Electrophoresis'79

Editor Bertold J. Radola





de Gruyter

Electrophoresis '79

Advanced Methods
Biochemical and Clinical Applications

Proceedings of the Second International Conference on Electrophoresis Munich, Germany, October 15–17, 1979

Editor Bertold J. Radola



Walter de Gruyter · Berlin · New York 1980

Editor

Prof. Dr. Bertold J. Radola Institut für Lebensmitteltechnologie und Analytische Chemie Technische Universität München D-8050 Freising-Weihenstephan Federal Republic of Germany

CIP-Kurztitelaufnahme der Deutschen Bibliothek

[Electrophoresis seventy-nine]

Electrophoresis '79: advanced methods, biochem. and clin. applications; proceedings of the 2. Internat. Conference on Electrophoresis, Munich, Germany, October 15-17, 1979/ed. Bertold J. Radola. - Berlin, New York: de Gruyter, 1980.

ISBN 3-11-008154-7

NE: Radola, Bertold J. [Hrsg.]; International Conference on Electrophoresis <02, 1979, München>

Library of Congress Cataloging in Publication Data

International Conference on Elektrophoresis, 2d, Munich, 1979.

Electrophoresis '79.

Includes index.

- 1. Electrophoresis-Congresses. 2. Isoelectric Focusing-Congresses.
- 3. Biological Chemistry-Technique-Congresses. 4. Chemistry Clinical-Technique-Congresses. 1. Radola, B.J., 1931-

QP 519.9.E. 434 I 57 1979 574.19'28 80-13830

ISBN 3-11-008154-7

© Copyright 1980 by Walter de Gruyter & Co., Berlin 30. All rights reserved, including those of translation into foreign languages. No part of this book may be reproduced in any form - by photoprint, microfilm, or any other means - nor transmitted nor translated into a machine language without written permission from the publisher. Printing: Color-Druck, Berlin. - Binding: Lüderitz & Bauer, Buchgewerbe GmbH. Printed in Germany.

Electrophoresis '79 Advanced Methods Biochemical and Clinical Applications



The International Conference "Electrophoresis '79" was held at the Technical University in Munich on October 15 - 17, 1979. It was the second of a projected series of international meetings organized with the objective to stimulate communication, information exchange and advancement of knowledge in all areas of electrophoresis. The need for this type of conferences is just an inference of a development in the field of electrophoretic methodology. In recent years not only have different techniques emerged but some have fused to powerful combinations, and it therefore seems justified to deal with different aspects of electrophoresis under a broader heading.

The conference in Munich was the largest of all electrophoretic meetings so far held. Much of the success of "Electrophoresis '79" has been achieved because it attracted most of the recognized leaders in the field. The conference was attended by participants from all parts of the world and from a broad range of academic disciplines. The format of the conference as well as the balanced representation from laboratories involved in the development and the application of electrophoresis has led to excellent personal interaction and much intellectual stimulation and benefit to the participants. The conference was certainly successful.

This volume contains a large portion of the papers presented either as oral reports or as posters at "Electrophoresis '79". The manuscripts have been compiled in four sections entitled:

I. Theory and Methods, II. High Resolution Two-Dimensional Electrophoresis, III. Preparative Separations and IV. Biomedical and Biological Applications. These sections correspond to the major topics on which emphasis was placed at the conference. Not every manuscript fits precisely into one or another of the four sections but the most appropriate assignment has been made

wherever possible. This volume could be produced because most authors were cooperative and admirably disciplined with regard to the deadline set for the submission of manuscripts. I take pleasure in expressing my appreciations and thanks to all contributors. The electrophoretic community owes much to them. I also greatly appreciate the efforts of the staff of Walter de Gruyter, Berlin, which led to the rapid publication of this volume.

Freising-Weihenstephan

Bertold J. Radola

ACKNOWLEDGEMENTS

I would like to acknowledge the splendid help of my laboratory staff in organizing the conference. I am indebted to Helga Piontek for excellent typing. I also thank my wife for volunteering her time and talent in helping to organize the conference and to prepare this volume for publication.

Financial help for the conference was provided by: Bio-Rad Laboratories, München; Desaga, Heidelberg; Deutsche Pharmacia, Freiburg; Immuno Diagnostika, Heidelberg; LKB Instrument, Gräfelfing; Serva Feinbiochemica, Heidelberg; Shandon Labortechnik, Frankfurt; Shimadzu (Europa), Düsseldorf.

SECTION I, THEORY AND METHODS

GEL ELECTROFOCUSING WITH INCREASED DEGREES OF FREEDOM A. Chrambach, L. Hjelmeland and N. Y. Nguyen	3
pH-MOBILITY CURVES OF PROTEINS BY ISOELECTRIC FOCUSING COMBINED WITH ELECTROPHORESIS AT RIGHT ANGLES P. G. Righetti and E. Gianazza	23
PARTITIONING AND ELECTROPHORESIS IN FLEXIBLE POLYMER NETWORKS H. J. Bode	39
DOUBLE ONE-DIMENSIONAL SLAB-GEL ELECTROPHORESIS K. Altland and R. Hackler	53
ULTRATHIN-LAYER HORIZONTAL ELECTROPHORESIS, ISOELECTRIC FOCUSING, AND PROTEIN MAPPING IN POLYACRYLAMIDE GELS ON CELLOPHANE A. Görg, W. Postel and R. Westermeier	67
ULTRATHIN-LAYER ISOELECTRIC FOCUSING IN 50 - 100 µm POLYACRYLAMIDE GELS ON SILANIZED GLASS PLATES OR POLYESTER FILMS B. J. Radola	79
ISOELECTRIC FOCUSING OF PROTEINS IN AGAROSE GELS AND DETECTION OF THE PROTEINS BY DIFFERENT STAINING PROCEDURES O. Vesterberg	95
AGAROSE ISOELECTRIC FOCUSING OF MONOCLONAL IGM AND IGG ANTIBODIES A. Rosén	105
IMMUNOPEROXIDASE STAINING AND RADIOIMMUNOBINDING OF HUMAN TUMOR MARKERS SEPARATED BY DIRECT TISSUE AGAROSE ISOELECTRIC FOCUSING C. A. Saravis, C. G. Cunningham, P. V. Marasco, R. B.	
Cook and N. Zamcheck	117

AGAROSE AS SUPPORTING MEDIUM FOR ANALYTICAL ISOELECTRIC FOCUSING: DETERMINATION OF THE RECENTLY DISCOVEREC SUBTYPES IN THE HUMAN SERUM PROTEIN GC (GROUP SPECIFIC	
COMPONENT) M. Thymann	123
FACTS AND ARTEFACTS IN ISOELECTRIC FOCUSING E. Gianazza and P. G. Righetti	129
ISOELECTRIC FOCUSING PATTERNS OF SIMIAN VIRUS 40 (SV 40) TUMOR ANTIGEN: VARIOUS ALKYLATION PROCEDURES CAUSE REVERSIBLE ARTEFACTS K. Palme and R. Hanning	141
THE ROLE OF SIALIC ACID IN THE MICROHETEROGENEITY OF ALPHA, ACID GLYCOPROTEIN: STUDY BY ISOELECTRIC FOCU-SING AND TITRATION CURVES P. Arnaud, E. Gianazza, P. G. Righetti and	
H. H. Fudenberg	151
THE EFFECT OF ELECTRODE SOLUTIONS ON THE PH DRIFT IN THIN-LAYER ISOELECTRIC FOCUSING H. Delincée	165
QUANTITATIVE IMMUNOELECTROPHORESIS: A SURVEY AND SOME APPLICATIONS T. C. Bøg-Hansen, I. Lorenc-Kubis and O. J. Bjerrum	173
AFFINITY ELECTROPHORESIS: QUANTIFICATION AND CHARAC-TERIZATION OF GLYCOPROTEINS WITH LECTINS T. C. Bøg-Hansen	193
RECENT ADVANCES IN MICROELECTROPHORESIS V. Neuhoff	203
A SIMPLE, EFFECTIVE AND INEXPENSIVE EQUIPMENT FOR POLYACRYLAMIDE GEL ELECTROPHORESIS IN COOLED MICRO-CAPILLARIES R. Peter	219
LINEAR POLYACRYLAMIDE GRADIENT GELS FOR MOLECULAR WEIGHT ESTIMATION OF PROTEINS	
P. Lambin	227

	IX
SOLUBLE POLYACRYLAMIDE GRADIENT GELS IN THE SEPARATION AND ESTIMATION OF PROTEINS M. P. Brown and A. V. Emes	235
QUANTIFICATION OF PROTEINS SEPARATED BY TWO-DIMENSIONAL PAGE: A NOVEL DYE ELUTION TECHNIQUE COMPARED WITH A DENSITOMETRIC PROCEDURE O. H. W. Martini, J. Kruppa and R. Temkin	241
PREPARATION AND ANALYSIS OF PROTEINS AND PROTEIN FRAGMENTS BY TWO-DIMENSIONAL THIN-LAYER GEL FILTRATION AND ISOELECTRIC FOCUSING K. G. Welider	249
ENHANCEMENT OF LOAD CAPACITY IN ISOTACHOPHORESIS F. M. Everaerts, F. E. P. Mikkers and Th. P. E. M. Verhegen	255
A MODEL FOR THE USE OF MORE THAN ONE SINGLE BUFFERING COMMON COUNTERION IN ISOTACHOPHORESIS P. J. Svendsen and C. Schafer-Nielsen	265
SEPARATION OF MOLECULES IN STEADY STATE ELECTROPHORESIS SYSTEMS WITH ZONES CONTAINING MORE THAN ONE TERMINATING ION C. Schafer-Nielsen and P. J. Svendsen	275
FLOW-THROUGH CONTINUOUS THIN LAYER CARRIER-FREE ISOTACHOPHORESIS Z. Prusik, J. Štěpánek and V. Kašička	287
SECTION II, HIGH RESOLUTION TWO-DIMENSIONAL ELECTROPHORESI	S
TWO-DIMENSIONAL ELECTROPHORESIS: HIGH RESOLUTION OF PROTEINS AND AUTOMATIC EVALUATION OF THE PATTERNS UNDER DIFFERENT METHODICAL CONDITIONS J. Klose, J. Nowak and W. Kade	297
HIGH-RESOLUTION TWO-DIMENSIONAL ELECTROPHORETIC MAPPING	

OF HUMAN PROTEINS
N. Anderson, J. J. Edwards, C. S. Giometti, K. E. Willard,
S. L. Tollaksen, S. L. Nance, B. J. Hickman, J. Taylor,
B. Coulter, A. Scandora and N. G. Anderson

313

ESTIMATION OF TWO-DIMENSIONAL ELECTROPHORETIC SPOT INTENSITIES AND POSITIONS BY MODELING J. Taylor, N. L. Anderson, B. P. Coulter, A. E. Scandora, Jr. and N. G. Anderson	329
INTERNAL CHARGE STANDARDIZATION FOR TWO-DIMENSIONAL ELECTROPHORESIS B. J. Hickman, N. L. Anderson, K. E. Willard and N. G. Anderson	341
A METHOD FOR STUDYING PROTEINS IN 2-D GELS USING THERMAL DENATURATION ANALYSIS S. L. Nance, B. J. Hickman, N. L. Anderson	351
THE QUANTITATION OF RADIOACTIVELY LABELED PROTEINS ON TWO-DIMENSIONAL GELS: TESTS OF A METHOD FOR ANALYZING CHANGES IN PROTEIN SYNTHESIS AND GENE EXPRESSION G. C. Stone, D. L. Wilson and G. W. Perry	361
TWO-DIMENSIONAL ELECTROPHORETIC MAPPING OF HUMAN ERYTHROCYTE PROTEINS J. J. Edwards, H. J. Hahn and N. G. Anderson	383
TWO-DIMENSIONAL ELECTROPHORESIS OF HUMAN SALIVA C. S. Giometti and N. G. Anderson	395
TWO-DIMENSIONAL ELECTROPHORESIS OF HUMAN URINARY PROTEINS IN HEALTH AND DISEASE S. L. Tollaksen and N. G. Anderson	405
ALTERATIONS OF TWO-DIMENSIONAL ELECTROPHORETIC MAPS IN HUMAN PERIPHERAL BLOOD LYMPHOCYTES INDUCED BY CONCANAVALIN A K. E. Willard and N. L. Anderson	415
HIGH RESOLUTION TWO-DIMENSIONAL ELECTROPHORESIS (ISO-DALT) IN CLINCAL CHEMISTRY: COMPARISON WITH ROUTINE ELECTROPHORETIC AND IMMUNOLOGICAL METHODS A. K. Thorsrud, H. F. Haugen and E. Jellum	425
TWO-DIMENSIONAL MAPS OF HUMAN APOLIPOPROTEINS IN NORMAL AND DISEASED STATES V. I. Zannis and J. L. Breslow	437

ISOELECTRIC FOCUSING, ISOELECTRIC POINTS, AND THE PREPARATIVE SEPARATION OF PROTEINS D. H. Leaback PREPARATIVE MULTIPHASIC ZONE ELECTROPHORESIS AND ISOELECTRIC FOCUSING IN DENSITY GRADIENTS USING THE POLY-PREP N. Catsimpoolas, A. Stamatopoulou and A. L. Griffith MULTIPHASIC COLUMN ELECTROFOCUSING: AN APPROACH TO COMPOSITE FRACTIONATION PROBLEMS D. Stathakos, A. Vellios and S. Koussoulakos 517 PREPARATIVE ELECTROFOCUSING OF ENZYMES INVOLVED IN AROMATIC DEGRADATION IN T. CUTANEUM A. B. Gaal and H. Y. Neujahr 529 PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin 539 CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon FRECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	ISOELECTRIC FOCUSING AND TWO-DIMENSIONAL ELECTRO-PHORESIS OF VIRAL PROTEINS AND VIRUS-INFECTED CELLS R. Drzeniek, C. Reichel, K. J. Wiegers, A. Hamann and M. Hilbrig	475
PREPARATIVE SEPARATION OF PROTEINS D. H. Leaback PREPARATIVE MULTIPHASIC ZONE ELECTROPHORESIS AND ISOELECTRIC FOCUSING IN DENSITY GRADIENTS USING THE POLY-PREP N. Catsimpoolas, A. Stamatopoulou and A. L. Griffith MULTIPHASIC COLUMN ELECTROFOCUSING: AN APPROACH TO COMPOSITE FRACTIONATION PROBLEMS D. Stathakos, A. Vellios and S. Koussoulakos 517 PREPARATIVE ELECTROFOCUSING OF ENZYMES INVOLVED IN AROMATIC DEGRADATION IN T. CUTANEUM A. B. Gaal and H. Y. Neujahr 529 PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin 539 CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon 545 RECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	SECTION III, PREPARATIVE SEPARATIONS	
ISOELECTRIC FOCUSING IN DENSITY GRADIENTS USING THE POLY-PREP N. Catsimpoolas, A. Stamatopoulou and A. L. Griffith 503 MULTIPHASIC COLUMN ELECTROFOCUSING: AN APPROACH TO COMPOSITE FRACTIONATION PROBLEMS D. Stathakos, A. Vellios and S. Koussoulakos 517 PREPARATIVE ELECTROFOCUSING OF ENZYMES INVOLVED IN AROMATIC DEGRADATION IN T. CUTANEUM A. B. Gaal and H. Y. Neujahr 529 PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin 539 CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon 545 RECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	PREPARATIVE SEPARATION OF PROTEINS	493
COMPOSITE FRACTIONATION PROBLEMS D. Stathakos, A. Vellios and S. Koussoulakos 517 PREPARATIVE ELECTROFOCUSING OF ENZYMES INVOLVED IN AROMATIC DEGRADATION IN T. CUTANEUM A. B. Gaal and H. Y. Neujahr 529 PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin 539 CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon 545 RECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	ISOELECTRIC FOCUSING IN DENSITY GRADIENTS USING THE POLY-PREP	503
AROMATIC DEGRADATION IN T. CUTANEUM A. B. Gaal and H. Y. Neujahr PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon S45 RECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	COMPOSITE FRACTIONATION PROBLEMS	517
MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon FECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	AROMATIC DEGRADATION IN T. CUTANEUM	529
P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon 545 RECYCLING OF CARRIER AMPHOLYTES BY ULTRAFILTRATION K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	PREPARATIVE FLAT-BED ISOELECTRIC FOCUSING OF LDH, MDH, ALD, SDH AND G-6.PDH FROM RABBIT LENS J. Bours, M. Garbers and O. Hockwin	539
K. Goerth and B. J. Radola 555 REMOVAL OF SALTS AND CARRIER AMPHOLYTES FROM BILIPEPTIDES OF LOW MOLECULAR WEIGHT	CONTINUOUS-FLOW ISOELECTRIC FOCUSING OF PROTEINS P. Basset, J. Zwiller, C. Froissart, M. Recasens, R. Massarelli and G. Vincendon	545
BILIPEPTIDES OF LOW MOLECULAR WEIGHT		555
	BILIPEPTIDES OF LOW MOLECULAR WEIGHT	565
	DISCONTINUOUS ELUTION	571

FURTHER DEVELOPMENTS IN PREPARATIVE DESPLACEMENT ELECTROPHORESIS IN GEL F. Hampson	583
VELOCITY GRADIENT STABILISED CONTINUOUS ELECTROPHORESIS A. R. Thomson, P. Mattock and G. F. Aitchison	591
PREPARATIVE DENSITY GRADIENT ELECTROPHORESIS OF LYMPHOID CELLS N. Catsimpoolas, A. L. Griffith, S. Gupta, R. A. Good and C. D. Platsoucas	607
PREPARATIVE CELL ELECTROPHORESIS IN A STATIC VERTICAL COLUMN STABILIZED WITH A HEAVY WATER GRADIENT C. J. van Oss and P. M. Bronson	623
SECTION IV, BIOMEDICAL AND BIOLOGICAL APPLICATIONS	
PAST, PRESENT AND FUTURE USES OF ELECTROPHORESIS IN CLINICAL MEDICINE R. C. Allen	631
TWO-DIMENSIONAL PROTEIN PATTERNS OF HUMAN BODY FLUIDS OBTAINED UNDER DISSOCIATING AND NON-DISSOCIATING CONDITIONS K. Felgenhauer	647
SIMPLIFIED DETERMINATION OF HEMOGLOBIN A 1C IN DIABETIC PATIENTS BY USE OF ELECTROFOCUSING J. O. Jeppson, B. Franzen and A. B. Gaal	655
A COMPARISON OF ISOELECTRIC FOCUSING AND ELECTRO-CHROMATOGRAPHY FOR THE SEPARATION AND QUANTIFICATION OF HEMOGLOBIN A 1c	
R. C. Allen, M. Stastny, D. Hallett and M. A. Simmons	663
INVESTIGATIONS OF HAEMOGLOBIN A 1c ANALOGUES BY ELECTROFOCUSING ON POLYACRYLAMIDE GELS C. J. Holloway, U. Schlanstedt-Jahn, I. Haeger,	
HJ. Mitzkat and I. Trautschold	669

	XIII
ISOELECTRIC ENZYME PATTERN: A NEW CONCEPT FOR TUMOR CLASSIFICATION H. J. Radzun, M. R. Parwaresch and D. Schmidt	679
MONOCYTE-SPECIFIC ISOELECTRIC FOCUSING PATTERN OF LYSOSOMAL ACID ESTERASE: A NEW POSSIBILITY FOR CELL-SPECIFIC IMMUNOHISTOCHEMICAL IDENTIFICATION J. W. Wittke, H. J. Radzun and M. R. Parwaresch	683
ISOELECTRIC FOCUSING IN CELLULOSE ACETATE MEMBRANE AND FLAT-BED GRANULATED GEL: APPLICATION TO THE STUDY OF HUMAN ALDEHYDE DEHYDROGENASE ISOZYMES S. Harada, D. P. Agarwal and H. W. Goedde	687
CEREBROSPINAL FLUID (CSF) PROTEIN PATTERNS DETER-MINED BY ISOELECTRIC FOCUSING IN MULTIPLE SCLEROSIS B. Perthen and W. Müller-Beißenhirtz	695
BINDING AFFINITIES BETWEEN VDBP AND VITAMIN D3, 25-(OH)-D3, 24-25-(OH) ₂ -D ₃ and 1-25-(OH) ₂ -D ₃ STUDIED BY ELECTROPHORETIC METHODS (PAGE-IEF, COMBINED IEF-ELECTROPHORESIS) AND PRINT-IMMUNOFIXATION J. Constans, M. Viau, C. Gouaillard, C. Bouissou and A. Clerc	701
IMMUNOFIXATION AFTER ELECTROFOCUSING: APPLICATION TO THE STUDY OF THE MICROHETEROGENEITY AND PLYMORPHISM OF SERUM PROTEINS C. Chapuis-Cellier and A. Francina	711
MICROHETEROGENEITY AND POLYMORPHISM OF THYROXINE-BINDING GLOBULIN: STUDY IN HUMAN SERUM BY RADIO-PRINT IMMUNOFIXATION Y. Lasne, F. Lasne, O. Benzerara and P. Arnaud	727
TWO-DIMENSIONAL IMMUNELECTROPHORESIS OF PLASMA-ANTITHROMBIN III IN THE PRESENCE OF HEPARIN-AGAROSE H. Bleyl and H. Peichl	733
DETERMINATION OF STREPTOKINASE ANTIBODY TITRE IN PLASMA OR SERUM BY AN IMMUNOELECTROPHORETIC METHOD B. Skoog, A. Söderlindh and B. Granstrand	743

TWO-DIMENSIONAL IMMUNOELECTROPHORESIS APPLIED TO THE SEMI-QUANTITATIVE DETERMINATION OF BENCE JONES PROTEIN IN PATHOLOGICAL URINES	
M. Campens, A. Francina, H. Cloppet, C. Chapuis Cellier and P. Arnaud	753
APPLICATION OF PHA IN ELECTROPHORETIC DIFFERENTIATION OF HUMORAL IMMUNOGLOBULINS G. A. Spengler and RM. Weber	761
FEASIBILITY OF STUDYING THE FUNCTIONAL NATURE OF HUMAN IGM SUBCLASS RESPONSES BY MEANS OF ANALYTICAL ISOTACHOPHORESIS K. W. Hedlund, R. Wistar, Jr. and D. Nichelson	765
R. W. Hedlund, R. Wistar, Jr. and D. Nichelson	765
IN VITRO INVESTIGATIONS OF THE GLUCURONIC ACID PATHWAY WITH THE AID OF ANALYTICAL CAPILLARY ISOTACHOPHORESIS C. J. Holloway	775
QUANTITATIVE RESOLUTION OF 1- AND 2-NAPHTHYL- GLUCURONIDES FROM SINGLE MIXED ZONES IN ISOTACHO- PHEROGRAMS	
C. J. Holloway, S. Husmann-Holloway, G. Brunner, I. Trautschold and A. Baldesten	781
A RAPID METHOD FOR QUANTITATIVE DETERMINATION OF URINARY OXALATE BY ANALYTICAL ISOTACHOPHORESIS K. Schmidt and G. Bruchelt	791
STUDIES ON SERUM CHOLINESTERASE ISOZYMES AND GENETIC VARIANTS IN HUMAN TISSUES USING POLYACRYLAMIDE GEL ELECTROPHORESIS	
D. P. Agarwal, T. Münch, V. Stein and H. W. Goedde	797
MATERNAL PLASMA PROTEIN VARIATIONS DURING NORMAL AND PATHOLOGIC PREGNANCY: A COMPARATIVE STUDY BY MEANS OF SDS-PAA ELECTROPHORESIS AND OSMOMETRIC EVALUATION OF NUMBER AVERAGE MOLECULAR WEIGHT R. Schroeck and E. Feicht	805
Donitocon und B. Telent	003
SERUM PROTEIN ANALYSIS BY MOLECULAR INTERPRETATION OF CELLULOSE ACETATE ELECTROPHORESIS: EVALUATION OF ITS CLINICAL USEFULNESS	
F. Aguzzi, C. Petrini, G. Merlini, S. Perolini, F. Pozzi and S. D. Jayakar	811

	$\mathbf{X}\mathbf{V}$
GENETICAL AND BIOCHEMICAL CHARACTERIZATION OF A DOMINANT MUTATION OF MOUSE LACTATE DEHYDROGENASE W. Pretsch and D. Charles	817
VERTEBRATE MITOCHONDRIAL 55S RIBOSOMES: COMPARISON OF PROTEIN PATTERNS WITH BACTERIAL ANC CYTOPLASMIC R-PROTEINS BY 2-D PAGE W. Czempiel and B. Ulbrich	825
ISOELECTRIC PEROXIDASE PATTERNS AS INDICATORS FOR GROWTH AND FOR THE EFFECT OF GROWTH REGULATORS IN TOBACO TISSUE CULTURES W. Rücker and J. Markotai	833
STUDY OF HEMOGLOBIN AND A SOLUBLE HEART PEROXIDASE IN LACERTA GALLOTI AND LACERTA STHELINI BY ISOELEC- TRIC FOCUSING Z. Gonzalez-Lama, R. H. Lopez Orge and A. M. Lamas	841
AUTHOR INDEX	847
SUBJECT INDEX	849

Section I

Theory and Methods