of Chemistry, Hungarian Academy  
of Sciences, Pusztaszeri út 57/169, H-1025 Budapest, Hungary
- NETZLY, D.H.  
Department of Botany, Miami University, Oxford 45056, Ohio,  
USA
- NIKOLOV, N.  
Centre of Biogenic Stimulators, Laboratory of Bioflavonoids,  
Sofia - 1225, Bulgaria
- NÓGRÁDI, M.  
Research Group for Alkaloid Chemistry of the Hungarian  
Academy of Sciences, H-1521 Budapest, P.O.B. 91, Hungary
- OROSZLÁN, P.  
Institute of Pharmacognosy, Semmelweis University Medical  
School, Ullői út 26, H-1085 Budapest, Hungary
- PÁPAY, V.  
Department of Medicinal Plants and Pharmacognosy, University  
Medical School, H-6701 Szeged, P.O.B. 121, Hungary
- PATONAY, T.  
Institute of Organic Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 20, Hungary
- PÉLI, E.  
Institute of Organic Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 20, Hungary
- PINCEMAIL, J.  
Laboratoire de Biochimie et de Radiobiologie, Institut de  
Chimie, B6, Université de Liège, Sart-Tilman, B-4000 Liège  
I, Belgium
- PUSZTAI, R.  
Institute of Microbiology, University Medical School,  
Dóm tér 10, H-6720 Szeged, Hungary
- RÁKOSI, M.  
Institute of Organic Chemistry, Kossuth Lajos University  
and Antibiotic Research Group of the Hungarian Academy of  
Sciences, H-4010 Debrecen, P.O.B. 20, Hungary
- REHN, D.  
Zyma GmbH Munich, D-8000 München 70, FRG
- RÉPÁSI, J.  
Alkaloida Chemical Factory, H-4440 Tiszavasvári, Hungary
- REY, R.  
Laboratoire de Biochimie A, Institut de Biologie, Bd Henri  
IV, 34000 Montpellier, France
- ROBERT, A.M.  
Laboratoire de Biochimie du Tissu Conjonctif, Faculté de  
Médecine, Université Paris XII, 8 rue du Général Sarrail,  
94010 CRETEIL cedex, France

- ROBERT, L.  
Laboratoire de Biochimie du Tissu Conjonctif, Faculté de  
Médecine, Université Paris XII, 8 rue du Général Sarrail,  
94010 CRETEIL cedex, France
- SÁRI, B.  
2nd Department of Medicine, University Medical School,  
Debrecen, Hungary
- SCHMIDT, C.L.  
Botanisches Institut der Tierärztlichen Hochschule, Bünteweg  
17d, D-3000 Hannover 71, FRG
- SCHULTZ, G.  
Botanisches Institut der Tierärztlichen Hochschule, Bünteweg  
17d, D-3000 Hannover 71, FRG
- SELIGMANN, O.  
Institute of Pharmaceutical Biology, University of Munich,  
Karlstrasse 29, D-8000 München, FRG
- SEPRÉNYI, Gy.  
Institute of Microbiology, University Medical School,  
Dóm tér 10, H-6720 Szeged, Hungary
- SHAW, I.C.  
Department of Clinical Pharmacology, School of Medicine,  
University College, London, UK
- SKINNER, S.  
Biomeasure Inc., 11/15E.avenue, Hopkinton Industrial Park,  
Hopkinton Mas. 01748, USA
- SOLTÉSZ, M.  
Department of Medicinal Plants and Pharmacognosy, University  
Medical School, H-6701, Szeged, P.O.B. 121, Hungary
- SONNENBICHLER, J.  
Max-Planck-Institut für Biochemie, D-8033 Martinsried, FRG
- SÓNYI, G.  
Abteilung Klinische Endokrinologie, Medizinische Hochschule,  
D-3000 Hannover 61, FRG
- SPANKA, M.  
Abteilung Klinische Endokrinologie, Medizinische Hochschule,  
D-3000 Hannover 61, FRG
- SULYOK, Gy.  
BIOGAL Pharmaceutical Works, Pallagi út 13, H-4042 Debrecen,  
Hungary
- SZEGÉNY, Zs.  
Institute of Organic Chemistry, Kossuth Lajos University and  
Antibiotic Research Group of the Hungarian Academy of  
Sciences, H-4010 Debrecen, P.O.B. 20, Hungary
- SZEJTLI, J.  
Chinoin Pharmaceutical and Chemical Works, H-1325, Budapest,  
P.O.B. 110, Hungary
- SZENDREI, K.  
Department of Pharmacognosy, University Medical School,  
H-6701 Szeged, P.O.B. 121, Hungary

- SZŐKE, A.  
Chinoin Pharmaceutical and Chemical Works, H-1325 Budapest,  
P.O.B. 110, Hungary
- SZÖLLÖSY, A.  
NMR Laboratory of the Institute of General and Analytical  
Chemistry, Technical University of Budapest, H-1521 Budapest,  
Hungary
- TÓTH, G.  
NMR Laboratory of the Institute of General and Analytical  
Chemistry, Technical University of Budapest, H-1521 Budapest,  
Hungary
- TÓTH, L.  
Department of Medicinal Plants and Pharmacognosy, University  
Medical School, H-6701 Szeged, P.O.B. 121, Hungary
- TWAIJ, H.A.  
Scientific Research Council, Biological Research Centre,  
Baghdad, Iraq
- VALANT-VETSCHERA, K.M.  
Institute of Pharmacognosy, University of Vienna, A-1090  
Wien, Austria
- VARRÓ, V.  
First Department of Medicine, University Medical School,  
H-6701 Szeged, Hungary
- VECKENSTEDT, A.  
Central Institute of Microbiology and Experimental Therapy,  
Academy of Sciences of the German Democratic Republic,  
6900 Jena, GDR
- VERMES, B.  
Research Group for Alkaloid Chemistry of the Hungarian  
Academy of Sciences, Gellért tér 4, H-1111 Budapest, Hungary
- VERZÁR-PETRI, G.  
Institute of Pharmacognosy, Semmelweis University Medical  
School, Üllői út 26, H-1085 Budapest, Hungary
- VILAIN, C.  
Laboratoire de Chimie organique, Université de Liège, Sart  
Tilman, B-4000 Liège 1, Belgium
- WAGNER, H.  
Institute of Pharmaceutical Biology, University of Munich  
Karlstrasse 29, D-8000 München, FRG
- WOLLENWEBER, E.  
Institute of Botany, University of Darmstadt, D-6100  
Darmstadt, FRG
- WURM, G.  
Institut für Pharmazie, Freie Universität Berlin,  
D-1000 Berlin-West 33
- ZETL, I.  
Max-Planck-Institut für Biochemie, D-8033 Martinsried, FRG
- ZSUGA, M.  
Institute of Applied Chemistry, Kossuth Lajos University,  
H-4010 Debrecen, P.O.B. 10, Hungary

## OPENING ADDRESS

by

PROF. DR. M. GÁBOR

*Ladies and Gentlemen,*

The Seventh Hungarian Bioflavonoid Symposium has been organized to commemorate the 50th anniversary of the discovery by Rusznyák and Szent-Györgyi in Szeged of the therapeutical effects of flavonoids.

In opening this Symposium, I think it is appropriate to try to give you a brief historical survey of flavonoid research in Hungary.

In 1935 Szent-Györgyi isolated a substance from lemon juice which decreased the permeability and increased the resistance of the capillary wall. Chemical analysis indicated that this substance was a flavonoid and it was named "citrin". Bruckner and Szent-Györgyi (1937) found that "citrin" was composed of hesperidin and eriodictiol glycoside. Huszák (1937) reported on the fate of parenterally administered "citrin".

A significant part in the research in Hungary was played by Jeney, who in 1936 reported the favourable effects of flavonoids on intact and poisoned isolated frog heart. Other internationally recognized experts in flavonoid chemistry included Zemlén, Bognár, Farkas and their schools.

The discovery in Szeged called attention to the biological action of flavonoids, and from 1940 onwards many papers were published by foreign researchers on the effects of flavonoid compounds, such as catechins, leucoanthocyanidins (procyanidins), tea catechis, rutin, etc.

Twenty years after Rusznyák and Szent-Györgyi's discovery the first flavonoid conference was organized in the United States under the name "Bioflavonoids and the Capillary", where Szent-Györgyi gave a lecture entitled "Perspectives for the Bioflavonoids".

I should mention that the Working Committee for Flavonoid Research of the Hungarian Academy of Sciences organized the First Hungarian Bioflavonoid Symposium in Szeged in 1965. Our international symposia are now held every 4 years; the previous one was organized by Professor Wagner in Munich.

Numerous congresses and conferences have been devoted to the flavonoids in Europe during the past twenty years, all showing the growing interest in these compounds. In two months' time, a symposium "Plant Flavonoids in Biology and Medicine" will be held in Buffalo.

Fifty years after the pioneering work by Rusznyák and Szent-Györgyi, the question naturally arises as to the explanation of the renaissance in flavonoid research. The answer is clear: chemists have synthesized new flavonoid derivatives with previously unknown biological effects; phytochemists have isolated numerous new flavonoids from many plants; biochemists have demonstrated the most varied effects on different enzymes; and an ever increasing number of pharmacologic effects have become known through variations of the chemical structures of the flavonoids and related compounds. This research has led to the discovery of many new drugs that can be applied for therapeutic purposes.

Hungarian flavonoid researchers started the useful work on these interesting natural, semisynthetic, or synthetic compounds here in Szeged, and I am sure that this present conference will provide us with accounts of many new results, and will give ample possibilities for the mutual exchange of experience. Let me wish every success to all the participants in this meeting.

I declare the Symposium open.

ADDRESS OF WELCOME

by

PROF. DR. L. FARKAS

*Ladies and Gentlemen,*

I have the great pleasure of welcoming you to this symposium on behalf of the Working Committee for Flavonoid Research of the Hungarian Academy of Sciences.

In his opening address Professor Gábor told us about our great traditions and the pioneering work of Hungarian scientists in this field. Our Working Committee for Flavonoid Research was established twenty years ago to facilitate and support the further contribution of Hungarian researchers to the chemistry, biochemistry and all other scientific or practical aspects of this interesting group of natural compounds. Moreover, an important aim of the Committee has been to ensure that our work in Hungary remains correctly integrated with that of others in the rest of the world.

This Seventh Hungarian Bioflavonoid Symposium seems to confirm again that our efforts have not been in vain. Just the fact that you all have honoured this meeting by coming to Szeged from distant countries and from various parts of Hungary is a sure mark of your appreciation, which makes us - the organizers of the present and former Symposia - proud and happy.

It is your presence and contributions which will certainly make this Symposium meaningful. We are convinced that the free exchange of our experience and ideas, discussions about the latest results and most promising trends of future research, and the possibility of doing so in person for three or four days, will be rewarding and enjoyable.

In this spirit, wishing you a useful and pleasant stay in this characteristically Hungarian town, Szeged, I extend a cordial welcome to you.



# CONTENTS

Preface	v
List of contributors	xi
M. GÁBOR	
Opening address	xix
L. FARKAS	
Address of welcome	xxi
D.M.X. DONNELLY and P.G.M. CANNON	
The synthesis and biological activity of the latinones	1
M. NÓGRÁDI, S. ANTUS, Á. GOTTSEGEN, D. KORBONITS, J. SZEJTLI, Á. SZÓKE, ZS. FÜRST and J. KNOLL	
Synthesis and analgesic properties of some cannabionids with ether type side chains	15
S. ANTUS, R. BAUER, Á. GOTTSEGEN, O. SELIGMANN and H. WAGNER	
Synthesis of americanin-D	31
M. RÁKOSI, ZS. SZEGÉNY, J. BÁLINT and R. BOGNÁR	
Synthesis of some novel flavonoid derivatives	39
A. LÉVAI, G. TÓTH and A. SZÓLLÓSY	
Synthesis of benzopyrano[4,3-c]pyrazolines and related compounds	47
C.S.R. IYER and P.R. IYER	
Synthesis of natural pyranochromones	55
B. VERMES and H. WAGNER	
Natural xanthones and their glycosides	63
E. PÉLI, T. PATONAY, M. ZSUGA and GY. LITKEI	
Kinetic investigations of the elimination reaction of 3-bromoflavanones	75
T. PATONAY and GY. LITKEI	
Reaction of 3-mesyloxyflavanones with S-nucleophiles	85
	VII