

MEDINFO 74

Proceedings of the First World Conference
on Medical Informatics
Stockholm, August 5–10, 1974

Edited by

JOHN ANDERSON

King's College Hospital Medical School, London

and

J. MALCOLM FORSYTHE

Kent Area Health Authority, Maidstone, Kent

Volume 1



NORTH-HOLLAND PUBLISHING COMPANY — AMSTERDAM · OXFORD
AMERICAN ELSEVIER PUBLISHING COMPANY, INC.—NEW YORK

©IFIP, 1974

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, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

Library of Congress Catalog Card Number: 74-83267
North-Holland ISBN: 0 7204 2042 3
American Elsevier ISBN: 0 444 10771 1

Published by:
North-Holland Publishing Company—Amsterdam
North-Holland Publishing Company, Ltd.—Oxford

Sole Distributors for the U.S.A. and Canada:
American Elsevier Publishing Company, Inc.
52 Vanderbilt Avenue, New York, N.Y. 10017

N.B. The papers by E. Hartmann, M.T. Caddick, J.G. Handby and J.F. Sharpe are British Crown Copyright and reproduced with the permission of Her Britannic Majesty's Stationary Office.

Printed in Sweden by
Göteborgs Offsettryckeri AB
Stockholm 1975

ENGR. LIBRARY

L

699.5

.M39W6

1974

v.1

PREFACE

MEDINFO 74 has been a challenge to the authors not only as the First World Conference on Medical Informatics sponsored by the International Federation for Information Processing, but as a means of conveying to the Congress participants and those who wish to consult the Proceeding afterwards, the communications that were presented.

The Conference was designed to be both specific and educational and intended not only for specialists but for all those involved in health care. To carry this out eighteen themes were chosen and are presented under the appropriate subject headings. Because of further discussion at the Conference addenda were allowed to authors, and also some additional papers, which were presented, have been inserted as addenda to the Preprints. It was, in fact, possible through the co-operation of the Session Chairmen and authors to have the Preprints completed before the meeting in August 1974.

We hope the readers will accept the compromises that are inevitable in having both the Preprints and the final volume established in format long before the Conference took place. We think the addenda bring the meeting up to date and that this will be one of the main authoritative statements about medical computing and medical informatics that exists in the world today.

The authors are very grateful to Miss Mollie Gordon and Mrs. Megan Bird who acted as secretaries both during the editing and at the meeting. Dr. Stellan Bengtsson has also given up a lot of his time to help us, over and above his role as a member of the Publications Committee, which relieved us of all the contract negotiations with the printers and publishers. We are grateful too to Mr. E. Fredriksson of the North-Holland Publishing Company whose co-operation and enthusiasm made the gigantic task much more realisable. We leave it to the readers to decide whether we have achieved our objectives.

December 1974

J. ANDERSON
J. M. FORSYTHE

CONTENTS VOLUME 1

Opening Ceremony and Opening Session

- V Preface
- XV Opening Speech by His Royal Majesty King Carl XVI Gustav
- XVI *Alva Myrdal*: Science, Secrecy and Power
- XXI *O. Nelander*: Plenary Session – Opening Address
- XXIII *B. Grab*: Address by the Representative of the World Health Organisation
- XXV *H. Zemanek*: Welcoming Address to MEDINFO
- XXVII *F. Gremy*: Opening Address
- XXIX *A. Grönwall*: Opening Lecture

INAUGURAL PLENARY SESSION

Trends of Computer Sciences Related to Problems and Needs in Medicine and Public Health Information Handling

- 1 *G. M. Nijssen*: Present and Future Possibilities of Data Base Technology.
- 5 *A. W. Pratt*: Computer Linguistics, with Special Regard to Medical Informatics.
- 13 *B. M. Sayers*: Signal Analysis.
- 21 *F. E. Heart*: Implications of the Computer-Communication Partner-ship.

SERIES 1 Session 1.1. Policies for Introducing Computers into Health Services

- 29 *V. Slamecka*: Objectives and Strategies for the Health Information Sciences
- 33 *R. H. Harding-Smith*: Priorities of Health Service Computing Development
- 39 *M. T. Caddick; D. T. Lee*: The Planning and Control of a Health Care Computing Policy
- 45 *J. van Egmond, M. de Meester, L. Hennico, S. Orloff, F. H. Roger, J. Willems*: Belgian Interuniversity Project on Computerization of the Medical Record Supported by the Belgian Government
- 51 *L. G. Sudarikov*: The Elaboration of Computerized Systems for the Management of Public Health Establishments
- 55 *W. K. de Bruijn*: A National Hospital Automation Plan for the Netherlands
- 59 *M. D. Vickers, K. Wolfenden*: Time-sharing as a Method of Providing Computing Power to the Smaller Hospital
- 63 *H. O. Sonne Andersen*: First Step in the Development of a Hospital EDP System
- 67 *M. Mangad, W. E. Hanna*: Computers and Health Insurance Models
- 75 *R. E. Hawkins*: Introduction of a User-oriented THIS into a Community Hospital Setting—Introductory Agents and their Roles

Session 1.2. Management Tactics for the Introduction of Computers into Health Care units

- 79 *J. G. Handby*: Successful Design Management of Integrated Terminal-Based Medical Systems
- 85 *W. Peumans*: Medical Computer Applications in Daily Practice by an Independent Group of Belgian Physicians
- 89 *C. R. Tyler*: Approaches to Hospital Information Systems
- 95 *K. H. Höhne, K. Dahlmann, W. R. Dix, W. Ebenritter, G. Pfeiffer, K. Harn, R. Montz*: A decentralized Computer System for Processing of Information from Heterogeneous Medical Applications
- 101 *J. M. Ashcroft, J. L. Berry*: The Introduction of a Real-time Patient Data Display System into the Cardio-Thoracic Department at Wythenshawe Hospital
- 109 *P. D. Griffiths, N. W. Carter*: Parasitism or Symbiosis? The Problem of Living with the Development of a Computer System in your Laboratory
- 113 *W. R. Ayers, J. C. Aller*: A Case Study of the Process of Introducing Automated Technology to Medical Care
- 121 *J. E. Gall, Jr.*: Introduction of a User-oriented THIS into a Community Hospital Setting—Tactical Management Revelations

- 127 *D. J. Kenny*: Management Tactics for the Introduction of Computers into Health Care Units. Experience with the London Hospital
 133 *W. L. Bennett*: The Computer and the Clinician

Session 1.3. Methodology of Evaluation of Health Information Systems

- 137 *J. Sharpe*: Towards a Methodology for Evaluating New Uses for Computers
 145 *B. A. Boraas*: Efficacy of Computer Related Services within a Health Sciences Center
 149 *D. Norwood*: Economic Evaluation of Total Hospital Information System
 155 *B. Barber*: The Approach to an Evaluation of the London Hospital Computer Project
 167 *A. Leligdowicz*: Medical Communication System and Continuing Education
 171 *F. S. Lennie, D. A. Ametrano, O. M. Haring*: Evaluation of an Automated Record Summary for Ambulatory Care

Session 1.4. Confidentiality and Security

- 181 *J. A. Dinklo*: Confidentiality of Medical Data in the Usage of Databanks
 189 *R. Thome*: Protection and Confidentiality of Medical Data. I: Efficient Data Protection Through Project Specific Combination of Methods
 193 *K. Böhm*: Protection and Confidentiality of Medical Data. II: Simple Methods for Meeting the Users' Needs
 197 *Th. Fischer, J. M. Helmbock*: Data Privacy and Data Security in Kiel KIS
 201 *L. M. Yanez*: Introduction of a User-oriented THIS into a Community Hospital Setting—Confidentiality and Security

Session 1.5A. Education of Health Staff in Computing

- 207 *J. Anderson, F. Gremy and J.-C. Pagès*: Educational Requirements for Medical Informatics
 213 *M. Scholes*: Education of Health Staff in Computing
 217 *M. S. Błois, Jr., A. Wasserman*: A Graduate Academic Program in Medical Information Science
 223 *J. M. Stutman*: Two New Curricula in Medical Computer Science
 229 *R. S. Tannenbaum*: Undergraduate Computer Science Education for Medical Computer Science Majors and Other Allied Health Personnel
 233 *H. Peterson*: Training and Follow-up of Hospital Personnel in the Use of EDP at Stockholm County

Session 1.5B. Medical Education through Computer Techniques

- 235 *H. S. Diamond, M. Weiner, C. M. Plotz*: Computer Simulation of Chart Teaching on the Rheumatic Diseases
 239 *H. Voirin, J. Delerive*: Study of Computer-assisted Instruction of Medical Biochemistry: The Use of A.P.L. in the Analysis of Chemical Formulas and Managing of Students' Results
 247 *F. T. de Dombal, J. C. Horrocks, S. E. Clamp, J. E. Storr*: Simulation Techniques and Computer-Aided Teaching of the Clinical Diagnostic Process: Five Years Experience
 253 *R. E. Pengov*: A Modularly-Designed Computer-based Management System (CBMS) for Support of Computer-assisted Instruction (CAI)
 263 *R. E. Ayers*: Instruction in Kinesiology via Film Loops and Computer-assisted Instruction
 267 *Y. Palti*: Computer-aided Teaching of Biophysics, Physiology and Pharmacology

Session 1.6. Impact of Medical Computing on Medical Practice and People

- 271 *C. R. Henney, P. Brodli, J. Crooks*: The Administration of Drugs in Hospital—How a Computer Can Be Used to Improve the Quality of Patient Care
 277 *D. B. Shires, A. G. Cameron, J. C. Acres, L. C. Steeves, W. R. Gillis*: MARS and the Family Doctor
 281 *D. M. Vickery, T. W. Morgan, K. T. Larsen, Jr., P. B. Collins, R. E. Stark*: Computer Support of Paramedical Personnel: The Question of Quality Control
 289 *J.-M. Mur, J.-M. Martin, J. Martin, L. Benamghar*: Doctors' Training for Medical Computing in a Hospital. Five Years of Progressive Experimental Management
 295 *D. Norwood*: Introduction of a User-oriented THIS into a Community Hospital

- Setting—Introduction and System Description
- 299 *R. J. Watson*: Medical Staff Response to a Medical Information System with Direct Physician-Computer Interface
- 303 *M. Cook*: Introduction of a User-oriented THIS into a Community Hospital Setting—Nursing
- 305 *B. Hartmann*: The Impact of Computers on Nursing

SERIES 2 Session 2.1. Methodology of Health Data Base Development

- 309 *W. Gothier, F. Ecker, P. Sellmair*: Implementation of an Inquiry Language for a Medical Data Bank System
- 313 *M. Jainz, P. Wick*: A Dialogue System for Updating and Displaying Patient Master Records
- 319 *A. G. Greenburg, M. Goldberg*: Information Utilization Monitoring: A Methodology for Data Base Definition
- 323 *G. J. Baker, S. W. Gardiner, D. J. L. Gradwell*: A Database for Four Hospitals in the United Kingdom
- 329 *A. G. W. Lansink*: PALGA Automated Archives of Pathological Anatomy in the Netherlands
- 335 *C. Gibbons, G. Fleischli*: Use of General Purpose Database Manager for Automation of Ambulatory Medical Care Records: A Feasibility Study
- 341 *F. Goupy, J.-C. Hirel, M. Legrain*: DIAPHANE: National Data Bank for Kidney Dialysis
- 347 *P. Jutier, M. T. Valat, M. F. Landre, A. M. Cellie, H. Ducrot*: Plain Language Medical Records
- 351 *L. Hercz, C. A. Laszlo, M. Reesal*: Data Base Organization and Implementation for a Computerized Pathology Information System

Session 2.2 Experience with Computer-based Medical Information Systems

- 357 *N. Findikyan, E. M. Laska, R. Bank*: A Review of the Multi-state Information System for Psychiatric Patients
- 363 *G. J. Knight, J. Forrer, D. Wigley, T. C. H. de Meyer*: The Computerized Medical Information System at the Red Cross Memorial Hospital for Children
- 369 *D. W. Macfarlane, L. J. Shanbeck, J. O. Elder*: An Automated Patient Profile as an Aid in Coordinating Multidisciplined Medical Care for Handicapped Children
- 375 *H. Grabner, G. Grabner*: Aims and Structure of the Vienna General Medical Information System WAMIS
- 381 *W. Schmincke, G. Penzel*: Patient-oriented Information Processing
- 387 *J. Zeraffa*: From Prototype to Realization. An Application of the Sinbad Programs to Poison Centers Data
- 391 *A. W. Thomas*: A Medical Family Register using Database Management Software.
- 399 *R. D. Hill, K. Sauter, P. L. Reichertz*: The Data Bank Concept of the Medical System Hannover and the Analysis of Patient Data
- 407 *C. Köhler, K. Schadewaldt*: AVAS—General Variable Evaluation System
- 411 *P. R. Pocklington*: The Necessity for, Requirements of and Basic Design of a General Data Interpretation and Evaluation System (DIES)
- 419 *F. H. Roger, M. Joos, J. J. Haxhe*: An automated Medical Record Summary for a Coordinated Inter-Hospital System
- 425 *V. X. Gledhill*: The Medical Synopsis—A Computer-compatible Problem-oriented Record
- 431 *J. M. Martin, G. Debry, P. Drouin, G. Vernhes*: Medical Results of Computing 2,000 Diabetes Case Records. Revision of some Present Concepts
- 435 *L. R. Neal*: Computer Techniques for Retrospective Analysis
- 439 *G. Sterner, K. Lantorp, B. Lindelöf, H. Peterson*: A Computer-based System for Preparation of Annual Medical Reports
- 443 *B. Hallén, C. Mellner, H. Selander, J. Wolodarski*: Guidelines for Choice of Anaesthesia—A Result of the Computerized Patient Data Base at the Karolinska Hospital

Session 2.3. Improving Health Care Delivery in the Community

- 449 *S. Broman*: Structuring Information for Computer-aided Evaluation of Methods and Results of Medical Care

- 453 *J. R. Möhr, K. D. Haehn, K.-J. Dreibholz*: Analysis and Standardization of the Activities of the General Practitioner in Preparation for a Computer-oriented Information System
- 459 *G. A. R. Temmerman*: The Use of a Computer in General Practice; Basic Principles and Two Examples
- 463 *A. J. Hedley and Members of the Steering Committee of the Scottish Automated Follow-up Register*: A Community Based National Follow-up Register for Patients Treated for Thyroid Disease
- 467 *D. J. Shepley*: A Health Information System for Ten Million People
- 471 *V. M. Timonin*: Some Optimization Problems of Public Health Management of a Large City from the Point of View of System Analysis
- 475 *J. F. Terdiman, F. E. van Brundt, L. S. Davis, M. F. Collen*: A Pilot Computer System for Health Care Delivery to a Community
- 481 *S. R. Garfield*: A New Ambulatory Health Care Delivery System Model
- 487 *G. Csoban*: The System Conception of Medical Information—A General System Model for the Health Care
- 493 *C. Sørensen*: The Relative Costs of Traffic Casualties
- Session 2.4. Improving Patient Administration in Hospitals**
- 497 *T. C. S. Kennedy*: A Computer-assisted Clerical System for Management of Hospital Waiting Lists
- 503 *D. Kanon*: Simulating Waiting Line Problems in a Hospital Setting
- 509 *S. Källström, G. Lund, H. Peterson*: A Planning and Scheduling System for Patient Admission to Surgical Departments
- 513 *B. Elfqvist*: A Patient Scheduling System
- 517 *R. E. Leighton*: Use of an Invoice Processing System for Health Data Acquisition
- 523 *P. W. Harvey, J. A. Farrer*: Investigation of the Work of the Casualty Department by Analysis of a Sample of the Case Notes
- 529 *B. Richards, E. J. Acheson, P. A. Howard, D. Longson, D. Whitworth, B. Young*: Computerization of a Programmed Investigation Unit
- 533 *H. P. Straach, G. Griesser*: Interaction of a Hospital Information System with a Regional Sickness Fund Information System
- 539 *P. J. Dixon*: Communications Between Hospitals and Family Doctors
- 543 *J. L. de Silva Faria*: Appointments Planification at the Gustav Roussy Institute. A Two Year Experience
- 547 *E. M. Jimenez, J. A. P. Albarran*: Data Computer Processing of Specially Designed Discharge Sheets, Experience in Seven Hospitals

CONTENTS VOLUME 2

- Session 2.5. Computer-aided Diagnosis—Theory and Practice**
- 553 *G. F. Walker, C. J. Kowalski*: Computer-aided Diagnosis of Craniofacial Abnormalities
- 559 *P. Fragu, E. Patois, C. Huber, J. Lellouch*: Original Approach of the Hyperthyroidism Diagnosis with Computer
- 565 *J. S. Olsen*: Teaching the Computer to Make Decisions—A Method
- 569 *L. F. Pau*: Sequencing Laboratory Tests for Improved Sequential Diagnosis
- 575 *L. Kohout*: Algebraic Models in Computer-aided Medical Diagnosis
- 581 *F. T. de Dombal, J. C. Horrocks*: Computer-aided Diagnosis: Conclusions from an Overall Experience Involving 4,469 Patients
- 587 *I. Brdowski, C. Chastang, G. Aucler, D. Salmon, C. Jacquillat*: Prognosis of Hodgkin's Disease: A Factor Analysis Approach
- 593 *C. Chastang, D. Salmon*: Parenthood Diagnosis
- 601 *D. Salmon, I. Brdowski, L. Michat, C. Cabrol*: Computer-aided Prognosis in Early Post-operative Terms for 139 Cases of Starr-Edwards Prostheses
- 607 *R. Thurmayr, M. Otte, G. R. Thurmayr*: Computer Aid for Diagnosing Pancreatic, Hepatic and Gastric Diseases by Pancreatic Function Test
- 613 *L. Dusserre, J. P. Nakache*: Sample Size Problems in Discriminant Analysis
- 621 *K. Kabasawa, N. Kawamura, S. Kaihara, K. Hiramatsu*: Sequential Diagnostic System Based on Reduction Theory

Session 2.6. Requirements for Hardware and Software in Medicine

- 625 *P. J. LeBeux, R. R. Henley, M. S. Blois*: Implementation for a Frame Selection System for a Modular Hospital Information System
- 633 *L. Ryström, J. D. Andersen, I. A. Larsen*: A Man-Machine Communication System for the Clinical Environment
- 639 *D. T. Henskes, H. E. Kronick*: Operator Acceptance of Data Entry Devices in Patient Care Areas of a Hospital
- 645 *H. Peterson*: A Password-oriented Privacy System for Stockholm County
- 649 *U. Ericsson, W. Schneider, K. Vogel*: The Problem of Privacy in a Computer-based Integrated Health Care Information System

SERIES 3 Session 3.1. Signal Analysis

- 653 *J. L. Talmon, J. H. van Bommel*: Modular Software for Computer-assisted ECG/VCG Interpretation
- 659 *P. Smets*: External Product for P Wave Detection in Noisy Signal
- 663 *C. E. Liedtke, N. Tuna*: Use of Linear Regression Techniques for the Classification of Electrocardiograms
- 671 *T. Weisz, H. C. Lee*: A Hybrid System for On-line Analysis of Composite Bio-electric Potentials
- 677 *J. Meyer, P. Jensch, S. Effert, W. Ameling*: A New Program for the Automatic Analysis of Cardiac Catheterisation Data
- 681 *W. Ameling, P. Jensch, J. Meyer, S. Effert*: Advantages in Computerized Cath-Lab-System with Coloured Display Units
- 687 *J. L. Willems*: Computer Determination of Non-invasive Measures of "Myocardial Contractility" on the Apexcardiogram
- 693 *W. Litwin, F. Begon*: The Impact of Computer on Phonocardiograms Interpretation
- 705 *J. Bergmans*: Computer Analysis of Single Motor Unit Potential Parameters in Human Electromyography
- 709 *L. H. Zetterberg, A. Isaksson, A. Wennberg*: An Operating System for Computer Analysis of EEG
- 713 *G. Dumermuth*: Numerical EEG Analysis in the Frequency Domain
- 723 *M. Chavance, P. Goldberg, D. S. Dollfus*: Spectral and Temporal Analyses Applied to the Study of EEG Reactivity in Children. First Results
- 731 *A. G. Hill, H. R. A. Townsend*: Determining the Patterns of Epileptic Spikes Despite Inefficient Recognition
- 735 *X. Lozoya, C. Gonzalez-Villalpando, J. Garcia-Pena, P. Solis-Camara, V. A. Parra Covarrubias*: Neuroendocrine Phenomena During Human Sleep. I. The EEG Band Analysis

Session 3.2. Intensive Care

- 739 *C. Marchesi, A. F. Perez de Talens, A. Maseri*: ECG and Pressures Waveforms Monitoring in CCU by a Module-structured Software
- 747 *J. W. Crawford, M. J. Henry*: Intensive Care in the Labour Room
- 755 *R. J. Plaszczynski*: Non-invasive Acquisition of Additional Informations for Cardiac Monitoring with Computing Facilities
- 761 *O. Wigertz, P. Blomqvist, J. Hulting, G. Matell, M.-E. Nygard, G. Törnkvist*: A Computer-based System for Continuous ECG Monitoring
- 767 *D. E. M. Taylor, J. S. Whamond, D. J. Hitchings*: A Probabilistic Approach to Patient Monitor Alarm Systems
- 773 *W. Rey, R. Bernard, H. Vainsel, M. A. Boothroyd*: On-line Arrhythmia Monitoring with an Intraatrial Electrode
- 777 *M. I. Kuzin, V. D. Jukovsky, E. M. Kuterman, M. E. Chervyakov*: The Significance of Automatic Sinus Rhythm Analysis of Patients in the Immediate Postoperative Period
- 781 *J. O. Beaumont*: Intensive Care
- 787 *A. Mikolajczuk*: Three Years of Experience with Computer-assisted Patient Monitoring
- 795 *C. A. Swenne, J. H. van Bommel, J. C. Looyen*: A Trainable System for CCU Monitoring

Session 3.3. Radiotherapy

- 801 *B. Barber*: Radiotherapy Computer Applications
 807 *I. R. Neilsen, J. M. Slater, J. E. Chrispens, W. T. Chu, E. N. Carlsen*: An Interactive Computer Ultrasound System for Radiation Treatment Planning

Session 3.4. Image Processing

- 813 *K. D. Kalantarov, V. P. Mejer, V. A. Scyrovkashin, E. Y. Elkind*: Computer-aided Processing of Radioisotope Diagnostic Information: Concept and Advances
 819 *J. Standeven, K. F. Bowden, G. M. Newble*: A Computer-controlled Radioisotope Scanner
 827 *M. V. Green, H. O. Ostrov, M. Douglas, R. W. Myers, J. J. Bailey, G. S. Johnston*: Scintigraphic Cineangiography of the Heart
 831 *T. Estrin, R. Sciabassi, R. Buchness*: Computer Graphics Applications to Neurosurgery
 837 *M. V. Zunzunegui Pastor, J. R. Martinez Alonso, J. Teijeiro Vidal, J. Ortiz Berrocal*: Comparison of Several Digital Filtering Techniques Applied to Anger Camera Images
 843 *I. T. Young, J. E. Walker, J. E. Bowie*: An Analysis Technique for Biological Shape—1
 851 *G. C. Cheng, R. R. Streiff, P. Enriquez, H. T. Lam*: Quantitative Study of Lymphomas Using Computers
 861 *G. Zajicek*: Image Analysis of Rat Liver Histological Sections
 865 *R. J.-P. Le Gô*: Automatic Selection of "Good" Metaphases by Machine

Session 3.5. Drug Data Handling

- 869 *M. Goldberg, C. Santini, B. Doyon, J. P. Emery, B. Graisely, M. Plotkine, B. Vezinet, P. Pignard, J. P. Frejaville, H. Ducrot*: A Drug Data Bank: Specific Problems in Connection with the Nature of Informations and Operating Methodology
 875 *L. Kubacek, P. Ondrejicka, M. Mikulecky, I. Hantak*: The Mathematical Model of Intermittent Drug Action
 879 *J. Selstrup*: Computer-assisted Epilepsy Survey
 883 *K. O. Rosenkranz, P. L. Reichertz*: DAVID—A Dialog system for Acquisition and Validation of Information on Drugs
 889 *S. N. Cohen et al.*: Computer Based Monitoring and Reporting of Drug Interactions
 895 *G. Tognoni, A. Andreani, M. Pedrazzi, E. Oliva*: SIF: A Drug Information System for an Italian Community Hospital
 901 *L. B. Sheiner, B. Rosenberg*: Individualizing Drug Therapy with a Feedback-responsive Computer System
 909 *T. Bogdanik*: The Application of Computer Program to the Digitalis Therapy

Session 3.6. Medical Linguistics

- 915 *F. Wingert*: Word Segmentation and Morpheme Dictionary for Pathology Data Processing
 923 *S. H. Kane*: Practical Nomenclature Handling
 927 *J. M. Martin, G. Debry, J. Martin, D. Viard*: Use of a Lexicon in Diabetology. Interest of Determination of the Frequency of the Clinical Terms Used
 931 *J. van Egmond, R. Wieme*: Systematized Codification of Medical Diagnostic Statements
 935 *M. de Heaulme, C. Mery*: REMAID: An Artificial Language for Medical Reports on Computer
 943 *D. E. Clark, T. C. Sharpe, P. O. Yates*: MUMAS (Manchester University Morbid Anatomy System)

Session 3.7. Clinical Laboratory

- 949 *K. Hempenius, R. J. H. Scholtis*: The Real-time Computer: An Essential Tool in the Medical Laboratories of Breda
 955 *W. Jaross, J. Elsner, J. J. Heinrich, G. Penzel*: Automation of the Clinical Laboratory at the Medical Academy of Dresden
 959 *T. Aronsson et al.*: A Data System for Clinical Chemistry Laboratories—Considerations, Brief Description and Evaluation

- 965 *B. Cassemar, O. Ramgren: Ten Years of an EDP System for Blood Transfusion*
- 969 *J. Bancsich: WIELAB—A New Hardware Concept and its Related Software Support for Automatic Sample-identification and Conversational Input in Clinical Laboratories*
- 975 *N. Wynne Carter, P. D. Griffiths, C. J. White, M. C. Chow, D. F. Lucas: Design and Implementation of a Real-time Computer System for Diagnostic Medical Laboratories*
- 979 *I. Mieth: The Structure of a Result Data Record for Clinical Chemistry*
- 983 *B. Sandblad, G. Östling, W. Schneider, T. Schütt, C.-H. de Verdier: Mathematical Modelling for Efficiency Studies of Clinical Chemical Laboratories*
- 989 **Final Plenary Session**
H. R. Warner, J. D. Morgan, T. A. Pryor, S. Clark and W. Miller: HELP—A self-improving System for Medical Decision Making

ADDENDA

- 995 *Session 1.1*
- 1005 *Session 1.2*
- 1009 *Session 1.3*
 1013 *H. E. Emler, Jr. and J. V. Morris: Evaluation of a Medical Information System for Appointment Scheduling*
- 1029 *Session 1.4*
 1031 *H.-G. Wolters: Implications of Introducing Computers into Health Services for Privacy of Medical Information*
 1037 *I. Freese: A Description of the Swedish Data Act*
- 1043 *Session 1.5A*
- 1045 *Session 1.5B*
- 1047 *Session 1.6*
- 1053 *Session 2.1*
- 1055 *Session 2.2*
- 1059 *Session 2.3*
- 1063 *Session 2.4*
- 1067 *Session 2.5*
- 1073 *Session 2.6*
- 1077 *Session 3.1*
 1079 *S. I. Pöppel: Testing Computer Allocation Rules for Automatic EEG-Classification*
 1089 *F. Findji, B. Renault, J. F. Baillon and A. Remond: A Mimetic Method of Automatic EEG Analysis: Principle and First Results*
- 1095 *Session 3.2*
- 1097 *Session 3.3*
 1103 *I. Cederlund, M. Dade, H. Dahlin and J.-E. Snell: An Intelligent Remote Batch-terminal for use in Radiotherapy*
 1109 *A. Gonzales, R. Martinez and M. C. Paredes: Determination of Dose Distribution Using Techniques in Moving Field Therapy*
- 1117 *Session 3.4*
 1119 *J. M. S. Prewit: The Role of Image Processing in Medical Informatics*
- 1125 *Session 3.5*
- 1133 *Session 3.6*
- 1135 *Session 3.7*
- Final Session*
- 1139 *F. Hartman: Round Table Session*
- 1143 *C. Vallbona, C.-P. Schade, R. L. Baker, S. Beggs-Baker, C. L. Moffet, C. D. Speck and W. J. Osher: Computer Support of Medical Decisions in Ambulatory Care*
- 1151 *S. Bengtsson: The Rational Use of Computing in Microbiology—A Modest Proposal*

1155	<i>F. Hartmann: What Could and Should Doctors Learn from their Experiences with Computers in Medicine</i>
1171	<i>B. McA. Sayers: Addendum</i>
1183	Author Index
1190	Subject Index

Opening Speech by His Royal Majesty King Carl XVI Gustav

Mr. Chairman,
Ladies and gentlemen,

It is with great pleasure that I take the opportunity to open this very important congress and wish our foreign visitors welcome to Sweden.

I consider it an honour and a privilege for Sweden to be host for and organize this International Federation for Information Processing Congress.

I understand that most, if not all, experts in the information processing field are convinced that great social changes follow the present technological development in information processing and its practical implementation. Yet, the visions are rather vague and it is difficult to appreciate their long range potential.

There is an increasing need for research into these aspects of the technological development. Clearly, the "Orwell 1984" is only a vision, hopefully not supported as a social goal by anybody, but good as a demonstration that safeguards in the interest of the citizen are highly important.

Such problems seem well suited for international debate, which will be increasingly important for many years until man succeeds to master the negative effects of extensive automation in the information processing field, without sacrificing its positive potentials. It is my hope that this congress shall, among other things, contribute towards such a development.

I hope this congress shall be a great success and wish again our guests from abroad very welcome to Sweden hoping that you shall have time to learn also a little about Sweden during your visit.

I now declare the International Federation for Information Processing Congress 1974 opened.

Science, Secrecy and Power

Opening speech by Madame Alva Myrdal, Sweden, (former Cabinet Minister in charge of Disarmament)

Your Majesty, Mr. President, Ladies and Gentlemen. Among the distinguished specialists here assembled I have no domicile rights neither by training nor by my professional work.

Rather, I stand before you to represent all the alert citizens who have been following with admiration how your new science and technology have brought about a tremendous expansion of the human brain's capacities to combine elements of knowledge, and combine them with unbelievable speed. We are, really, filled by admiration, but also by wondrous awe, at the remarkable development, which automated processing of information is generating in all azimuths over the horizon.

The programme for this Congress amply testifies to the vast range of achievements already made and aspirations of new discoveries and applications to come.

We are, of course, also aware that it must leave out some fields and even tends to create new problems.

Human and social relations are of a kind and a dimension that can never be completely fitted into even the most intricate machine. Because the human mind does not deal only in logics, we must give the computer scientists right when they argue that any tasks, defined in rational terms, can be handled better by their machines than by our brains, with fewer errors and incomparably greater speed. Outside all what is not so rational but represents all the charming, odd, creative, adaptive qualities which make man supreme because he is human.

Computer, science, cybernation, or how you prefer to name it, must leave unresolved such deeper problems of the human life and the organization of society. There are also signs that it is exactly in those domains that the new technical conquests themselves contribute to create new problems. So, a public debate has been unrolling itself in many countries, focussing on the problems connected with the social role of computers. Just in the present era and particularly just in this country, this debate has been very lively, to say the least. Therefore, expectations on part of the general public are probably rather different from your own expectations of what this Congress will give.

It goes without saying that as explorers and inventors you must at this Congress give the lion's share to an exchange of technical ideas. But we hope also to get some guidance as to important problems connected with the transition from specialized idea-exchange to public debate. But perhaps the experts are as baffled as are citizens at large, in regard to the social impact of their own creation.

So I can quite understand if the Congress may have wanted to get such guidance from this very opening speech. A masterly vision of how to deal with this cardinal question of where the interface must be considered between men and machines, the confrontation between computerized knowledge of facts and human desires, between problemsolving in the deterministic terms of automated logic and society's strivings to change. I can do much less.

I have given my talk the title Science, Secrecy and Power, in order to remind us all, by some brief points, how your field is "situated" in our culture, and how at

the bottom of all your specialized concerns there lie a host of ethical problems. I hope that they will be ventilated at the open sessions foreseen. I also venture to express the hope that these discussions, on the social impact will go deeper into the complexities than the current popular debate. It has come to concentrate on but one aspect, which is of course of legitimate and pressing concern, but does not fully probe the problem field. This debate has evolved around the rights of individuals as human beings, the protection they want for their integrity as persons, and a maximum of individual leeway for them to take responsibilities of their own as citizens, as workers, yes, as patients and as family-members.

In order to help to widen the forthcoming debates on the social impact of computer science and technology, I venture just to raise a few points, which are reflected in my chosen title:

SCIENCE—What is really the driving motivation for advances in science and sophistication of technologies? How far can it go in its inborn lust for perfection? Does it risk to turn into “technology for its own sweet sake”? Can perfectionism become too costly for society? But this is a question for your own “science policy”. I leave it for the second point for which I have chosen the watchword POWER. KNOWLEDGE IS POWER—we all know. But power for whom? The manifold, yes millionfold, expansion of knowledge you present to the world means an increase in power. But power to be used by whom? The computer technologies are, of course, neutral in themselves. This neutrality is symbolized in the fact that—in the Programme—the occupational affiliation of the participants is not given, whether they belong to academia, to industrial, administrative or military establishments. All of these are important employers of the talents you represent.

The overarching problem for society as a whole is just: by whom are the new instruments for increased knowledge to be used? When somebody finances them they do not function in the refined air of theoretical interests. They always contribute to an accumulation of power. An inescapable consequence is that those who possess the most advanced systems—be they nations, firms or groups—also wield the greatest power. How can this power concentration be made socially responsible?

Let me take two examples, widely different, as far as this ethical question of power, but both derived from the most advanced combination of information theory and systems analysis, coupled with the possibility electronically to computerize information from satellites, these new super eyes in the skies. The first one is like a fairy tale of the miracle success that computerization has brought a field like weather forecasting. When the pioneer of modern dynamic meteorology, L. F. Richardson wrote his “Weather Forecasting by Numerical Processes” in 1922, he outlined—for putting his theoretical dream into practice—a system using “human computers”, but he needed 64 000 of them, working in a “Forecast factory”.

Today, weather prediction problems requiring many million times more computing capacity are solved many times a day as a routine. And now comes my sensmoral: this is done in the service of mankind, without danger of misuse of the power of that accumulated knowledge. We have internationally organized a World Weather Watch. This is my positive, I might say glorious example of how your devices may be used to great benefit. The other example refers to military applications, a subject I know somewhat better but have not found mentioned at all in the programme. The two superpowers, US and USSR, who are the only ones to possess satellite capacities worth mentioning, have used these not for pooling observations, but for their own interests. A telling example was given in the last Israel-Arab war, the so-called Yom Kippur war. The new yearbook from SIPRI—Stockholm International Peace Research Institute shows the trajectories

travelled during this period, by US as well as by Soviet reconnaissance satellites. They demonstrate how closely the battlefield was scanned by these supereyes, and the observations registered computerwise nearly instantaneously, in what I believe you call real-time terms. These examples ought to teach us that the technical developments may be encouraging, but only under the proviso that there is *open sharing of the information*.

I want to underline that this is a conclusion that must be drawn not least in civilian, e. g. economic and political connections: The problem of power over the information, now so much more effectively collected and stored, becomes over-awing. Democracy is really being made more difficult. While the multiplication table was a democratic device, available to every-man, the computers are per se shutting off information from the ordinary people. As citizens we must all be vitally concerned with the question who wields the power over information processing and distribution?

So I arrive at my third point—**SECRECY**—the dilemma between openness and secrecy. Those who are the masters in control, the owners of the computer-stored information must be confronted with a most vexious ethical problem: when to apply secrecy and when openness in the circulation of computer-stored information. A key to this delicate choice may in general terms be found in a distinction of whether it is social or human relationships that are involved and may be revealed.

For society as a whole I hold it to be adamantly important that information of concern to social matters should be laid wide open. Information in the anonymous form of statistics is necessary for carrying out social reforms. But openness is needed more generally in order to defend and effectivize democracy. Citizenship must be based on knowledge. Information of value for social and political decisions should not be allowed to be buried by any power group to be used at its own discretion, perhaps at the detriment of others. This is a lesson I have painstakingly learned from my participation in international negotiations. To let the world know your strength is much more effective than having it guess about your weaknesses—and that holds in commercial dealings as well as in disarmament discussions.

The military have been the greatest protagonists of secrecy. It has led us into a kind of weapons culture where their policy of secrecy even justifies the practice of espionage as a counterpart. But we have also learned enough about the disastrous blunders caused by their mutual secretiveness. The most calamitous for the whole world, to see and to suffer from, was of course the development of the atom bomb in the mistaken belief that Hitler was about to have it.

The conviction emerging that all secretiveness about facts of importance to society is unethical is very much strengthened when information is becoming stored in the concentrated and highly effective way of computers if we accept as a truism that “knowledge is power” then it should follow that “secret knowledge is illicit power”.

This is the pivotal point around which so much hot air has lately been turning in the public debates concerning your field of interest in country after country: Who has power over all this information? and—more personally—Do they get power over me?

Here we come to the one sector where the interest in secrecy must outweigh that of openness. It is where the individual human being is concerned. The debate of today largely hovers around this question of preserving human integrity, yes, one might say about the human being's protection from an almighty machine culture.

The debate in this country which is host to your Congress may be of some interest as we have defended rather in extremity the respect for the double aspects, laid down by our system of government, of on one hand open access to public

documents in general but also on the other a deep respect for the integrity of the individual. This was not so much of a dilemma in olden times when free access to public documents still shielded them from excessive curiosity of neighbours by the sheer trouble of travelling to the non-centralized documents of individual bureaucracies. Computerization of personal data and the possibility of linkage between various registers has changed all that.

The situation has become particularly delicate in Sweden on account of at least three social factors that are typical of our society:

(1) the near-sacrosanct principle that all kinds of documents shall be openly available to the public,

(2) the multiplication of what must be considered as documents, data, information occurring through the very rapid application of computer processing, and

(3) the fact that every Swede is given a personal identification number.

Thus it is made particularly easy to cross-reference computer registers and through linkage obtain any amount of personal data.

The international literature has now told the story how we have sought to handle the manifold problems, first and foremost by establishing a Data Inspection Board with sweeping powers over Data Banks. The law provides penalties not only for unauthorized operation of a data bank and for improper disclosure of information gained through employment in a data-processing activity, but also for the offence of "data trespass", i. e. unauthorized access to computerized records. So here we have got what is probably the first Data Ombudsman with responsibilities encompassing a whole nation. From the point of view of the individual citizen it is important, not only that his integrity be protected but that the law also gives him the explicit right to obtain information as to what the registers tell about him, be they kept by public administrations, or banks, or employers, etc. (But I hasten to add that the law only went into effect on July 1st, so perhaps you should "wait and see".)

Similar reforms are having a break-through in many more countries. You know that better than I do. (Also that these trends are given close attention in various international bodies, OECD, the Council of Europe, the International Commission of Jurists, and United Nations itself.) A close watch is certainly needed to keep up what should amount to a Code of Ethics for information processing. For those working in the field this becomes a personal concern. It is interesting to find that attempts are now being made to formalize such Codes of Professional Ethics also for the engineering and computer sciences—such as exists for medicine since Hippocrates day. If I reveal a certain suspiciousness it is because I personally have learned most about computer use in the military field to increase kill-effectiveness, and the computer is, as we all know, very much a brain-child of the war industry. This of course does not create any heredity of original sin for the whole field.

At another Congress, rather for engineers, such a draft code has recently been proposed. It lays down in one article, the rule

Inform yourself about the possible consequences, direct and indirect, immediate and remote of projects you are working on.

In Article 14. To the greatest extent possible, focus on work that you deem on balance to be of positive value to humanity.

In Art. 15 Where abuses of the public interest are encountered in the course of professional activities, speak out in whatever form is best calculated to lead to a remedy, and in

Art. 16 Help inform the lay public about technological developments and of the alternatives they make available.

XX *Opening Ceremony and Opening Session*

Any code for information processing must bear a double task in mind, both to promote and to protect. We must look to a future where on one hand is exploited to the utmost the blessings which your new miracle methods of information processing promise, but where on the other hand the privacy of individuals can be respected as sacred.

With these words, may I end by saying how happy it makes a layman to see such a great number of experts ready to exchange experiences and views on what lies right on—and even beyond—the frontier of the new science and technology of processing information, making possible an explosive expansion of human knowledge. We wish you success, certain that your success will serve us all.

Plenary Session—Opening Address

O. NELANDER

Mr. Chairman, Ladies and Gentlemen, Dear Friends,

It is an honour and pleasure for me to welcome you to this Conference—and specially to welcome those of you from other nations to Sweden and to Stockholm, the capital of Sweden for over 700 years. Particularly at this time of the year Sweden is a wonderful country to live in and I think that Sweden, as Stockholm also has a lot to offer its visitors.

In area Sweden is the fourth largest country of Europe. Only France, Russia and Spain are larger. The population however is only 8 millions and, particularly in the North, Sweden is sparsely populated. This gives us large recreational areas but of course it also creates difficulties, for instance in delivering health care. The distance between Sweden's southernmost city and the northernmost point—well above the Arctic circle—is more than 1500 km. Stockholm has about the same latitude as the southern tip of Greenland. The Gulf Stream however makes the climate relatively mild. Outside Stockholm you will find a beautiful and refreshing archipelago and inside Stockholm a lot of interest.

I greet you with a hearty welcome to Sweden and to Stockholm. It is an honour for Swedish Health Care that Stockholm has been chosen for the First World Conference on Medical Informatics, Medinfo 74. We are happy to see so many participants in the Conference (about 900) coming from about 30 countries in different parts of the world and representing many professions of health care activities. In the exhibition hall we can see an impressive amount of advanced systems and technical equipment, presented by 172 manufacturers and institutions, of which one third are demonstrating medical systems. I think that this great interest for MEDINFO 74 is an expression of the fact, that we need each other in this field, and that cooperation and information exchange is felt to be necessary to bring about good solutions. The field is difficult not only from the technical but also from the ethical and other points of view.

With a few exceptions health care in Sweden is delivered by about 25 county councils covering different areas of Sweden. The councils are elected by the people in each area and each council has great freedom to decide and great responsibility, within laws, governmental policies, and rules and advice from the National Board of Health and Welfare. The county councils together founded 50 years ago the Federation of county councils located in Stockholm. This is their central organisation for cooperation and negotiations firstly with doctors, nurses and workers unions, secondly with the government, and thirdly with the National Board of Health and Welfare and so on.

The Federation of county councils and the Swedish government are the main sponsors of Spri—the Swedish Planning and Rationalization Institute of the Health and Social Services—working in a consulting position to the county councils.

Spri and the Federation of county councils play an essential role in the progress of medical computing in Sweden—Spri through its systems-development for medical care and administration, and the Federation through its central EDP-planning and the technical development of computer services.

The uniform organization of Swedish health care and the high medical and technical standard offer, I think, favourable conditions for the development and exploitation of computer systems. Considerable efforts have also been made, by health care authorities, universities and computer manufacturers to develop computer based information systems. Comprehensive experience has been achieved and a great number of systems have been developed and implemented, particularly in the fields of patient management and medical auxiliary services.

But we have also been aware of the difficulties in this development, difficulties which are partly different from those in other fields. This is due primarily to the special nature of medicine. The health information systems have to work with large and highly variable information volumes, the care activities are only to a limited extent possible to plan, and the medical decision-process is mainly outside the competence of the computer.

However, I think that computer techniques—properly used—can bring about an increase in clinical and administrative efficiency and better facilities for management and research.

Like medicine medical computing knows no geographical or national boundaries. So it is natural that international cooperation is rapidly growing in this rather new field. I am sure that this cooperation will mean a saving of time of the way towards good solutions.

In fact I think that international cooperation in developing computer systems is specially important in the field of medicine. Cooperation is needed in several “dimensions”: between projects, between health care units (for instance within a region), and last but not least between representatives from the different professions involved: doctors, administrators, nurses, computer specialists and others. Such a cooperation is necessary, I think, also to guarantee that the systems will respond primarily to the wishes and the needs of patients, users and society.

I hope that this first MEDINFO—conference will meet its expectations: that is to present the current status of computer applications in medicine and health care and to provide guidelines for future development. MEDINFO—conferences then may succeed and grow to an effective means to bring progressive cooperation over the borders.

I wish this conference every success and declare MEDINFO 74 opened.

Address by the Representative of the World Health Organisation

B. GRAB

Mr. Chairman, Ladies and Gentlemen,

It is a great honour and also a great pleasure for me to address, on behalf of the World Health Organization, this distinguished assembly of worldwide experts in medical computing.

In his last Annual Report to the World Health Assembly, the Director-General emphasised the need for a reassessment of WHO's role and activities. This has been made possible by new improvements in communications science resulting from the applications of computer technology. There was a need to develop programming and evaluation techniques to establish a much closer relationship between the two processes of priority-setting by governments, collectively at the World Health Assembly and individually at the country level. Increased emphasis on WHO's coordination role at the country level can contribute substantially towards bringing the two priority-setting processes together.

One of the mechanisms being developed to assist countries in identifying national priorities is country health programming, by which the health problems of a country are assessed systematically in their proper context, taking into account the resources that are, or could be available, with the aim of pinpointing areas susceptible to change. Country health programming is only the first stage. It is intended to be followed by project formulation, which describes the measures to be adopted and the detailed use of resources for their implementation in the priority areas. Management techniques and evaluation procedures are then applied in the implementation of these decisions. This is the stage of project management.

The main programme areas identified by WHO include the strengthening of health services, the development of health manpower, the prevention and control of communicable and chronic diseases, the promotion of environmental health, and health information and literature. The increasing role of the computer in all these areas has long been recognized by WHO. The demand for efficiency and for optimal allocation of the resources, the requirements of sound management, as well as the complexity of the systems involved, all require the extended development of computer technology in the field of biology, medicine and public health.

Computer applications in medicine and public health are already firmly established in economically advanced countries. As a technological instrument of great potential they can also help the less developed countries in their efforts to promote improved health activities. The organization of public health systems and the delivery of health services in different countries must therefore be considered: There may be wide variation within and among such systems, and this has major implications for the transplantation of computer systems developed elsewhere.

The need for computers thus depends on the stage of development of the health care systems in different areas, regions and countries; different levels of development being associated with different computer requirements and applications.

The need for improved coordination of WHO's activities in this field is being felt increasingly, and it is considered that the Organization should put itself in a

position to give both policy guidance and technical advice to countries that request it. The continued interest of WHO in the development of computer techniques is reflected by the successive conferences, symposia, seminars and other meetings arranged by the Organization.

For example, a conference on the Application of Automatic Data Processing Systems in Health Administration was convened by the European Regional Office in 1964 in Copenhagen. In 1966, the same Office organized a symposium in Stockholm on the Use of Electronic Computers in Health Statistics and Medical Research, in 1968 a seminar in London and Chichester on the Public Health Uses of Electronic Computers, and in 1971 a symposium on the Development of Hospital Computing Systems which was held in Toulouse. In 1970 an informal working group was convened in Bratislava by the European Regional Office to discuss their activities in the field of medical computing. Finally, in 1972 the same Office organized a European Conference on Medical Computing in Luxembourg.

On the recommendation of the Fifth Meeting of its Regional Advisory Committee on Health Statistics, the WHO Regional Office for the Americas created, in 1968, a Regional Advisory Committee on Computers in Health. This Committee held its first meeting in Buenos Aires in 1970 and its second meeting in Washington in 1972.

The first Consultation on Medical Computing in Public Health organized by WHO Headquarters was held in 1971. It was followed by a second Consultation in 1972 and a third one is planned for the end of this year.

A rapid glance at the programme of the present Conference shows that practically the whole range of computer applications will be reviewed, going all the way from problems of automation in medical linguistics to policies for introducing computers into health services.

I am sure that the result of these discussions will substantially help in deciding on the directions to be taken in the future, and in recommending the advantageous uses of the new computer technology for the improvement of health delivery systems throughout the world.

The International Federation for Information Processing which is sponsoring this World Conference on Medical Informatics is already in official relations with the World Health Organization. Good professional contacts have been established in the past. And it is hoped that further fruitful collaboration will develop in the future for the mutual benefit of both organizations. May I conclude by saying that the World Health Organization expresses its warmest wishes for the full success of MEDINFO 74.

Welcoming Address to MEDINFO

HEINZ ZEMANEK, IFIP President

Mr. Chairman, Honoured Guests, Ladies and Gentlemen,

The combination of Medicine, one of the oldest professions in history, and information processing, one of the youngest fields in science and technology, is one of the noblest tasks in IFIP. I am, therefore, proud that the First World Conference on Medical Informatics takes place during my term as IFIP President. We considered this event so important that we did something we had rejected in the past: we embodied this conference in the IFIP Congress 74 because—as I said this morning in my welcome address to the Congress—we wanted to demonstrate our successful cooperation with one of the most important professions of human life and our estimation of the computer user. We all realise that there is still a big piece of common work to be done,

Since IFIP has the honour and the pleasure of welcoming at this World Conference so many medical doctors and hospital specialists, it seems useful to say a few words on IFIP, the International Federation for Information Processing. In your folder you will find a little IFIP present, a small brochure called IFIP Summary, giving you the formal information and a lot of data. I invite you to look through it.

The main activity of IFIP is the IFIP Congress every three years. There is no need to describe it—you are in the middle of one and you get your direct impression of what it is and how it runs. The IFIP Congress proceedings store every three years a picture of the science and art of information processing in overview and detail.

A second important part of IFIP's work goes on in the Technical Committee (TC's) and Working Groups (WG's). The TC's are composed of representatives of our national member societies (if they want to send somebody and if they can find somebody to do this hard work—one representative for each country), while the membership to the working group (decided by the TC) is individual and independent of country and membership—a group of competent specialists. The WG's meet for the discussion of their subject, they produce working papers and many have done very important development work. The TC's coordinate this work and, in particular, they organise Working Conferences on subjects which require advance. There have already been more than a dozen Working Conferences and their proceedings document IFIP contribution to the progress of information processing.

TC 4, the Technical Committee in Medical Information Processing, followed precisely the model of an IFIP TC. The idea originated in France, and I am happy that Professor Francois Grémy, the initiator and chairman from 1966 to 1973 is your conference chairman. In Mr. Roukens, TC 4 chairman since 1974 he found an active and competent successor.

I have personally always taken much interest in TC4 and I was at many of their meetings. I have great respect for their achievements. I have seen with satisfaction and pleasure how fast the difficulty was overcome to bring medical doctors, hospital administrators and computer specialists to a common language and to a mutual understanding in the field of information processing.

This was, however, no surprise for me. I have been a "cybernetician" in some period of my life, cooperating a lot with medical doctors and biologists. My experience brings me to the conclusion that if medical doctors and biologists would get another 24 hour per day, they would be able to develop any science or technology they need without any physicist or engineer (which is proven, e. g., by the medico-biological development of the feedback principle—the re-afference principle— independent of electrical engineering).

Medical doctors would use computers without any support from information processing specialists if our tool, the computer, was more perfect. IFIP is extremely satisfied that TC 4 offers the necessary support, and IFIP will continue to help as long as this is required, until our tool will be perfect enough that Medical Information Processing will be a pure medical problem so that TC 4 can return to an international medical federation—where it belongs. This comment was made to my friends in TC 4 before. It does include the condition of a perfect enough computer, so that it refers far into future—which should never be overlooked—and it mainly expresses that IFIP does not want to dominate but to help).

The idea of MEDINFO is a creation of TC 4 and IFIP is very thankful to its initiators and its organisers, in first line to Professor Grémy, the Conference Chairman, to Mr. Wendel, the chairman of the organising subcommittee within the Organising Committee of Congress 74, and to the two editors, Professor Anderson and Dr. Forsythe—experienced by also having edited the first TC 4 Working Conference Proceedings. The present volume impresses by its size and quality. This might reflect in the price for it, but IFIP is proud of having helped to make this book representative in the medical environment.

Let me now give a short excerpt of a part of my welcoming address to the Congress this morning. I said that the participant, although he has paid his participation fee, still has several duties, and I mention four of them:

- to select what he wants and is able to attend (easier at MEDINFO than at the Congress because of few parallel sessions),
- to integrate what you hear to your personal picture of Medical Informatics in 1974,
- to meet people and,
- to enjoy actively the conference;

and I also want to repeat what I said on the English language as our communication tool, going across medicine, administration and information processing. Very cordially, but energetically, I ask all speakers who enjoy the privilege to get through at our congress with their mother language to control their speed and their pronunciation, and to restrict themselves to the subject of their wonderful language which they can expect to be grasped by us "developing English consumers".

Mr. Chairman, Ladies and Gentlemen—IFIP is satisfied that its name has been a motivation for so many volunteers to share the design of this conference and I want to thank all of them. A particular word of thanks, however, is due to the World Health Organisation, who have given to TC 4 and to this conference not only the valuable formal background—in addition they have given substantial active practical support which is of infinite help to our work.

The Conference on Medical Informatics is at your disposition. Ladies and Gentlemen—reward the preparation work by gaining information, insight, friends and enjoyment.

Opening Address

F. GREMY, Chairman of the conference, Chairman of the Programme Committee

MEDINFO 74 is the first World Conference on Medical Informatics sponsored by International Federation for Information Processing (IFIP).

The IFIP body responsible for the organization of this World Conference is the 4th Technical Committee (T.C.4) of the Federation devoted to Information Processing in Medicine, and chaired by J. Roukens from the Netherlands.

On setting up this Conference, the Programme Committee adopted the following scientific policy: we thought that the impact of this Conference should be not only scientific, but also, and mainly educational. Indeed, it is intended not only for specialists but also for lay people, medical doctors, nurses and health administrators who would like to have a broad view on the problems, hopes, and difficulties raised by the development of health computing.

This is the reason why we designed, as precisely as possible, the framework of the Conference. We have chosen 19 themes from those we thought the most important both for the present and for the future of the development of computing in the health field. Our intention was to try and cover most aspects of medical computing including human, psychological and political as well as scientific and technical. These themes were divided into 3 parallel series of sessions, each of these devoted to one theme. For each session a chairman was carefully selected among the most prominent members of the international scientific community, and given the responsibility of the organization of his session (specifically the selection of the papers, the order of presentation, the introduction, and the conclusion of the session).

This policy of designing the whole Conference very strictly has had the following consequences:

- (1) the burden of the Conference lies on the shoulders of the session chairman. Some of them have had a very difficult task to accomplish, and all have to be thanked very warmly. They are the true makers of the Conference, and its success will be theirs.
- (2) the numbers of submitted papers to the different sessions were very unequal. So the rate of selection was very different from one session to another. The chairman of sessions 2.1, 2.2, 2.5 and 3.1 had to particularly severe in their choice. Indeed it can be reasonably claimed that our policy is unfair to papers which have been discarded, though they were of very good scientific quality, just because they were submitted for an over-subscribed session. When adopting our policy we knew this risk, and accepted it.

We thought also that it was necessary to enclose the whole Conference within two plenary sessions. The inaugural plenary session is devoted to general information on the present trends of computer sciences. Such information will be, we hope, very useful to all doctors and health specialists who, even if interested in health computing, are not always in a position to follow up very narrowly the evolution of information processing sciences and techniques.

The final plenary session will tackle an essential problem: "Is the use of computers in medical practice an illusion or a reasonable hope?" Professor H. Warner, and Professor C. Vallbona are among the best suited to give an answer to this thrilling question.

It is also my duty, and a very pleasant one indeed, to tell you how many people have contributed to the success of this conference, and to thank them in the name of the programme conference and of all the participants to the conference.

I must first thank IFIP and particularly past president Academician Dorodnicyn from USSR and Heinz Zemanek from Austria, who is the current President of IFIP.

Let me thank the World Health Organization and the International Hospital Federation for their assistance and interest, the Swedish government and parliament, the authorities of the county of Stockholm, and the town of Stockholm for their help and hospitality.

A special mention must be made of the contribution of the Swedish Planning and Rationalization (SPRI) Institute of the health and social services.

Several private companies have sponsored and financially supported the conference: the list can be found on page V. They deserve all our gratitude.

I have already said how important was the contribution of the session chairmen for the scientific quality of the conference.

The present proceedings have not been achieved without a great cooperative effort. If one remembers that more than 95 % of these proceedings have been issued as preprints for the participants of the conference, one can understand how hard, fast and well the editors, Professor John Anderson and Dr. Malcolm Forsythe have worked to review the papers. For this task, the help of their secretaries Miss Gordon, Mrs. Mary Graffin and Mrs. Bird was invaluable. Mr. Rasmussen was in charge of the contact with the printing company (Almqvist and Wiksell) and the publishers (North-Holland): this collaboration was perfect.

One must specially quote the work done by Dr. S. Bengtsson: with his colleagues of the Department of Microbiology of Uppsala, he accepted to redraw nearly 100 pictures, correcting a mistake of the call for papers which omitted to require explicitly from the authors the originals of their pictures. This wonderful effort deserves our admiration.

It would not be complete if I forgot the work done by the Organising Committee, and especially by S. Wendel, W. Schneider, H. Peterson, and Svetlana Broman.

I am also specially grateful to Miss Mary Ann Grant, who was to myself and to the Programme Committee an excellent secretary, discrete, efficient and charming.

This litany may appear boring—and I apologise for that—but all this enterprise has been a manifestation of efficient international fraternity. It was my duty to bring the attention of the readers of these proceedings to that.

Opening Lecture

A. GRÖNWALL, Uppsala, Sweden

Medical Computing as a Component of Health Care Delivery Systems

Mr. Chairman, Ladies and Gentlemen,

I feel indeed greatly honoured by the invitation to give the opening lecture at this first world conference on medical informatics. I am no specialist either on information systems, on information processing or on computer techniques. I only represent the consumer side, and I do not even master the scientific jargon which is spoken by information and computer specialists. It is however my hope that, despite all this, I shall make myself understood.

To begin with, I would say that this conference comes at the very right time. I feel that, since we have by now collected so much knowledge and experience, made so much progress and so many mistakes, evoked so much enthusiasm and caused so many disappointments, it is at this point important for us to make a survey of the present situation, to determine our position, and to establish the objectives for the future. This will be difficult with regard to the great number of specialists involved. There are specialists in information systems, in informatics and in computer techniques; there are doctors representing the most varying scientific branches, and there are public health and hospital administrators and decision-making politicians. It will be necessary that a clear picture is presented to all these groups. They will need to know:

(1) what has hitherto come out of medical computing that clearly justifies its application with regard to function, effectiveness and economy?

(2) under which prerequisites is it possible and advisable to introduce medical computing?

(3) which parts of present activities are development and research projects and therefore not as yet ready for general use?

(4) which guidelines shall be followed for development and research work?

I was pleased to observe that all these points coincide with the intentions of this conference as pronounced in the official invitation as follows: "Medinfo 74 will cover the broad field of information processing in medicine and public health. The objective is to critically review and discuss the current status and provide guidelines for the future". It will perhaps be of interest for this audience to learn that exactly the same trains of thoughts have been discussed within the International Hospital Federation (IHF) which, at its congress in Montreal in 1973, decided to set up a study group of prominent specialists who are to give a report on these problems at the international hospital congress in Zagreb in 1975. The same needs have thus been found urgent simultaneously within the IFIP and the IHF.

In this context I would also like to convey the very best wishes from the IHF for successful and interesting work during this conference.

At the starting moment of a conference on information technology for world health there may be reason to put the question how the introduction of electronic data processing has been received and experienced within the health and medical

care section. I have already partly answered that question when talking about progress and mistakes, enthusiasm and disappointments. By and large, it could probably be said that the information needs have not been sufficiently studied and that, consequently, the information systems have not been sufficiently defined. It could also be said that there was a lack of a well-defined conceptual basis. In that situation the medical care field was not well enough prepared to enter the data age. It was taken by surprise. Some of the negative effects were difficulties in judging rightly the possibilities and limitations of the new technique, which was therefore in many places introduced insecurely and unsystematically. It sometimes happened that the computer technique too much steered the development of information systems instead of being a tool for processing ready-developed systems.

Within the medical care field we can distinguish two groups of data and information systems, that is, an administrative and a medical sector. For certain parts of the administrative sector the introduction of electronic data processing has been fairly free from complications. This is particularly true of well-defined data such as salaries, etc., whereas patient management data have caused considerably more problems. It is, however, within the medical sector that we have met with the greatest difficulties. This difference is rather natural, since the administrative sector has in many respects had fairly well defined systems and routines. One has almost exactly known what pieces of information that should be extracted, but it created many difficulties and caused too high costs to do this with manual methods. It then became rational to take to computer techniques. The initial position of the medical sector was wholly different. We had there no solid basis for the development since we lacked logically constructed systems. But we work with lots of medical data which have not, as yet, been sufficiently analyzed with respect to:

(1) the true value of information at the patient's contact with the health care system;

(2) the value of such data as future anamnestic information;

(3) the value of data as steering information within the system.

With this background, it was unfortunate that we had not sufficiently distinguished between systems development and informatics and that we started at the wrong end by introducing electronic data processing too early and before the systems had been properly defined. An unhappy confrontation, as related to time and development, between medicine and electronic data processing has in certain instances influenced patient care and its information systems, as the interest was focussed too much on the possibilities of the computer technique. This is not the right strategy to tackle the problem.

Another extreme has been to introduce electronic data processing for the information material of medical records. Most of us still think too much of the medical record as a file full of data that should be kept in order. Essential improvements have been introduced, but the medical records still vary both as regards the degree of systematization and the structuring. At first it may seem important to have such data transmitted to a big computer. But this is not the case. The road via such a material is not passable. The essential thing is to find out the logical connections and thereafter to create a logical structure.

I imagine that by now it will have appeared that I do not see future difficulties in the data processing as such but more in the development of functional and rational information systems. No one can question the needs within health and medical care for information, straight information lines, and adequate data processing. It is, however, difficult to indicate exactly which roads we shall follow in order to obtain the right answers. We will obviously have to study the whole patient care system

with respect to the application of modern electronic data processing but without letting ourselves get intoxicated by its great possibilities. The systems must not be more comprehensive, more circumstantial, or more sophisticated and expensive than they need to be. I can see four main roads to reach this goal and that is by:

- basic research in medical informatics,
- experimental application,
- evaluation of experiments,
- education.

When there have been possibilities to start from completed systems—I here mainly think of the administrative sector—it has been simple to estimate the costs for introducing electronic data processing and to earmark a certain proportion of the budget for the purpose. This has equally been done in a few, though narrow, medical sectors such as the laboratory services. We have here simple data and flows of information with which we have been able to make acceptable cost-benefit estimations. With such results in hand it has been possible to obtain grants both for basic research and for experimental work. Considerable amounts of money have also been invested for such purposes and the practical results must be considered as relatively good. This is however only a very small part of the whole medical sector.

Within the greater and most important part of the medical sector it has not been possible to make similar analyses and estimations as regards future development. As we all know, much money has nevertheless been invested in this field and it is here that we have met with the greatest difficulties and disappointments. I believe, however, that even those who maintain that we have wasted money and that it has cost too much on reconsideration must accept the comprehensiveness and complexity of health and medical care and also its very heavy costs. For countries like the United States, Canada, Great Britain and Sweden it is a question of costs amounting to 5–8 % of the gross national product. If we look at the problem in that perspective, we cannot deny that, so far, relatively unimportant sums have been spent on that which is basic in this context, namely the development of the medical information systems.

I would maintain that sufficient research has not been done in this field, and there is too much evidence to show that the research part has been incompletely dealt with or sometimes even totally neglected. There is definitely a need for more intensive research in order to make clear both the need for information and the relative value of varying kinds of information. This may seem to be an unreasonable project, as it would have to include health and medical care at all organizational levels and within all specialities. Quite obviously, this is comprehensive but, on the other hand, it could be easily divided into minor objects. Much also depends on the amount of data which are to be used for the computerized systems.

If we agree on this, it will be important that no one promises and that no one expects too quickly practical results in the form of rationalization gains and lower costs. Also in this domain one has to accept a basic and cost-consuming research period which does not yield instant practical results. It thus becomes more and more clear that research on information systems for health and medical care stands out as an important part of the extensive research field which is epitomized in the concept “medical care research”.

It would be wrong of me to try here to indicate guidelines for such research. That is the task of this conference. But I do believe that the work will be successful, if a critical attitude is maintained when medical information systems are to be defined and if more attention is paid to that which is necessary and justifiable than to that which could be carried out thanks to the great technical possibilities. We must produce a method that shows which of the data collected for in- as well as

outpatients that should go into the system, because they are needed at the time or will be so in future. You will have to put such drastic questions as how far it is worth going in details and perfection when defining the systems. I imagine that one can also shed light on these questions by studying the inconveniences appearing when patients come to newly opened hospitals and health centres which do not have any previous data about the patients, or when patients are admitted as emergency cases to a hospital where they have never been before. How important is it for the treatment of middle-aged patients' fractures or for the indication of a cholecystectomy to have quick access to information on illnesses during childhood? And how important is it within long-term care to have information about previous fractures and cholecystectomies? I believe that questions of this kind may help us to find out what logical information is needed and this should be structured, i. e., how the systems should be defined.

It is now about 15 years since the pioneers in the medical information field told us how very backward our old information systems and our data processing were. Since then the development has been uneven and in certain important sub-sections rather sluggish. But it is essential that we learn from our experiences. Some projects have been very comprehensive and have more or less aimed at complete systems, whereas others have been more modest in that respect. There is no doubt that the more extensive the efforts, the greater the difficulties. It is definitely easier to attack smaller sections, but you will then instead have to make sure that your section is so designed that it can later be incorporated in a larger system. This train of thoughts agrees with the module strategy for health and medical care information systems for which Werner Schneider has been the spokesman. As an illustration of such sub-sections, or modules, within which successful work has been carried out can be mentioned:

- laboratory services,
- chemistry,
- bacteriology
- radiophysics,
- physiology,
- rehabilitation,
- raditherapy,
- patient follow-ups,
- routine health controls.

The evaluation of the systems or the sub-systems ought to be carried out both at the international and the national level. There exist no great fundamental differences between the various countries as regards health and medical care, but there are great many differences in details. A national evaluation that I am specially familiar with is that carried out in Sweden and which was started by Spri (the Institute for the Planning and Rationalization of Health and Social Welfare Services in Sweden) in 1969. An inventory and evaluation of current projects and their results were published in 1971. It could be said that Spri has hereby given to Swedish health and medical care a consumer information that includes both economic analyses and qualitative evaluations. The latter kind of information was made available on even such complex instruments as data base management soft-ware.

A question that is both important and difficult concerns education. When it comes to introducing computer technique within health and medical care, we know from experience that we may meet with many difficulties that will cause crises within the organisation. These are mainly psychological factors connected with the level of training or lack of training and data experience among the staff concerned.

If the staff does not possess the data maturity that is required, successful cannot be expected. The fact is also that the whole group of users along the line, that is, doctors, nurses, etc., have not had any training in this field during ordinary professional education. The very few who got some training usually attended those courses that are more oriented towards coding, machine operation, etc., but not to that which is really important in this context, namely definition of information, information systems, information processing, and storage and retrieval of information. An improvement must indeed be achieved in this respect. Knowledge is not only necessary for introducing the systems but also a prerequisite for continued development.

To conclude, I would like to return to this conference and its programme as a good omen for the future that so many specialists of varying categories and high standard have been engaged for its meetings. This warrants that the problems of medical information will be discussed on a higher professional level than perhaps ever before. We are all glad that so many doctors nowadays spend so much time in information processing and its medical applications within patient care and so many of them take part in this congress. They will be quite indispensable in the joint efforts for the welfare of patient care as they will no doubt work in the tradition of one of the Swedish pioneers in this field, Gunnar Wallenius, who used to say that the aim was not to computerize the hospital but to hospitalize the computer.

AUTHOR INDEX

- Acres, J. C., see Shires, D. B., 277
 Albarran, J. A. P., see Jimenez, E. M., 547
 Aller, J. C., see Ayers, W. R., 113
 Alonso, J. R. M., see Pastor, M. V. Z., 837
 Ameling, W., Jensch, P., Meyer, J. and Effert, S., Advantages in Computerised Cath-Lab-System with Coloured Display Units, 681
 Ameling, W., see Meyer, J., 677
 Ametrano, D. A., see Lennie, F. S., 171
 Andersen, H. O. S., First Step of Development of a Hospital EDP, 63
 Andersen, J. D., see Rystrom, L., 633
 Anderson, J., Gremy, F. and Pages, J.-C., Educational Requirements for Medical Informatics - Results of the First International Survey, 207
 Andreani, A., see Tognini, G., 895
 Armstrong, M. F., see Cohen, S. N., 889
 Aronsson, T. et al., A Data System for Clinical Chemistry Laboratories - Considerations, Brief Description and Evaluation, 959
 Ashcroft, J. M. and Berry, J. L., The Introduction of a Real-Time Patient Data Display System into the Cardio-Thoracic Department at Wythenshawe Hospital, 101
 Auclerc, G., see Brdowski, I., 587
 Ayers, R. E., Instruction in Kinesiology via Film Loops and Computer Assisted Instruction, 263
 Ayers, W. R. and Aller, J. C., A Case Study of the Process of Introducing Automated Technology to Medical Care, 113
 Bailey, J. J., see Green, M. V., 827
 Bailey, J. S., see Mikolajczuk, A., 787
 Baillon, J. F., see Findji, F., 1089
 Baker, G. J., Gardiner, S. W. and Gradwell, D. J. L., A Database for Four Hospitals in the United Kingdom, 323
 Baker, R. L., see Vallbona, C., 1141
 Bancsich, J., A New Hardware Concept and its Related Software Support for Automatic Sample-Identification and Conversational Input in Clinical Laboratories WIELAB, 969
 Bank, R., see Findikyan, N., 357
 Barber, B., The Approach to an Evaluation of London Hospital Computer Project, 155
 Addition, 1011
 Barber, B., Radiotherapy Computer Applications, 801
 Addition, 1097
 Beaumont, J. O. and Osborn, J. J., Experience with Remote Intensive Care Monitoring, 781
 Beggs-Baker, S., see Vallbona, C., 1141
 Begon, F., see Litwin, W., 693
 Benamghar, L., see Mur, J.-M., 289
 Bengtsson, S., The Rational Use of Computing in Microbiology - A Modest Proposal, 1151
 Bennett, W. L., The Computer and the Clinician, 133
 Bergmans, J., Computer Analysis of Single Motor Unit Potential Parameters in Human Electromyography, 705
 Bernard, R., see Rey, W., 773
 Berrocal, J. O., see Pastor, M. V. Z., 837
 Berry, J. L., see Ashcroft, J. M., 101
 Blois, M. S. and Wasserman, A. I., A Graduate Academic Program in Medical Information Science, 217
 Blois, M. S., see LeBeux, P. J., 625
 Blomqvist, P., see Wigertz, O., 761
 Bogdanik, T., The Application of a Computer Program to the Digitalis Therapy, 909
 Bohm, K., Protection and Confidentiality of Medical Data II: Simple Methods for the Users Needs, 193
 Boothroyd, M. A., see Rey, W., 773
 Boraas, B. A., Efficacy of Computer Related Services within a Health Sciences Center, 145
 Bowden, K. F., see Standeven, J., 819
 Bowie, J. E., see Young, I. T., 843
 Brdowski, I., Chastang, C., Auclerc, G., Salmon, D., Jacquillat, C. and Weil, M., Prognosis of Hodgkin's Disease: A Factor Analysis Approach, 587
 Brdowski, I., see Salmon, D., 601
 Briggs, R. L., see Cohen, S. N., 889
 Brodli, P., see Henney, C. R., 271
 Broman, S., Structuring Information for Computer-Aided Evaluation of Methods and Results of Medical Care, 449
 Brown, D. J., see Mikolajczuk, A., 787
 Buchness, R., see Estrin, T., 831
 Cabrol, C., see Salmon, D., 601
 Caddick, M. T. and Lee, D. T., The Planning and Control of a Health Care Computing Policy, 39
 Addition, 1000
 Cameron, A. G., see Shires, D. B., 277
 Card, W., Computer Diagnosis Theory + Practice, 1067
 Carlsen, E. N., see Neilsen, I. R., 807
 Carrington, P. J., see Mikolajczuk, A., 787
 Carter, N. W., Griffiths, P. D., Parasitism or Symbiosis? The Problem of Living with the Development of a Computer System in your Laboratory, 109
 Addition, 1007
 Carter, N. W., Griffiths, P. D., White, C. J., Chow, M. C. and Lucas, D. F., Design and Implementation of a Real-time Computer System for Diagnostic Medical Laboratories, 975
 Cassemar, B. and Ramgren, O., Ten Years of an EDP System for Blood Transfusion, 965
 Cederlund, J., Jade, M., Dahlin, H. and Snell, T.-E., An

- Intelligent Remote Batch-terminal for use in Radiotherapy, 1103
- Cederlund, J., Radiotherapy, 1097
- Cellie, A. M., see Jutier, P., 347
- Chastang, C. and Salmon, D., Parenthood Diagnosis, 593
- Chastang, C., see Brdowski, I., 587
- Chavance, M., Goldberg, P. and Samson-Dollfus, D., Spectral and Temporal Analyses Applied to the Study of EEG Reactivity in Children: First Results, 723
- Chavez-Pardo, R., see Cohen, S. N., 889
- Cheng, G. C., Streiff, R. R., Enriquez, P. and Lam, H. T., Quantitative Study of Lymphomas Using Computers, 851
- Chervyakov, M. E., see Kuzin, M. I., 777
- Chow, M. C., see Carter, N. W.², 975
- Chu, W. T., see Neilsen, I. R., 807
- Clamp, S. E., see de Dombal, F. T.², 247
- Clark, D. E., Sharpe, T. C. and Yates, P. O., MUMAS Manchester University Morbid Anatomy System, 943
- Cohen, S. N., Drug Data Handling, 1125
- Cohen, S. N., Armstrong, M. F., Briggs, R. L., Chavez-Pardo, R., Feinberg, L. S., Hannigan, J. F., Hansten, P. D., Hunn, G. S., Illa, R. V., Moore, T. N., Nishimura, T. G., Podlone, M. D., Shortliffe, E. H., Smith, L. A. and Yosten, L., Computer-Based Monitoring and Reporting of Drug Interactions, 889
- Collen, M. F., Improving Health Care Delivery in the Community, 1059
- Collen, M. F., see Terdiman, J. F., 475
- Collis, P. B., see Vickery, D. M., 281
- Cook, M., Introduction of a User-Oriented THIS into a Community Hospital Setting - Nursing, 303
- Crawford, J. W. and Henry, M. J., Intensive Care in the Labour Room, 747
- Crispens, J. E., see Neilsen, I. R., 807
- Crooks, J., see Henney, C. R., 271
- Csoban, G., The System Conception of Medical Information - A General System Model for the Health Care, 487
- Dade, M., see Cederlund, J., 1103
- Dahlin, H., see Cederlund, J., 1103
- Davis, L. S., see Terdiman, J. F., 475
- de Bruijn, W. K., A National Hospital Automation Plan for the Netherlands, 55
Addition, 1000
- Debry, G., see Martin, J. M.¹, 431
- Debry, G., see Martin, J. M.², 927
- de Dombal, F. T. and Horrocks, J. C., Computer-Aided Diagnosis: Conclusions from an Overall Experience Involving 4,469 Patients, 581
Addition, 1070
- de Dombal, F. T., Horrocks, J. C., Clamp, S. E. and Storr, J. E., Simulation Techniques and Computer-Aided Teaching of the Clinical Diagnostic Process: Five Years Experience, 247
- de Heulme, M. and Méry, Ch., REMAID: An Artificial Language for Medical Reports on Computer, 935
- Deliverie, J., see Voirin, H., 239
- de Meester, M., see van Egmond, J.¹, 45
- de Meyer, T. C. H., see Knight, G. J., 363
- de Talens, A. F. P., see Marchesi, C., 739
- de Verdier, C.-H., see Sandblad, B., 983
- Diamond, H. S., Weiner, M. and Plotz, C. M., Computer Simulation of Chart Teaching on the Rheumatic Diseases, 235
- Dinklo, J. A., Confidentiality of Medical Data in the Usage of Databanks, 181
- Dixon, P. J., Communications between Hospitals and Family Doctors, 539
- Douglas, M., see Green, M. V., 827
- Doyon, B., see Goldberg, M., 869
- Dreibholz, K.-J., see Möhr, J. R., 453
- Drouin, P., see Martin, J. M.¹, 431
- Ducrot, H., see Goldberg, M., 869
- Ducrot, H., see Jutier, P., 347
- Dummermuth, G., Numerical EEG Analysis in the Frequency Domain, 713
- Dusserre, L., and Nakache, J. P., Sample Size Problems in Discriminant Analysis, 613
- Ecker, Fr., see Gothier, W., 309
- Effert, S., see Ameling, W., 681
- Effert, S., see Meyer, J., 677
- Elder, J. O., see Macfarlane, D. W., 369
- Elfqvist, B., A Patient Scheduling System, 513
- Elkind, E. Y., see Kalantarov, K. D., 813
- Elsner, J., see Jaross, W., 955
- Emery, J. P., see Goldberg, M., 869
- Emlet, H. and Morris, J. V., Evaluation of a Medical Information System for Appointment Scheduling, 1013
- Enriquez, P., see Cheng, G. C., 851
- Ericsson, et al., The Problem of Privacy in a Computer Based Integrated Health Care Information System, 649
- Estrin, T., Sciabassi, R. and Buchness, R., Computer Graphics Applications to Neurosurgery, 831
- Faria, J. L. da S., Appointments Planification at the Gustav Roussy Institute. A Two Year Experience, 543
- Farrer, J. A., see Harvey, P. W., 523
- Feinberg, L. S., see Cohen, S. N., 889
- Findikyan, N., Laska, E. M. and Bank, R., A Review of the Multi-State Information System for Psychiatric Patients, 357
- Findji, F., Renault, B., Baillon, J. F. and Remond, A., A Mimetic Method of Automatic EEG Analysis: Principle and First Results, 1089
- Fischer, Th., and Hembock, J. M., Data Privacy and Data Security in Kiel KIS, 197
- Fleischli, G., see Gibbons, C., 335
- Forrer, J., see Knight, G. J., 363
- Fragu, P., Patois, E., Huber, C. and Lellouch, J., A Diagnostic Approach of the Hyperthyroidism Diagnosis with Computer, 559
Addition, 1068
- Fraser, T. M., see Shepley, D. J., 467
- Frejaville, J. P., see Goldberg, M., 869
- Freese, J., A Description of the Swedish Data Act, 1037
- Gall, J. E. and Norwood, D., Introduction of a User-Oriented THIS into a Community Hospital Setting -

- Tactical Management Revelations, 121 Addition, 1007
- Garcia-Pena, J. B., see Lozoya, X., 735
- Gardiner, S. W., see Baker, G. J. 323
- Garfield, S. R., A New Ambulatory Health Care Delivery System Model, 481
- Gibbons, C. and Fleischli, G., Use of General Purpose Database Manager for Automation of Ambulatory Medical Care Records: A Feasibility Study, 335
- Gillis, W. R., see Shires, D. B., 277
- Gledhill, V. X., The Medical Synopsis – A Computer Compatible Problem Oriented Record, 425
- Goldberg, M., Santini, C., Doyon, B., Emery, J. P., Graisely, B., Plotkine, M., Vezinet, B., Pignard, P., Frejaville, J. P. and Ducrot, H., A Drug Data Bank: Specific Problems in Connection with the Nature of Informations and Operating Methodology, 869
- Goldberg, M., see Greenburg, A. G., 319
- Goldberg, P., see Chavance, M., 723
- Gonzalez, A., Martinez, R. and Paredes, M. C., Determination of Dose Distribution Using Techniques in Moving Field Therapy, 1109
- Gonzalez-Villalpando, C., see Lozoya, X., 735
- Gothier, W., Ecker, Fr. and Sellmair, P., Implementation of an Inquiry Language for a Medical Data Bank System, 309
- Goupy, F., Hirel, J.-C. and Legrain, M., DIAPHANE: National Data Bank for Kidney Dialysis, 341
- Grab, B., Address by the Representative of the World Health Organisation, XXI
- Grabner, G., see Grabner, H., 375
- Grabner, G., Medical Education through Computer Techniques, 1045
- Grabner, H. and Grabner, G., Aims and Structure of the Vienna General Medical Information System WAMIS, 375
- Gradwell, D. J. L., see Baker, G. J., 323
- Graisely, B., see Goldberg, M., 869
- Green, M. V., Ostrow, H. O., Douglas, M., Myers, R. W., Bailey, J. J. and Johnston, G. S., Scintigraphic Cineangiography of the Heart, 827
- Greenberg, A. G. and Goldberg, M., Information Utilization Monitoring: A Methodology for Data Base Definition, 319
- Gremy, F., Opening Address, XXV
- Gremy, F., see Anderson, J., 207
- Griesser, G., see Straach, H.-P., 533
- Griffiths, P. D., see Carter, N. W.¹, 109
- Griffiths, P. D., see Carter, N. W.², 975
- Grönwall, A., Medical Computing as a Component of Health Care Delivery Systems, XXVII
- Haehn, K. D., see Möhr, J. R., 453
- Hallén, B., Mellner, Ch., Selander, H. and Wolodarski, J., Guide-Lines for Choice of Anaesthesia – A Result of the Computerised Patient Data Base at the Karolinska Hospital, 443
- Handby, J. G., Successful Design Management of Integrated Terminal-Based Medical Systems, 79
- Hanna, W. E., see Mangad, M., 67
- Hannigan, J. F., see Cohen, S. N., 889
- Hansen, P. D., see Cohen, S. N., 889
- Hantak, I., see Kubacek, L., 875
- Harding-Smith, R. H., Priorities of Health Service Computing Development, 33
- Haring, O. M., see Lennie, F. S., 171
- Hartmann, B., The Impact of Computers on Nursing, 305
Addition, 1048
- Hartmann, F., Medical Information System, 1139
- Hartmann, F., What Could and Should Doctors Learn from their Experiences with Computers in Medicine, 1155
- Harvey, P. W. and Farrer, J. A., Investigation of the Work of the Casualty Department by Analysis of a Sample of the Case Notes, 523
Addition, 1064
- Hawkins, R. E. and Norwood, D., Introduction of a User-Oriented THIS into a Community Hospital Setting – Introductory Agents and their Roles, 75
- Haxhe, J. J., see Roger, F. H., 419
- Heart, F. E., Implications of the Computer-Communication Partnership, 21
- Hedley, A. J. and Members of the Steering Committee of the Scottish Automated Follow-up Register, A Community Based National Follow-up Register for Patients Treated for Thyroid Disease, 463
- Heinrich, J.-J., see Jaross, W., 955
- Helmbock, J. M., see Fischer, Th., 197
- Hempenius, K. and Scholtis, R. J. H., The Real-Time Computer: An Essential Tool in the Medical Laboratories of Breda, 949
- Henley, R. R., see LeBeux, P. J., 625
- Henney, C. R., Brodlie, P. and Crooks, J., The Administration of Drugs in Hospital – How a Computer can be used to Improve the Quality of Patient Care, 271
- Hennico, L., see van Egmond, J.¹, 45
- Henry, M. J., see Crawford, J. W., 747
- Henskes, D. T. and Kronick, H. E., Operator Acceptance of Data Entry Devices in Patient Care Areas of a Hospital, 639
- Hercz, L., Laszlo, C. A. and Reesal, M., Data base Organisation and Implementation for a Computerized Pathology Information System, 351
- Hill, A. G. and Townsend, H. R. A., Determining the Patterns of Epileptic Spikes Despite Inefficient Recognition, 731
- Hill, R. D., Sauter, K. and Reichertz, P. L., The Data Bank Concept of the Medical System Hannover and the Analysis of Patient Data, 399
- Hiramatsu, K., see Kabasawa, K., 621
- Hirel, J.-C., see Goupy, F., 341
- Hitchings, D. J., see Taylor, D. E. M., 767
- Hohne, K. H., et al., A Decentralised Computer System for Processing of Information from Heterogeneous Medical Applications, 95
- Horrocks, J. C., see de Dombal, F. T.¹, 581
- Horrocks, J. C., see de Dombal, F. T.², 247
- Huber, C., see Fragu, P., 559
- Hulting, J., see Wigertz, O., 761
- Hunn, G. S., see Cohen, S. N., 889
- Hunt, J. R., see Mikolajczuk, A., 787

- Illa, R. V., see Cohen, S. N., 889
 Isaksson, A., see Zetterberg, L. H., 709
- Jacquillat, C., see Brdowski, I., 587
 Jainz, M. and Wick, P., A Dialogue System for Updating and Displaying Patient Master Records, 313
 Jaross, W., Elsner, J., Heinrich, J.-J. and Penzel, G., Automation of the Clinical Laboratory at the Medical Academy of Dresden, 955
 Jensch, P., see Ameling, W.¹, 681
 Jensch, P., see Meyer, J., 677
 Jimenez, E. M. and Albarran, J. A. P., Data Computer Processing of Specially Designed Discharge Sheets, Experience in Seven Hospitals, 547
 Johnston, G. S., see Green, M. V., 827
 Jones, M. L., see Mikolajczuk, A., 787
 Joos, M., see Roger, F. H., 419
 Jukovsky, V. D., see Kuzin, M. I., 777
 Julius, R. S., Shepley, D. J., 467
 Jutier, P., Valat, M. T., Landre, M. F., Cellie, A. M. and Ducrot, H., Plain Language Medical Records, 347
 Addition, 1054
- Kabasawa, K., Kawamura, N., Kaihara, S. and Hiramatsu, K., Sequential Diagnostic System Based on Reduction Theory, 621
 Kaihara, S., see Kabasawa, K., 621
 Kalantarov, K. D., Mejer, V. P., Scyrokvasin, V. A. and Elkind, E. Y., Computer-aided Processing of Radioisotope Diagnostic Information: Concept and Advances, 813
 Källström, S., Lund G. and Peterson, H., A Planning and Scheduling System for Patient Admission to Surgical Departments, 509
 Addition, 1064
 Kane, S. H., Practical Nomenclature Handling, 923
 Kanon, D., Simulating Waiting Line Problems in a Hospital Setting, 503
 Kästner, V., Booking Systems, 1074
 Kawamura, N., see Kabasawa, K., 621
 Keiding, R., Clinical Laboratory, 1135
 Kennedy, T. C. S. and Moss, N. B., A Computer Assisted Clerical System for Management of Hospital Waiting Lists, 497
 Kenny, D. J., Real Time Computing in a Teaching Hospital: An Assessment of Tactical Approach and Operational Effectiveness, 127
 Addition, 1008
 Knight, G. J., Forrer, J., Wigley, D., de Meyer, T. C. H., The Computerised Medical Information System at the Red Cross Memorial Hospital for Children, 363
 Kohler, C. and Schadewaldt, K., AVAS - General Variable Evaluation System, 407
 Kohout, L., Algebraic Models in Computer-Aided Medical Diagnosis, 575
 Addition, 1069
 Kowalski, C. J., see Walker, G. F., 553
 Kronick, H. E., see Henskens, D. T., 639
 Kubacek, L., Ondrejicka, P., Mikulecky, M. and Hantak, I., The Mathematical Model of the Intermittent Drug Action, 875
- Kuterman, E. M., see Kuzin, M. I., 777
 Kuzin, M. I., Jukovsky, V. D., Kuterman, E. M. and Chervyakov, M. E., The Significance of Automatic Sinus Rhythm Analysis of Patients in the Immediate Post-operative Period, 777
- Lam, H. T., see Cheng, G. C., 851
 Lamson, B., Management Tactics for the Introduction of Computers into Health Care Units, 1005
 Landre, M. F., see Jutier, P., 347
 Lansink, A. G. W., PALGA Automated Archives of Pathological Anatomy in the Netherlands, 329
 Lantorp, K., see Sterner, G., 439
 Larsen, I. A., see Rystrom, L., 633
 Larsen, Jr., K. T., see Vickery, D. M., 281
 Laska, E. M., see Findikyan, N., 357
 Laszlo, C. A., see Hercz, L., 351
 LeBeux, P. J., Henley, R. R. and Blois, M. S., Implementation of a Frame Selection System for a Modular Hospital Information System, 625
 Lee, D. T., see Caddick, M. T., 39
 Lee, H. C., see Weisz, T., 671
 Le Gö, R. J.-P., Automatic Selection of 'Good' Metaphases by Machine, 865
 Legrain, M., see Goupy, F., 341
 Leighton, R. E., Use of an Invoice Processing System for Health Data Acquisition, 517
 Leligdowicz, A., Methodology of Evaluation of Health Information Systems, 167
 Lellouch, J., see Fragu, P., 559
 Lennie, F. S., Ametrano, D. A. and Haring, O. M., Evaluation of an Automated Record Summary for Ambulatory Care, 171
 Addition, 1012
 Liedtke, C.-E. and Tuna, N., Use of Linear Regression Techniques for the Classification of Electrocardiograms, 663
 Lindelöf, B., see Sterner, G., 439
 Litwin, W. and Begon, F., The Impact of Computer on Phonocardiograms Interpretation, 693
 Lozoya, X., Gonzalez-Villalpando, C., Garcia-Pena, J. B., Solis-Camara, V. P. and Parra-Covarrubias, A., Neuroendocrine Phenoma During Human Sleep I. The EEG Band Analysis, 735
 Lucas, D. F., see Carter, N. W.², 975
 Lund, G., see Källström, S., 509
- Macfarlane, D. W., Shanbeck, L. J. and Elder, J. O., An Automated Patient Profile as an Aid in Co-ordinating Multi-disciplined Medical Care for Handicapped Children, 369
 Mangad, M. and Hanna, W. E., Computers and Health Insurance Models, 67
 Marchesi, C., de Talens, A. F. P. and Maseri, A., ECG and Pressure Waveform Monitoring in CCU by a Module-structured Software, 739
 Martin, J., see Martin, J. M., 927
 Martin, J., see Mur, J.-M., 289
 Martin, J. M., Debry, G., Drouin, P. and Vernhes, G., Medical Results of Computing 2,000 Diabetes Case Records, Revision of Some Present Concepts, 431

- Martin, J. M., Debry, G., Martin, J. and Viard, D., Use of a Lexicon in Diabetology. Interest of Determination of the Frequency of the Clinical Terms Used, 927
- Martin, J. M., see Mur, J.-M., 289
- Martinez, R., see Gonzales, A., 1109
- Maseri, A., see Marchesi, C., 739
- Matell, G., see Wigertz, O., 761
- Mejer, V. P., see Kalantarov, K. D., 813
- Mellner, C., see Hallén, B., 443
- Members of the Steering Committee of the Scottish Automated Follow-up Register, see Hedley, A. J., 463
- Mery, Ch., see de Heaulme, M., 935
- Meyer, J., Jensch, P., Effert, S. and Ameling, W., A New Program for the Automatic Analysis of Cardiac Catheterisation Data, 677
- Meyer, J., see Ameling, W., 681
- Michat, L., see Salmon, D., 601
- Mikolajczuk, A., Bailey, J. S., Brown, D. J., Carrington, P. J., Hunt, J. R., Jones, M. L., Morgan, D. G., Preston, T. D., Stafford, M. and Stevens, A. J. M., Three Years of Experience with Computer-Assisted Patient Monitoring, 787
Addition, 1095
- Mieth, I., The Structure of a Result Data Record for Clinical Chemistry, 979
- Mikulecky, M., see Kubacek, L., 875
- Moffet, C. L., see Vallbona, C., 1141
- Möhr, J. R., Haehn, K. D. and Dreibholz, K.,-J., Analysis and Standardization of the Activities of the General Practitioner in Preparation for a Computer-Oriented Information System, 453
Addition, 1062
- Moore, T. N., see Cohen, S. N., 889
- Morgan, D. G., see Mikolajczuk, A., 787
- Morgan, T. W., see Vickery, D. M., 281
- Morris, J. V., see Emler, H. E., 1013
- Moss, N. B., see Kennedy, T. C. S., 497
- Mur, J.-M., Martin, J. M., Martin, J. and Benamghar, L., Doctors Training for Medical Computing in a Hospital. Five Years of Progressive Experimental Management, 289
- Myers, R. W., see Green, M. V., 827
- Myrdal, A., Science, Secrecy and Power, XIV
- Nakache, J.-P., see Dusserre, L., 613
- Nakayama, T., Privacy - Confidentiality, 1029
- Neal, L. R., Computer Techniques for Retrospective Analysis, 435
- Nielsen, I. R., Slater, J. M., Crispens, J. E., Chu, W. T. and Carlsen, E. N., An Interactive Computer Ultrasound System for Radiation Treatment Planning, 807
- Nelander, O., Plenary Session - Opening Address, XIX
- Newble, G. M., see Standeven, J., 819
- Nijssen, G. M., Present and Future Possibilities of Data Base Technology, 1
- Nishimura, T. G., see Cohen, S. N., 889
- Norwood, D., Economic Evaluation of Total Hospital Information System, 149
Addition, 1011
- Norwood, D., Introduction of a User-Oriented THIS into a Community Hospital Setting - Introduction and System Description, 295
- Norwood, D., see Gall, J. E., 121
- Norwood, D., see Hawkins, R. E., 75
- Nygards, M.-E., see Wigertz, O., 761
- O'Beirne, H., see Shepley, D. J., 467
- Ogilvie, J. C., see Shepley, D. J., 467
- Oliva, E., see Tognini, G., 889
- Olsen, J. S., Teaching the Computer to Make Decisions - A Method, 565
- Ondrejicka, P., see Kubacek, L., 875
- Orloff, S., see van Egmond, J. I., 45
- Osborn, J. J., see Beaumont, J. O., 781
- Osher, W. J., see Vallbona, C., 1141
- Ostling, G., see Sandblad, B., 983
- Ostrow, H. O., see Green, M. V., 827
- Otte, M., see Thurmayr, R., 607
- Pages, J.-C., Education of Health Staff in Computing, 1043
- Pages, J.-C., see Anderson, J., 207
- Palti, Y., Computer Aided Teaching of Biophysics, Physiology and Pharmacology, 267
- Paredes, M. C., see Gonzales, A., 1109
- Parra-Covarrubias, A., see Lozoya, X., 735
- Pastor, M. V. Z., Alonso, J. R. M., Vidal, J. T. and Berrocal, J. O., Comparison of Several Digital Filtering Techniques Applied to Anger Camera Images, 837
- Patois, E., see Fragu, P., 559
- Pau, L. T., Sequencing Laboratory Tests for Improved Sequential Diagnosis, 569
- Pedrazzi, M., see Tognini, G., 895
- Pengov, R. E., A Modularly-Designed Computer-Assisted Instruction Reporting System (CAIRS), 253
- Penzel, G., see Jaross, W., 955
- Penzel, G., see Schmincke, W., 381
- Peterson, H., Improving Patient Administration in Hospital, 1063
- Peterson, H., A Password Oriented Privacy System for Stockholm County, 645
Addition, 1074
- Peterson, H., Training and Follow-up of Hospital Personnel in the use of EDP at Stockholm County, 233
Addition, 1044
- Peterson, H., see Källström, S., 509
- Peterson, H., see Sterner, G., 439
- Peumans, W., Medical Computer Applications in Daily Practice by an Independent Group of Belgian Physicians, 85
Addition, 1007
- Pignard, P., see Goldberg, M., 869
- Plaszczynski, R. J., Non-Invasive Acquisition of Additional Information for Cardiac Monitoring with Computing Facilities, 755
- Plotkine, M., see Goldberg, M., 869
- Plotz, C. M., see Diamond, H. S., 235
- Pocklington, P. R., The Necessity for, Requirements of, and Basic Design of a General Data Interpretation and Evaluation System (DIES), 411
- Podlone, M. D., see Cohen, S. N., 889
- Pöpl, B. S. J., Testing Computer Allocation Rules for Automatic EEG Classification, 1079

- Pratt, A. W., *Medicine and linguistics*, 5
 Pratt, A. V., *Medical linguistics*, 1133
 Preston, T. D., see Mikolajczuk, A., 787
 Preuss, L. G., *Image Processing*, 1117
 Prewitt, Judith M. S., *The Role of Image Processing in Medical Informatics*, 1119
- Ramgren, O., see Cassemar, B., 965
 Reesal, M., see Hercz, L., 351
 Reichertz, P. L., *Methodology of Health Database Development*, 1053
 Reichertz, P. L., see Hill, R. D., 399
 Reichertz, P. L., see Rosenkranz, K. O., 883
 Remond, A., *Signal Analysis*, 1077
 Remond, A., see Findji, F., 1089
 Renault, B., see Findji, F., 1089
 Rey, W., Bernard, R., Vainsel, H. and Boothroyd, M. A., *On-line Arrhythmia Monitoring with an Intra-atrial Electrode*, 773
 Richards, B., et al., *Computerisation of a Programmed Investigation Unit*, 529
 Roger, F. H., Joos, M. and Haxhe, J. J., *An Automated Medical Record Summary for a Co-ordinated Inter Hospital System*, 419
 Roger, F. H., see van Egmond, J.¹, 45
 Rosenberg, B., see Sheiner, L. B., 901
 Rosenkranz, K. O. and Reichertz, P. L., *DAVID - A Dialogsystem for Acquisition and Validation of Information on Drugs*, 883
 Rystrom, L., Andersen, J. D. and Larsen, I. A., *A Man-Machine Communication System for the Clinical Environment*, 633
- Salmon, D., Brdowski, I., Michat, L. and Cabrol, C., *Computer Aided Prognosis in Early Post-Operative Terms for 139 Cases of Starr-Edwards Prostheses*, 601
 Salmon, D., see Brdowski, I., 587
 Salmon, D., see Chastang, C., 593
 Samson-Dollfus, D., see Chavance, M., 723
 Sandblad, B., Ostling, G., Schneider, W., Schutt, T. and de Verdier, C.-H., *Mathematical Modelling for Efficiency Studies of Clinical Chemical Laboratories*, 983
 Santini, C., see Goldberg, M., 869
 Sauter, K., see Hill, R. D., 399
 Sayers, B. McA., *The Analysis of Biological Signals*, 13
 Schade, C. P., see Vallbona, C., 1141
 Schadewaldt, K., see Kohler, C., 407
 Schmincke, W. and Penzel, G., *Patient Oriented Information Processing*, 381
 Schneider, W., *Panel on Confidentiality and Security*, 1040
 Schneider, W., *Requirements for Hardware and Software in Medicine*, 1073
 Schneider, W., see Sandblad, B., 983
 Scholes, M., *Education of Health Staff in Computing*, 213
 Scholtis, R. J. H., see Hempenius, K., 949
 Schutt, T., see Sandblad, B., 983
 Sclabassi, R., see Estrin, T., 831
 Scyrovkashin, V. A., see Kalantarov, K. D., 813
 Selander, H., see Hallén, B., 443
 Seldrup, J., *Computer Assisted Epilepsy Survey*, 879
 Addition, 1125
 Sellmair, P., see Gothier, W., 309
 Shanbeck, L. J., see Macfarlane, D. W., 369
 Sharpe, J., *Towards a Methodology for Evaluating New Uses for Computers*, 137
 Sharpe, T. C., see Clark, D. E., 943
 Sheiner, L. B. and Rosenberg, B., *Individualizing Drug Therapy with a Feedback-Responsive Computer System*, 901
 Shepley, D. J., Fraser, T. M., Julius, R. S., O'Beirne, H., Ogilvie, J. C. and Valberg, L. S., *A Health Information System for Ten Million People*, 467
 Shires, D. B., Cameron, A. G., Acres, J. C., Steeves, L. C. and Gillis, W. R., *MARS and the Family Doctor*, 277
 Shortliffe, E. H., see Cohen, S. N., 889
 Slack, W., *Impact of Medical Computing on Medical Practice and People*, 1047
 Slamecka, V., *Objectives and Strategies for the Health Information Sciences*, 29
 Slater, J. M., see Neilsen, I. R., 807
 Smets, P., *External Product for P Wave Detection in Noisy Signal*, 659
 Smith, L. A., see Cohen, S. N., 889
 Snell, J.-E., see Cederlund, J., 1103
 Solis-Camara, V. P., see Lozoya, X., 735
 Sorensen, C., *The Relative Costs of Traffic Casualties*, 493
 Speck, C. D., see Vallbona, C., 1141
 Stafford, M., see Mikolajczuk, A., 787
 Standeven, J., Bowden, K. F. and Newble, G. M., *A Computer Controlled Radioisotope Scanner*, 819
 Stark, R. E., see Vickery, D. M., 281
 Steeves, L. C., see Shires, D. B., 277
 Sterner, G., Lantorp, K., Lindelöf, B. and Peterson, H., *A Computer-based System for Preparation of Annual Medical Reports*, 439
 Stevens, A. J. M., see Mikolajczuk, A., 787
 Storr, J. E., see de Dombal, F. T.², 247
 Straach, H.-P. and Griesser, G., *Interaction of a Hospital Information System with a Regional Sickness Fund Information System*, 533
 Streiff, R. R., see Cheng, G. C., 851
 Stutman, J. J., *Two New Curricula in Medical Computer Science*, 223
 Sudarikov, L. G., *The Elaboration of Computerised Systems for the Management of Public Health Establishments*, 51
 Addition, 1000
 Swenne, C. A., et al., *A Trainable System for CCU Monitoring*, 795
- Talmon, J. L. and van Bommel, J. H., *Modular Software for Computer-Assisted ECG/VDG Interpretation*, 653
 Tannebaum, R. S., *Undergraduate Computer Science Education for Medical Computer Science Majors and Other Allied Health Personnel*, 229
 Taylor, D. E. M., Whamond, J. S. and Hitchings, D. J., *A Probabilistic Approach to Patient Monitor Alarm Systems*, 767
 Addition, 1095

- Temmerman, G. A. R., The Use of a Computer in General Practice: Basic Principles and Two Examples, 459
Addition, 1062
- Terdiman, J. F., van Brundt, E. E., Davis, L. S. and Collen, M. F., A Pilot Computer System for Health Care Delivery to a Community, 475
- Thomas, A. W., Experience with an On-line Patient Information System, 391
- Thome, R., Protection and Confidentiality of Medical Data I: Efficient Data Protection Through Project Specific Combination of Methods, 189
- Thurmayr, G. R., see Thurmayr, R., 607
- Thurmayr, R., Otte, M. and Thurmayr, G. R., Computer Aid for Diagnosing Pancreatic, Hepatic and Gastric Diseases by Pancreatic Function Test, 607
Addition, 1070
- Timonin, V. M., Some Aspects of Optimization of the Public Health Management of a Large City from the Position of a System Analysis, 471
- Tognini, G., Andreani, A., Pedrazzi, M. and Oliva, E., SIF: A Drug Information System for an Italian Community Hospital, 895
Addition, 1126
- Tornkvist, G., see Wigertz, O., 761
- Townsend, H. R. A., see Hill, A. G., 731
- Tuna, N., see Liedtke, C.-E., 663
- Tyler, C. R., Approaches to Hospital Information Systems, 89
- Vainsel, H., see Rey, W., 773
- Valat, M. T., see Jutier, P., 347
- Valberg, L. S., see Shepley, D. J., 467
- Vallbona, C., Schade, C. P., Baker, R. L., Beggs-Baker, J., Moffet, C. L., Speck, C. D. and Osher, W. J., Computer Support of Medical Decisions in Ambulatory Care, 1141
- van Bommel, J. H., see Talmon, J. L., 653
- van Brundt, E. E., Methodology of Evaluating Health Information Systems, 1009
- van Brundt, E. E., see Terdiman, J. F., 475
- van Egmond, J., de Meester, M., Hennico, L., Orloff, S., Roger, F. H. and Willems, J., Belgian Inter-University Project on Computerization of the Medical Record Supported by the Belgian Government, 45
- van Egmond, J. and Wieme, R., Systematized Codification of Medical Diagnostic Statements, 931
- Vernhes, G., see Martin, J. M.¹, 431
- Vezinet, B., see Goldberg, M., 869
- Viard, D., see Martin, J. M.², 927
- Vickers, M. D. and Wolfenden, K., Time-Sharing as a Method of Providing Computing Power to the Smaller Hospital, 59
Addition, 1001
- Vickery, D. M., Morgan, T. W., Larsen, Jr., K. T., Collis, P. B. and Stark, R. E., Computer Support of Paramedical Personnel: The Question of Quality Control, 281
- Vidal, J. T., see Pastor, M. V. Z., 837
- Voirin, H. and Delerive, J., Study of Computer Assisted Instruction of Medical Biochemistry: The Use of A. P. L. in the Analysis of Chemical Formulas and Managing of Students' Results, 239
- Wagner, G., Experience with Computer Based Medical Information Systems, 1055
- Walker, G. F. and Kowalski, C. J., Computer Aided Diagnosis of Craniofacial Abnormalities, 553
- Walker, J. E., see Young, I. T., 843
- Warner, H. R., et al., HELP - A Self-Improving System for Medical Decision Making, 989
- Wasserman, A. I., see Blois, M. S., 217
- Watson, R. J., Medical Staff Response to a Medical Information System with Direct Physician-Computer Interface, 299
Addition, 1047
- Weil, M., see Brdowski, I., 587
- Weiner, M., see Diamond, H. S., 235
- Weisz, T. and Lee, H. C., A Hybrid System for On-Line Analysis of Composite Bio-Electric Potentials, 671
- Wennberg, A., see Zetterberg, L. H., 709
- Whamond, J. S., see Taylor, D. E. M., 767
- White, C. J., see Carter, N. W.,², 975
- White, D., Policy for Introducing Computers into Health Services, 995
- Wick, P., see Jainz, M., 313
- Wieme, R., see van Egmond, J.², 931
- Wigertz, O., Blomqvist, P., Hulting, J., Matell, G., Nygard, M.-E. and Tornkvist, G., A Computer-Based System for Continuous ECG Monitoring, 761
- Wigley, D., see Knight, G. J., 363
- Willems, J., see van Egmond, J.¹, 45
- Willems, J. L., Computer Determination of Non-Invasive Measures of 'Myocardial Contractility' on the Apex-cardiogram, 687
- Wingert, F., Word Segmentation and Morpheme Dictionary for Pathology Data Processing, 915
- Wolfenden, K., see Vickers, M. D., 59
- Wolodarski, J., see Hallén, B., 443
- Wolters, H.-G., Implications of Introducing Computers into Health Services for Privacy of Medical Information, 1031
- Yanez, L. M., Introduction of a User-Oriented THIS into a Community Hospital Setting - Confidentiality and Security, 201
- Yates, P. O., see Clark, D. T., 943
- Yosten, L., see Cohen, S. N., 889
- Young, I. T., Walker, J. E. and Bowie, J. E., An Analysis Technique for Biological Shape - I, 843
- Zajicek, G., Image Analysis of Rat Liver Histological Sections, 861
- Zemanek, H., Welcoming Address to Medinfo, XXIII
- Zeraffa, J., From the Prototype to the Realisation. An Application of the Sinbad Programs to Poison Centres Data, 387
- Zetterberg, L. H., Isaksson, A. and Wennberg, A., An Operating System for Computer Analysis of EEG, 709

SUBJECT INDEX

- Anaesthesia, 443, 444, 447
 A. P. L. (A Programming Language), 239, 240, 242, 243
 Apexcardiogram (ACG), 687, 688, 691
 ARPA Network, 22, 24, 25, 26
 Assembler Language, 407, 415, 417, 544, 739, 740, 749, 870
 Audit and Quality Control, 281-287, 435, 439
- Bayes Theory, 560, 581, 583, 595, 599, 621, 623, 767, 770
- Cardio-thoracic Department, 102, 104, 107, 767
 Casualty and Emergency Department, 523
 Catheter Laboratory, 677, 681, 683, 684, 685
 Charing Cross Hospital (U. K.), 59, 60, 61
 Clinical Chemical Laboratory, 959, 960, 963, 979, 981, 983-987
 Clinical Laboratories, 59, 85, 86, 128, 129, 130, 133, 156, 955, 969, 989
 COBOL, 2, 3, 146, 337, 358, 373, 394, 395, 419, 422
 CODASYL, 2, 3, 4, 323, 324, 376
 Computer Aided Diagnosis, 553, 559, 569, 570, 575, 581, 584, 601, 607, 613, 767, 769, 1067
 Communications systems, 21, 90, 633
 - Network, 307
 - -, Real-Time, 89
 Computer Assisted Evaluation, 449
 - - Instruction (CAI), 231, 233, 235, 236, 237, 238, 239, 253, 256, 257, 263, 267, 497
 Computer Networks, 22-27, 57, 90, 91, 93, 94, 96, 99, 111, 146, 329-331, 535
 Confidentiality of Data, 87, 181, 183, 186, 187, 194, 197, 201, 204, 205, 476, 649, 652, 873, 1001, 1031, 1037
 Coronary Care Unit, 102, 104, 105, 106, 633-635, 681, 682, 739-744, 761, 763, 773, 788, 795, 990
 Costing (Systems), 36, 493, 533, 1098
- Data Acquisition, 109, 111, 517-521, 639
 - Analysis Evaluation, 67, 400, 401, 412, 413, 423, 429, 960, 961
 Databank, 31, 32, 36, 181-187, 193, 233, 330-333, 341, 343, 376-378, 381, 387-390, 399-403, 409, 468, 469, 514, 554, 645-648, 873, 885-888, 897
 Database, 1-4, 30, 31, 46, 53, 57, 69, 70, 71, 73, 89, 98, 99, 147, 194, 198, 199, 260, 282, 285, 295, 309-311, 319-323, 325-327, 336-339, 347, 351-353, 365, 367, 373, 399, 403, 408, 413, 419, 423, 424, 426, 435, 443, 447, 449, 450, 452, 475-479, 494, 536, 537, 547, 555, 626, 650, 652, 744, 773, 774, 870, 871, 873, 885, 886, 889
 - , Drug, 326, 869, 886, 891-893
 - , Management System, 2, 309, 327, 335, 375, 478, 1005
 - , Organisation, 351
 - , Specification, 450
 - , Structure 82, 222, 326, 358, 393, 898
 - , System, 309, 310, 311
 Data Collection, 127, 278, 279, 281, 283, 286, 509, 634, 750, 787, 823, 826, 870, 897, 959, 960, 963, 991, 992
 - Processing, 63, 64, 65, 110, 256, 293, 407, 432, 435, 523, 524, 547, 548, 593, 681, 718, 869, 870, 872, 915, 953, 960, 979,
 - Retrieval, 358, 477, 625, 634, 651
 - Security, 95, 189, 190, 193, 194, 195, 197, 198, 201, 202, 336, 544, 645-648
 Decision Table, 565-566, 571
 Department of Health and Social Security (U.K.), 59, 61, 127, 137, 138, 140, 141, 157, 161, 305, 323, 324, 532, 801, 804, 976
 Diabetes, 431-433, 927, 928
 Diagnosis, see Computer Aided Diagnosis
 Digitalis Therapy, 902-906, 909-913
 Discharge Summary, 46, 171, 419, 547
 Display of Data, 101, 299, 625, 639, 681, 787, 843, 865
 Discriminant Function Analysis, 553-557, 601-605, 607, 608, 613-619, 719
 - - -, Non-linear, 609-611
 Drug Dosage, 427, 630, 631, 901, 902, 906, 909, 910
 Drug Information System, 271-276, 869, 878, 883-885, 889, 895, 896, 898, 1125
 - Interactions, 274, 276, 889-894, 895, 897, 901
 - Therapy, 883, 884, 895, 896, 901
- ECG, 16, 87, 119, 367, 423, 455, 456, 634, 635, 636, 653, 654, 656, 663-668, 677, 684, 685, 687, 688, 694, 702, 703, 739-743, 747, 755-759, 761-766, 768, 773-777, 783, 795, 796, 827, 828, 989, 990, 991
- Education, Medical Informatics, 207, 213, 217, 229, 289, 1043, 1045
 EEG, 17, 18, 417, 709, 710, 713-723, 725, 727, 728, 731, 735, 736, 738, 834, 835, 1077
 El Camino Hospital (USA), 76, 121, 123, 134, 149, 150, 154, 201, 204, 205, 295, 296, 299, 301, 303, 304
 Electronic Data Processing (EDP), 40, 63, 65, 135, 233, 369, 375, 381, 391, 395, 397, 407, 453-455, 475, 633, 535, 537, 681, 645, 965, 967
 EMG, 14-16, 705-707
 Epilepsy, 731, 733, 879-881
 Evaluation, XXVIII, 145, 149, 155, 407, 411, 449, 459, 959, 1009-1011
 Excerpta Medica Databank, 86, 330, 331, 460

- Exeter Community Health Services Computer Project, 81
 Extended Data Management System (EDMS), 324–326
- Factor Analysis, 587–592, 601, 722
 Fast Fourier Transform (FFT) Procedure, 713, 714, 816, 838, 843–848, 865
 Filtering Techniques, 17, 18, 837
 Follow-up Register, 463
 FORTRAN, 2, 3, 146, 224, 267, 321, 334, 337, 343, 349, 358, 419, 423, 525, 597, 613, 633, 637, 654, 656, 710, 739, 740, 775, 866, 870, 910, 943, 945, 946, 961
- General Practitioner, 80, 82, 86, 87, 181, 182, 184, 186, 209, 218, 335, 453, 454, 457, 459–466, 539–541
- Haematology, 59, 61, 161
 Health Care, 39, 45, 113, 127, 133, 135, 141, 145, 146, 281, 296, 487, 489, 481–485, 517–519, 534, 535, 537, 894–896, 991
 – Information Science, 29, 32
 – Record, XXVIII, 277–279
 – Services, 33, 34, 39, 40, 305, 487–490, 509, 523, 801, 979
 – System, 335, 534, 535
 H-ICDA, 46, 420–423, 519, 520, 931
 HIS (Hospital Information System), 56, 57, 89, 476–478, 533, 625, 631
 Hodgkin's Disease, 581, 588, 857
- ICD, 6, 366, 401, 409, 439, 440, 453, 454, 526, 536, 923, 931
 ICDA, 6, 353–356, 372
 IFIP, 208, 209, XXV
 Image Processing, 819, 827, 831, 837, 843, 851, 865, 1119–1124
 Information, Medical, 289, 290, 293, 927, 935, 949
 Information Processing, 125, 381
 Information Systems, 1, 125, 233, 277, 290, 292, 303, 321, 351, 356–361, 387–391, 394, 397, 439, 453, 467, 468, 509, 645, 646, 649, 651
 Information Systems, Management, 1, 399, 790
 Information Systems, Medical, 76, 125, 149, 201, 203–205, 218, 219, 295–304, 319, 320, 363, 366, 375, 475–479, 487, 497, 499–502, 884, 969
 Intensive Care Unit, 102, 105, 106, 681–685, 747, 756, 759, 767, 781, 783, 784, 787, 991
 Invoice Processing, 517
- Karolinska Hospital (Stockholm), 101, 443–447, 514, 709, 710
 Kidney Dialysis, 341
 Kinesiology, 263–265
 King's College Hospital (UK), 46, 540
- Laboratory, 85, 96, 109, 239, 529, 949, 955, 959, 969, 975, 983, 1135, 1151
- Linguistics, Medical, 5, 915, 923, 931, 935, 943, 1133, 1155
 LOLA, 2
 London Hospital Project, 127, 128, 155, 157, 161, 164, 213, 214
 Lymphoma, 851–853, 865
- Management (Policy), 1, 53, 55, 69, 123, 137, 471, 481, 487
 Management Information Systems, see Information Systems
 Mecanograms, 700–703, 758
 Medicaide/Medicare, 67, 68, 482, 517–521
 Medical Information Systems, see Information Systems
 Medical Record, 45–47, 116, 282, 286, 287, 291, 347, 364, 382, 291, 395–397, 411, 412, 419, 421, 425–431, 435, 436, 464, 476, 477, 494, 547, 548, 551, 879, 897, 932
 MEDLARS, 6, 25, 30
 MESH, 6
 Microbiology, 59, 61
 Mini-computer, 36, 146, 279, 366, 367, 650, 728, 729, 765, 967
 Multivariate Analysis, 601
 MUMPS, 86, 282, 892, 894, 898, 943
- National Board of Medical Ethics (Belgium), 85
 National Health Service (UK), 33, 41, 43, 44, 60, 137–139, 141, 156, 161, 306, 308, 804
 NCEPMS (National Computerised Economic Planning and Management System), 51, 53
 Nursing, 303, 305, 385, 1049
 NZR (Netherlands), 55, 56
- On-Line Systems, 36, 40, 63, 203, 205, 222, 247, 256, 347, 375, 391, 395, 397, 412, 414, 415, 475, 567, 671, 681, 747, 749, 755, 773, 807–809, 894, 969, 989
- PALGA, 329–334
 Pancreatic Function Test, 608, 697
 Pathology, 7, 9, 10, 59, 61, 351–355, 395, 915, 943–945, 947
 Pattern Recognition, 569, 731, 733, 797
 Pediatrics, 363, 369
 Phonocardiograms, 687, 688, 693–703, 756
 Poisons, 387
 Problem Oriented Record, 425, 459
 Psychiatry, 357
 Public Health, XXI, 51, 471, 475, 481, 487, 995, 1059, 1141
 Purinor Therapy of Liver Diseases, 876, 877
 P-Waves, 654, 659–666, 762, 766, 773, 775
- QRS-Complex, 18, 655, 656, 659, 663, 665, 666, 678, 679, 688, 693, 695, 702, 740, 755, 761–766, 773, 775, 778, 795–798
 Quality Control, 281, 683, 959

- Radio-isotope Scanner, 819–826
 Radiotherapy, 801, 804, 807–811, 1097, 1107
 Real-Time System, 34, 36, 38, 40, 89, 96, 97, 101, 102, 110, 127, 128, 130, 145, 206, 214, 233, 256, 295, 308, 367, 394–396, 459, 475, 513, 514, 543–545, 625, 671, 728, 729, 747, 749, 761, 773, 775, 820, 943, 945, 949, 950, 975, 976
 Reduction Theory, 621–623
 RIS (Regional Information System), 57
 Regression, Linear, 663, 666, 668, 690, 691
 R-R Interval, 677, 763, 777, 778, 795, 798, 829
 R-Wave, 655, 741, 761, 762, 827, 828
- Security, 184, 189, 193, 197, 645, 1029
 Semantics, 5–10, 626, 629, 871, 872, 915–920, 936, 938, 940
 Signal Analysis, 13, 1077
 – Noise, 659–662, 671–674, 693, 694, 696, 699, 705–707, 731, 732, 733
 Signals, Biological, 13–20, 45, 731, 740, 743, 865
 Simulation (Modelling), 69, 73, 146, 247, 248, 250–252, 337, 473, 498, 503–506, 960, 983
 SNDO, 6, 429, 923
 SNOM, 372, 373, 925
 SNOP 7, 9–11, 330, 331, 333, 353, 354, 356, 373, 915–921, 923–925, 943, 989, 992
 Social Security Administration (SSA) (USA), 67, 69–73
 Soft Tissue Sarcomas, 435–437
 Spectral Analysis, 709–718, 723, 726–728, 735, 777, 778
 Stochastic Point Process, 19
 Syntax, 5, 7, 94, 290–292, 311, 347, 626, 629, 915, 917, 936, 940, 973
 – Operator, 932, 933, 936
 System Analysis, 471, 548, 961
- Thalassemia 556, 557
 THIS (Total Hospital Information System), 75, 76, 121, 123, 149, 201, 295, 303, 955, 957
 Thyroid Disease, 463–466, 559, 560, 770
 Time-Sharing (Computer), 59
 Training Programme, 167, 207, 213, 217, 223, 233, 1044
 T-Wave, 663, 741, 762
- Variability, Coefficient of, 15, 16
 Variance, Analysis of, 15, 16, 719
 VCG, 653, 654, 656, 659–667, 795
- Waiting Lists, 497–505, 510, 111, 529–531
 WAMIS, 375, 969
 WEILAB, 375, 969–974
 WHO, XXI, 439–441
 Wyandotter General Hospital Michigan, 118
 Wythenshawé Hospital, 101, 102, 107