

Automation in Microbiology and Immunology

Edited by

CARL-GÖRAN HEDÉN

TIBOR ILLÉNI

AUTOMATION IN MICROBIOLOGY AND IMMUNOLOGY

EDITED BY

CARL-GÖRAN HEDÉN
AND
TIBOR ILLÉNI

Karolinska Institute, Stockholm

A WILEY BIOMEDICAL-HEALTH PUBLICATION

JOHN WILEY & SONS
New York • London • Sydney • Toronto

Copyright © 1975, by John Wiley & Sons, Inc.

All rights reserved. Published simultaneously in Canada.

No part of this book may be reproduced by any means, nor transmitted, nor translated into a machine language without the written permission of the publisher.

Library of Congress Cataloging in Publication Data:

Automation in microbiology and immunology.

(Techniques in pure and applied microbiology) (A Wiley biomedical-health publication)

Papers presented at a symposium on rapid methods and automation in microbiology held in Stockholm, June 3-9, 1973, and sponsored by UNESCO, WHO, and the International Organization for Biotechnology and Bioengineering.

Includes bibliographical references.

1. Microbiology—Automation—Congresses. 2. Microbiology—Technique—Congresses. 3. Immunology—Automation—Congresses. 4. Immunology—Technique—Congresses. I. Hedén, Carl Göran, ed. II. Illéni, Tibor, 1937—ed. III. United Nations Educational, Scientific, and Cultural Organization. IV. World Health Organization. V. International Organization for Biotechnology and Bioengineering. VI. Series.

[DNLM: 1. Automation—Congresses. 2. Automation—Laboratory manual. 3. Immunology—Congresses. 4. Immunology—Laboratory manuals. 5. Microbiology—Congresses. 6. Microbiology—Laboratory manuals. QW25 A939 1973]

QR65.A8 576'.028 74-12082

ISBN 0-471-36745-1

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

AUTOMATION IN MICROBIOLOGY AND IMMUNOLOGY

**TECHNIQUES IN
PURE AND APPLIED MICROBIOLOGY**

CARL-GÖRAN HEDÉN, Editor

Karolinska Institute, Stockholm

G. Sermonti, *Genetics of Antibiotic-Producing Microorganisms*

V. B. D. Skerman, Editor, *Abstracts of Microbiological Methods*

Noel R. Rose and Pierluigi E. Bigazzi, Editors, *Methods in Immunodiagnosis*

Carl-Göran Hedén and Tibor Illéni, Editors, *Automation in Microbiology and Immunology*

Carl-Göran Hedén and Tibor Illéni, Editors, *New Approaches to the Identification of Microorganisms*

Brij M. Mitraka, *Gas Chromatographic Applications in Microbiology and Medicine*

AUTHORS

- Nils Holger Axelsen
Protein Laboratory
University of Copenhagen
Copenhagen, Denmark
- G. A. Barclay
Department of Biological Sciences
Hatfield Polytechnic Institute
Hatfield, Hertfordshire, England
- Th. M. Berg
Microbiological Research and
Development Laboratories
Organon Intern, B.V.
Oss, The Netherlands
- Tom Bergen
Microbiological Institute University
of Tromsø
Tromsø, Norway
- Ernst Berkhan
Phywe AG
Göttingen, West Germany
- Philip Blume
Department of Laboratory Medicine
and Pathology
University of Minnesota
Minneapolis, Minnesota
- R. J. Borovoy
Central Research
Pfizer Inc.
Groton, Connecticut
- P. Burboeck
Carl Zeiss Inc.
New York, New York
- A. Celada
WHO Research Unit of the Geneva
Blood Center
Cantonal Hospital
Geneva, Switzerland
- L. S. Cram
Biophysics and Instrumentation
Group
Los Alamos Scientific Laboratory
Los Alamos, New Mexico
- A. C. Curtiss
Instrument Development Department
Pfizer Diagnostics
Waterford, Connecticut
- J. F. Dooley
Central Research
Pfizer Inc.
Groton, Connecticut
- C. S. Duvall
Microbiology Department
College of Agriculture and Biological
Sciences
South Dakota State University
Brookings, South Dakota
- Harvey A. Elder
Loma Linda University
School of Medicine
Loma Linda, California
- E. Engelbrecht
Stichting Samenwerking Delftse
Ziekenhuizen
Department of Microbiology

Bacteriological/Serological
Laboratory
Delft, The Netherlands

E. Engvall
Department of Immunology
Wenner-Gren Institute
University of Stockholm
Stockholm, Sweden

G. R. Evanega
Central Research
Pfizer Inc.
Groton, Connecticut

J. B. Flato
Princeton Applied Research
Corporation
Princeton, New Jersey

J. C. Forslund
Biomedical Research Group
Los Alamos Scientific Laboratories
Los Alamos, New Mexico

Georg Goertz
Department of Bacteriological
Bioengineering
Karolinska Institute, Stockholm,
Sweden

P. K. Horan, Biomedical Research
Group
Los Alamos Scientific Laboratories
Los Alamos, New Mexico

Tibor Illéni
Department of Bacteriological
Bioengineering
Karolinska Institute
Stockholm, Sweden

A. K. Jackson
Unilever Research Laboratory
Sharnbrook, Bedford, England

Janet W. Johnson
Department of Laboratory Medicine
and Pathology
University of Minnesota
Minneapolis, Minnesota

G. I. Kaufman
Perkin-Elmer Corporation
Wilton, Connecticut

Johs. Kvittingen
Bacteriological Laboratory
Central Hospital
Trondheim, Norway

P. H. Lambert
WHO Research Unit of the Geneva
Blood Center
Cantonal Hospital,
Geneva, Switzerland

John E. Lewis
Loma Linda University
School of Medicine
Loma Linda, California

D. K. Longhenry
Instrument Development Department
Pfizer Diagnostics
Waterford, Connecticut

Sonja Lundell
Department of Bacteriological
Bioengineering
Karolinska Institute
Stockholm, Sweden

P. G. Mansourian
Office of Science and Technology
World Health Organization (WHO)
Geneva, Switzerland

A. Markovits
Clinical Sciences Inc.
Whippany, New Jersey

- Alexander E. Martens
Bausch & Lomb Inc.
Rochester, New York
- John M. Matsen
Department of Laboratory Medicine
and Pathology
University of Minnesota
Minneapolis, Minnesota
- J. E. McKie, Jr.
Central Research
Pfizer Inc.
Groton, Connecticut
- G. Mendoza
Central Research
Pfizer Inc.
Groton, Connecticut
- P. A. Miescher
WHO Research Unit of the Geneva
Blood Center
Cantonal Hospital
Geneva, Switzerland
- F. Meyer
Central Research
Pfizer Inc.
Groton, Connecticut
- E. Mishuck
Aerojet Medical and Biological
Systems
El Monte, California
- M. A. Mitz
Office of Space Science
National Aeronautics and Space
Agency (NASA)
Washington, D. C.
- M. Moody
Central Research
Pfizer Inc.
Groton, Connecticut
- Josephine A. Morello
Departments of Pathology and
Medicine
University of Chicago
Chicago, Illinois
- Roger R. A. Morton
Bausch & Lomb Inc.
Rochester, New York
- Jerald C. Nelson
Loma Linda University
School of Medicine
Loma Linda, California
- Carl-Erik Nord
National Bacteriological Laboratory
Stockholm, Sweden
- Urs E. Nydegger
WHO Research Unit of the Geneva
Blood Center
Cantonal Hospital,
Geneva, Switzerland
- G. W. O'Dom
Princeton Applied Research
Corporation
Princeton, New Jersey
- D. E. Packer
Central Research
Pfizer Inc.
Groton, Connecticut
- G. C. Parikh
Microbiology Department, College of
Agriculture and Biological Sciences
South Dakota State University
Brookings, South Dakota
- P. Perlmann
Department of Immunology
Wenner-Gren Institute
University of Stockholm
Stockholm, Sweden

J. Praglin Instrument Development Department Pfizer Diagnostics Waterford, Connecticut	T. C. Sorensen Microbiology Department, College of Agriculture and Biological Sciences South Dakota State University Brookings, South Dakota
M. Roberts Aerojet Medical and Biological Systems El Monte, California	J. A. Steinkamp Biomedical Research Group Los Alamos Scientific Laboratory Los Alamos, New Mexico
E. Schoutens Microbiological Laboratory Brugmann University Hospital Brussels, Belgium	Kiyoshi Tsuji Control Research and Development the Upjohn Company Kalamazoo, Michigan
Björn Seger Department of Bacteriological Bioengineering Karolinska Institute Stockholm, Sweden	Torkel Wadström National Bacteriological Laboratory Stockholm, Sweden
A. N. Sharpe Unilever Research Laboratory Colworth/Welwyn, Sharnbrook, Bedford, England	Peter J. F. Watkins Baird and Tatlock London, England
H. D. Siegerman Princeton Applied Research Corporation Princeton, New Jersey	Bengt Wretlind Department of Clinical Microbiology Karolinska Hospital, and Department of Bacteriological Bioengineering Karolinska Institute Stockholm, Sweden
H. Smith Central Research Pfizer Inc. Groton, Connecticut	Philip J. Wyatt Science Spectrum, Inc. Santa Barbara, California
	E. Yourassowsky Microbiological Laboratory Brugmann University Hospital Brussels, Belgium

CONFERENCE PARTICIPANTS

Mohamed Abdou Boehringer Sohn Ingelheim, West Germany	Richard Benn Department of Bact. Royal Prince Alfred Hospital Camperdown, Australia	Miroslav Bomar Bundesforschungsanstalt für Lebensmittelfrischaltung Karlsruhe West Germany
Jacques Acar Hopital St. Joseph Paris, France	Theo M. Berg Organon International B.V. Oss, The Netherlands	Vallentin Bonifas Institute of Microbiology University of Lausanne Lausanne, Switzerland
Daniel Amsterdam Kingsbrook Jewish Medical Center Brooklyn, New York	Tom Bergan Microbiological Institute University of Tromsö Tromsö, Norway	Umberto Bonomi Laboratoria Microbiologia Istituti Opsitalieri Verona, Italy
Pertti Arstila Department of Virology Turku, Finland	Robert Bergquist Immunological Department National Bacteriological Laboratory Stockholm, Sweden	Jerzy Borowski Department of Microbiology University Medical School Bialystok, Poland
Hans Aus Institut für Virologie Universität Würzburg Würzburg, West Germany	Bengt Bergrahm Orion Pharmaceutical Helsinki, Finland	Åke Bovallius The Research Institute of the National Defense Sundbyberg, Sweden
Nils Axelsen Protein Laboratory University of Copenhagen Copenhagen, Denmark	Ernst Berkhan Phywe AG Göttingen, West Germany	Niels Brems A/S N. Foss Electric Hillerød, Denmark
Åse Bakketun Norwegian Institute for Water Research Oslo, Norway	Sunil Kumar Biswas Department of Pathology and Bacteriology B.S. Medical College Bankura, West Bengal, India	Alan E. Brookfield Mast Laboratories Ltd. Liverpool, England
Zoltán G. Bánáhi Department of Microbiology Royal Inst. of Technol. Stockholm, Sweden	Elmar Blatt SCS Scientific Control Systems Hamburg, West Germany	J.-E. Brorson Medicinsk mikrobiologi Göteborgs Sjukvardsstyrelse Göteborg, Sweden
Graham Barclay Hatfield Polytechnic Hatfield, England	Henry Bloom BioQuest Cockeysville, Maryland	Derek Brown Clinical Research Centre Division of Hospital Infection Harrow, England
Lothar Behrendt Farbwerke Hoechst Frankfurt/M West Germany	Philip Blume Department of Laboratory Medicine University of Minnesota Minneapolis, Minnesota	Herwig Brunner Boehringer-Mannheim GmbH Biochemica-Werk Tutzing Tutzing, West Germany
John E. Benbough Microbiology Research Establishment Salisbury, England	Arne Bolinder Technicon AB Solna, Sweden	

Conference Participants

Klaus Bryn Methodology Department National Institute for Public Health Oslo, Norway	Alice de Czekala Hoffmann-La Roche, Inc. Nutley, New Jersey	Eva Engvall Wenner-Gren Institute Stockholm, Sweden
Rolf Brönnestam Clinical Bacteriological Laboratory Umeå Hospital Umeå, Sweden	Karin Dalenius AB Pripps Bryggerier Bromma, Sweden	Berthe Sigrid Erichsen Forenede Margarinfabrikker Oslo, Norway
A. C. J. Burgers UNESCO Paris, France	Dan Danielsson Clinical Bacteriology Laboratory The Regional Hospital Örebro, Sweden	Hans Ericsson Department of Clinical Microbiology Karolinska Hospital Stockholm, Sweden
Valerie Nusbaum Bush Delaware State College Dover, Delaware	S. R. Das Central Drug Research Institute Lucknow, India	Lena Ewetz The Research Institute of the National Defense Sundbyberg, Sweden
Heinz Bürger Hygiene-Institut der Universität Marburg, West Germany	Edgar DaSilva Department of Microbiology St. Xavier's College, University of Bombay Bombay, India	Akinyele Fabiyi Virus Research Laboratory University of Ibadan Ibadan, Nigeria
Paxton Cady Bactomatic, Inc. Palo Alto, California	Jozef De Ley Laboratory of Microbiology and Microscopy Genetics, State University Ghent, Belgium	Giovanni Fadda Institute of Microbiology University of Parma Parma, Italy
Jephta Campbell Division of Microbiology U.S. Food and Drug Administration Cincinnati, Ohio	Allen R. DeLong Bellco Glass, Inc. Vineland, New Jersey	Malcolm Falconer Eastman Kodak Company Health & Safety Laboratory Rochester, New York
Alain Canavate Lab. Lepetit Suresnes, France	Dick Detmar Gist-Brocades N.V. Delft, Netherlands	Robert Fildes Glaxo Laboratories Ltd. Fermentation Development Dept.
Torbjörn Caspersson Karolinska Institute Stockholm, Sweden	Shirley Dixson Microbiol. Department St. Vincent's Hospital Fitzroy, Australia	Ulverston, Lancashire, England
E. Chapelle Systems Analysis Branch NASA/GSFC Greenbelt, Maryland	Lars Edebo Department of Medical Microbiology University of Linköping Linköping, Sweden	Walter Fisher Difco Laboratories Detroit, Michigan
Olaf Corydon-Petersen A/S N. Foss Electric Hillerød, Denmark	Conny Eklund Aminkemi AB Bromma, Sweden	Jud. B. Flato Princeton Applied Research Corporation Princeton, New Jersey
Dimitro Costin E. Merck Svenska AB Stockholm, Sweden	Eduard Engelbrecht Department of Bacteriology and Serology Stichting Samenwerkung Delftse Ziekenhuisen Delft, Netherlands	Mohamed Aly Fouda Department of Microbiological Research Egypt Ministry of Agriculture Giza, Egypt
L. Scott Cram Biophysics and Instrum. Gr. Los Alamos Scientific Laboratory Los Alamos, New Mexico	Ronald Freake Ames Company Division of Miles Laboratories Elkhart, Indiana	

Wilhelm Frederiksen Statens Serum Institut Aalborg, Denmark	Bengt Gästrin Bacteriology laboratory Central Hospital Eskilstuna, Sweden	William Ian Hopkinson Vickers Limited Research Establishment Ascot, Berkshire, England
Leif Oddvar Fröhholm Methodology Department, National Institute of Public Health Oslo, Norway	Günther Hahn Institut für Hygiene Bundesanstalt für Milchforschung Kiel, West Germany	Miles Hossom Canalco, Inc. Rockville, Maryland
Mack J. Fulwyler Particle Technology, Inc. Los Alamos, New Mexico	Lawrence B. Hall Planetary Programs, NASA Washington, D.C.	Dennis G. Howell Ontario Veterinary College, University of Guelph Guelph, Ont., Canada
Daniel Y. C. Fung Department of Microbiology Pennsylvania State University University Park, Pennsylvania	Walter Hameister E. Merck Medical Research Darmstadt, West Germany	Tibor Illéni Institute of Bact. Karolinska Institutet Stockholm, Sweden
Rudolf Gallien Hoffmann-La Roche AG Grenzach, West Germany	Brian Harrington Mercy Hospital Toledo, Ohio	Hal Ingram Medical Technomics Oakbrook, Illinois
Donald M. Gibson Ministry of Agriculture, Fisheries and Food Torry Research Station Aberdeen, Scotland	Norman D. Harris Department of Pharmacy, Chelsea College London, England	Jan Isoz LKB-Produkter AB Bromma, Sweden
Gordon Gifford Beecham Research Laboratories Wothing, Sussex, England	Jim Harrison UNESCO Paris, France	Adrian K. Jackson Unilever Research Laboratory Sharnbrook, Bedford, England
Donald Glaser University of California Berkeley, California	Carl-Göran Hedén Institute of Bacteriology Karolinska Institute Solna, Sweden	Jindrich Janda Oxoid Ltd. London, England
Luigi Grassi Lab. Analisi Ospedale Sesto S. Giovanni Milano, Italy	Walther Heeschen Institut für Hygiene Bundesanstalt für Milchforschung Kiel, West Germany	Erik Jantzen The State Institute for Public Health Oslo, Norway
Rune Grubb Institute for Med. Microbiology Lund, Sweden	Karl Heil Farbwerke Hoechst AG Frankfurt/M., West Germany	Bundusiri Jayasekara Yardleys of London Basildon, Essex, England
Paul Grönroos Central Hospital Tampere, Finland	Vera Heilborn AB Kabi Stockholm, Sweden	Moncef Jeddi Bacteriological Laboratory Hospital Charles Nicolle Tunis, Tunisia
Hans Gyllang Pripp Bryggerierna AB Bromma, Sweden	George Heimer Public Health Laboratory Central Middlesex Hospital London, England	Gert Johansson Köttforskningsinstitutet Kävlinge, Sweden
Helge G. Gyllenberg Department of Microbiology University of Helsinki Helsinki, Finland	Robert E. Hinkel U.S. Army Frankfurt/M., West Germany	Ingmar Juhlin Bacteriological Institute Malmö Hospital Malmö, Sweden
		Tage Justesen Statens Serum Institut Copenhagen, Denmark

Lauri Jännes Central Public Health Laboratory Helsinki, Finland	Emil Laga Peter Bent Brigham Hospital Boston, Massachusetts	Il-Young Maing Bundesanstalt für Fleischforschung Kulmbach, West Germany
Lars Olof Kallings National Bacteriological Laboratory Stockholm, Sweden	Heinz Henning Lampe Bayer AG Leverkusen, West Germany	Ferruccio Mandler Laboratoria Microbiologica Ospedale Sacco-Vialba Milan, Italy
Martin Kaplan WHO Geneva, Switzerland	Stephen Lapage National Collection of Type Cultures Central Public Health Laboratory London, England	B. G. Mansourian WHO Geneva, Switzerland
Karl-Axel Karlsson The Research Institute of the National Defense Sundbyberg, Sweden	Henri Lavirotte Laboratoire B-D Mérieux Marcy l'Etoile, France	Pertti Markkanen Helsinki, Finland
Gerald Kaufman Perkin-Elmer Corporation Wilton, Connecticut	Henri Leclerc Institut Pasteur Lille, France	Arthur Markovits Clinical Sciences Inc. Whippany, New Jersey
Piet Kistemaker FOM-Institute for Atomic and Molecular Physics Amsterdam, The Netherlands	John Leonardopoulos Department of Microbiol. National University of Athens Athens, Greece	Alexander Martens Bausch & Lomb Inc. Rochester, New York
Jan Kjellander The Regional Hospital Örebro, Sweden	John Lewis Loma Linda University Medical Center Loma Linda, California	I. A. Martin Department of Pharmacy Chelsea-College London, England
Tapani Kohonen National Board of Waters Helsinki, Finland	Owen M. Lidwell Central Public Health Laboratory London, England	Tom Martin Allied Breweries Burton-on-Trent, England
Henry Kramer Union Carbide Research Institute Tarrytown, New York	Arne Lithander Serafimer Hospital Stockholm, Sweden	Michale McIllmurray Wellcome Research Laboratories Beckenham, Kent, England
Donald Paul Kronish Department of Diagnostics Research Warner-Lambert Research Institute	Jorge Lopez-Trello Antibioticos, S.A. Madrid, Spain	James E. McKie Pfizer Inc. Groton, Connecticut
Morris Plains, New Jersey	Holger Lundback National Bacteriological Laboratory Stockholm, Sweden	Coenraad Meijer Lab. v.d. Volksgezondheid Leeuwarden, The Netherlands
Jozef Feliks Kubica Wojskowy Instytut for Hygiene and Epidemics Warsaw, Poland	Arne Lundin The Research Institute of the National Defense Sundbyberg, Sweden	Volker ter Meulen Institut für Virologie Universität Würzburg Würzburg, West Germany
Ronald Kundargi Hospital of St. Raphael New Haven, Connecticut	Mackay-Scollay Pathlab Subiaco, Australia	Henry Meunier Sobioda Seyssinet-Pariset, France
Johs. Kvittingen Bacteriological Laboratory Central Hospital Trondheim, Norway		Henk Meuzelaar FOM-Institute for Atomic and Molecular Physics Amsterdam, The Netherlands

Yvon Michel-Briand Faculté de Médecine et Pharmacie Besançon, France	Thomas R. Neblett Department of Pathology Henry Ford Hospital Detroit, Michigan	Joop Oostendorp Gist-Brocades N.V. Delft, The Netherlands
Dino Migliorini Lab. Analisi, Ospedale Fatebenefratelli Milan, Italy	Samuel W. B. Newsom Department of Microbiology Papworth Hospital Cambridge, England	Örjan Ouchterlony Bacteriological Institute Sahlgrenska Hospital Göteborg, Sweden
Brij Mitruka Division of Health Science Resources Yale University New Haven, Connecticut	Slavko Neytcheff Bulgarian Academy of Medicine Sofia, Bulgaria	Francesco Parenti Gruppo Lepetit Milan, Italy
Milton A. Mitz NASA Washington, D.C.	Hans Aage Nielsen Statens Seruminstiute Copenhagen, Denmark	G. C. Parikh Bacteriology Department South Dakota State University Brookings, South Dakota
Nils Molin Department of Applied Microbiology Karolinska Institutet Stockholm, Sweden	Tapiio Niemelä Department of Microbiology University of Helsinki Helsinki, Finland	Robin Pavillard Department of Microbiol. Royal Perth Hospital Perth, Australia
Richard Moore Central Public Health Laboratory London, England	Jorma Niemi Department of Microbiology University of Helsinki Helsinki, Finland	Holger Pedersen Biocentralen Hørsholm, Denmark
Juan-R. Mor Institute of Microbiol. Swiss Federal Institute of Technology Zürich, Switzerland	Teruo Nishiyama Sanko Junyaku Co. Ltd. Tokyo, Japan	Olli Pensala Technical Research Centre of Finland
Josephine Morello University of Chicago Chicago, Illinois	C.-E. Nord National Bacteriological Laboratory Stockholm, Sweden	Food Research Laboratory Otaniemi, Finland
R. S. Moussa Nestlé Products Technical Assistance Co. Ltd. La Tour de Peilz, Switzerland	Staffan Norell Coagulation Laboratory Karolinska Hospital Stockholm, Sweden	Kurt F. Petersen Institut für Laboratoriumsdiagnose Gauting, West Germany
Muscan Biotest Serum Institut GmbH, Frankfurt/M., West Germany	Erling Norrby Department of Virology Karolinska Institutet Stockholm, Sweden	Sven A. Petersson N.V. Philips' Gloeilampenfabrik Eindhoven, The Netherlands
Frédéric Müller Institut de Physiologie Lausanne, Switzerland	Urs Nydegger Centre de Tranfusion Hopital Cantonal Geneva, Switzerland	Michelangelo Petrini Laboratoria Microbiologia Ospedale Maggiore Ca' Granda Milan, Italy
Ulrich Müller Battelle-Institut Frankfurt/M., West Germany	Edwin Oden Schering Corporation Bloomfield, New Jersey	Jean-Daniel Piguet Institute of Hygiene Department of Bacteriology Geneva, Switzerland
	Tov Omland Forsvarets mikrobiologiske laboratorium Oslo, Norway	John Pike Union Carbides Research Institute Tarrytown, New York

Michael A. Pisano Department of Biology St. John's University Jamaica, New York	Egidio Rigoli Istituto Microbiologia e Immulogia Ospedale di Treviso Treviso, Italy	T. J. Sgouris College of Medicine Michigan State University East Lansing, Michigan
Gérard van der Ploeg Department of Medical Microbiology University of Nijmegen Nijmegen, The Netherlands	Ian Robertson Adelaide, Australia	Anthony N. Sharpe Unilever Research Laboratory Sharnbrook, Bedford, England
Franco Porta Laboratoria Analisi Ospedale Civile di Sondrio Sondrio, Italy	Åke Rosengren Aminkemi AB Bromma, Sweden	David Shepherd Nestlé Products Technical Assistance Co. Ltd. Orbe, Switzerland
Julius Praglin Pfizer Inc. Groton, Connecticut	Manfred Rotter Hygiene-Institutet of the University Vienna, Austria	Knud Siboni Statens Seruminst Odense, Denmark
Vladimir Presecki Department of Bacteriology Institute of Public Health of Croatia Zagreb, Yugoslavia	Warren J. Russell Instrumentation Laboratory Lexington, Massachusetts	Poul Sigsgaard Biocentralen Hørsholm, Denmark
Franz Pötsch Bundesstaatliche Bakt.-Serol. Untersuchungsanstalt Vienna, Austria	Per Rønsted Novo Terapeutisk Laboratory Bagsvaerd, Denmark	Carl Silfverstolpe Silveca AB Norsborg, Sweden
Rudolf Quast Hygiene Institut der Universität Marburg, West Germany	Alvar Sandqvist AB Bofors, Nobel-Pharma Mölndal, Sweden	Libor Slechta The Upjohn Company Kalamazoo, Michigan
Annikka Rantama Orion Pharmaceutical Helsinki, Finland	Matti Sarvas Central Public Health Laboratory Helsinki, Finland	William R. Smith G. D. Searle & Co. Chicago, Illinois
Fred Ray BioQuest Cockeysville, Maryland	Stanley Scher New College of California Sausalito, California	Benkt Göran Snnygg Swedish Institute for Food Preservation and Research Göteborg, Sweden
Jim Rechsteiner National Institute of Public Health Bilthoven, Netherlands	Werner Schneider Uppsala Datacentral Uppsala, Sweden	Lennart Sparell Swedish Water and Air Pollution Research Laboratory Stockholm, Sweden
Joseph D. Reilly G.D. Searle & Co. Chicago, Illinois	Elisabeth Schoutens Hôpital Univ. Brugmann Brussels, Belgium	Max Spinell A/S N. Foss Electric Hillerød, Denmark
Nicola Riccardino Laboratoria Analisi Ospedale S. Giovanni Battista Molinette Torino, Italy	Karlheinz Schroeder Bad Oldesloe, West Germany	David Spooner Microbiology Division, The Boots Company Nottingham, England
	H.-R. Schulten Institut für Physicalische Chemie der Universität Bonn, West Germany	Simone Stadtsbaeder Cliniques St. Pierre Université Louvain Leuven, Belgium
	Hanfried Seyfarth Dr. Karl Thomae GmbH Biberach/Riss, West Germany	

L.-V. von Stedingk Mikrobiol. Centrallab. Stockholm, Sweden	Jerry Tulis Becton, Dickinson & Company Research Center Research Triangle Park, North Carolina	L. A. Williams Kodak Ltd. Harrow, England
Vilma Stenius Orion Pharmaceutical Helsinki, Finland	Nils-Erik Törnblom Orion Pharmaceutical Helsinki, Finland	Heinz Wolff Clinical Research Centre Harrow, England
Charles E. D. Taylor Public Health Laboratory and Department of Microbiology	Joseph Ungar Liebenfeld, Switzerland	Stanley Wolfsen Clinical Sciences Inc. Whippany, New Jersey
Central Middlesex Hospital London, England	Amiram Ur Clinical Research Centre London, England	John Wood British Food Manuf. Ind. Res. Ass.
Françoise Tchernia Laboratoire microbiologie Lavera, France	Richard Urbanczik Schwarzwaldb-Sanatorium Schömberg, West Germany	Leatherhead, England
Ernst Thal National Veterinary Institute Stockholm, Sweden	Bernard Vayssiere Laboratory Lepetit Suresnes, France	Bengt Wretlind Department of Clinical Microbiology
Jean Thomas Laboratoire d'Analyses medicales de Wissembourg Wissembourg, France	Da Cruz Ilda M. Vicente Institute Nacional de Invest. Industrial	Karolinska Hospital Stockholm, Sweden
Sjur Thomassen Apothekernes Laboratorium Oslo, Norway	Lisbon, Portugal	Philip J. Wyatt Science Spectrum, Inc. Santa Barbara, California
Dietrich Thon Erprobungsstelle der Bundeswehr	Arturo Visconti Laboratoria Microbiologica Ospedale S. Carlo Borromeo Milan, Italy	Sven E. Young S. E. Young Research Laboratories Ltd. Toronto, Ont., Canada
Munster/Oertze, West Germany	Torkel Wadström National Bacteriological Laboratory Stockholm, Sweden	Eugène Yourassowsky Hôpital Univ. Brugmann Brussels, Belgium
Anders Thore The Research Institute of the National Defense	Francis A. Waldvogel Clinique universitaire de Médecine	K Youssef Misericordia Hospital Medical Center
Sundbyberg, Sweden	Hôpital cantonal Geneva, Switzerland	Bronx, New York
Anthony Thorne Dynatech AG Zug, Switzerland	Calvin Ward Cetus Scientific Laboratory Inc.	Klaus Yrjas Oy Rohto AB Erkenäs, Finland
Adolf Tolle Institut für Hygiene Bundesanst für Milchforschung	Berkeley, California	Klaus-Jürgen Zaadhof Lehrstuhl für Hyg. und Techn. der Milch, Univ. München
Kiel, West Germany	Motomi Watanabe Sanko Junyaku Co., Ltd. Tokyo, Japan	München, West Germany
Robert Trotman St. Mary's Hospital Medical School	Peter Watkins Baird & Tatlock London, England	Bengt Zacharias The Research Institute of the National Defense
London, England	A. H. Whaba WHO	Sundbyberg, Sweden
Kiyoshi Tsuji The Upjohn Company Kalamazoo, Michigan	Copenhagen, Denmark	Jadranka Zajc-Satler Institute of Microbiology Medical Faculty Ljubljana, Yugoslavia

H. C. Zanen
Laboratory voor de
Gezondheidsleer
University Amsterdam
Amsterdam, The Netherlands

Vitali Zubov
Department of Chemistry
University of Moscow
Moscow, USSR

Rüknettin Ögütman
Medical School, Microbiology
Department, Atatürk
University
Erzurum, Turkey

Secretariat

Sophie Olsen
Department of Applied
Microbiology
Karolinska Institutet
Stockholm, Sweden

Sylvai Molin
Swedish Nutrition Foundation
Uppsala, Sweden

Inger Öhman
Flygt AB
Solna, Sweden