PROCEEDINGS from the international meetings on

Automated Data Processing
in Hospitals

in Elsinore, Denmark, april - maj 1966
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which were not delivered as a manuscript, just as a few very long con-
tributions have been abridged. We hope that the authors will forgive us
these omissions and restrictions. Time, money and the extent have ne-
cessitated these interferences.

At the opening of the symposium I inquired about a model for the medical
information system. If papers and discussions had been co-operated better,
the answer to this inquiry would probably have been more clear. However,
it might have been too early to have this model defined. Still, we do
not know enough about the medical information to be able to lay down
the interaction. Though, the impression is that the Elsinore conference
has helped us very much to understand the content and the interactions
in the medical information.

The medical data processing is in an epoch age. Earlier age's groping
and limited experiments must now be replaced by a determined work. Doc-
tors, nurses and the national health administration have a very great
demand of the data processing technique, and it must be the job of the
EDP-system people to fulfil the demand which is claimed from these so
important activities, seen from a social point of view.

The Elsinore meetings clarified much for us. But they did not give us any
occasion to rest on the achieved results. The manuscripts published give
us a survey of our knowledge of to-day, and we are grateful to the per-
sons who through work and intelligence have brought us so far. Now we
are, however, all going to work to obtain the more perfect results.

Hereby my thanks to all who participated.

Copenhagen, August 1966.

Erling Dessau.
Organization Committee:

Dr. A. Tybjaerg Hansen  
Professor of Internal Medicine,  
Rigshospitalet, Copenhagen B, Denmark

Mr. E. Dessau  
Head of Mathematical and Statistical Department,  
Datacentralen, Copenhagen S, Denmark

Dr. J. Mosbech  
Medical Consultant, Statistical Section,  
National Health Service of Denmark, Copenhagen

Dr. P. E. Andersen  
Senior Physician, Odense County and City Hospital, Odense, Denmark

Dr. V. Oram  
Head of Surgical Department, Århus Municipality Hospital, Denmark

Mr. Åke Pernelid  
Director-in-Chief, National Swedish Rationalisation Agency, Stockholm, Sweden

Mr. Gillis Claus  
Director, SJURA, Stockholm, Sweden

Dr. F. Hall  
Senior Physician, Karolinska Sjukhuset, Stockholm, Sweden

Dr. T. Hauen  
Senior Physician, National Board of Health, Oslo, Norway

Dr. J. F. Davis  
Director, International Institute for Medical Electronics and Biological Engineering, Paris, France

Wednesday 20th April

Opening of the conference  
The president, Prof. A. Tybjaerg Hansen.  
Opening address by the Danish minister of education: Mr. K. E. Andersen.

The role of computers in the hospital - the interface problems in medical and administrative patient management.  
Chairman: E. Dessau

A. Tybjaerg Hansen  
Professor, Rigshospitalet, Univ. of Copenhagen

Aksel Marchmann  
Vice-director, Copenhagen County Hospital Administration.

On the Requirements for Information Systems in Hospitals  
Charles D. Flagle  
Professor, Johns Hopkins Univ., Baltimore, USA.

Time-Sharing a Computer for Processing Patient Data direct from Transducers at the Bedside  
Homer Warner  
M.D., Ph. D., Univ. of Utah, Salt Lake City.

The Role of Computers in the Hospital  
Lee D. Lusted  
Professor of radiology, Univ. of Oregon, Portland.

The Computer in the National Health Service  
Henry Yellowlees  
M.D., Ministry of Health, London

Thursday 21st April

Analog-Digital Data Processing; Hybrid Systems.  
Chairman: Professor H. Warner

Antoine Rémond  
M. D., La Salpêtrière, Paris

A Digital Computer for the Management and Study of the Critically Ill  
Max H. Weil  
M.D., Ph. D., Univ. of Southern California, Los Angeles

Hybrid Approaches to a Hybrid World  
Josiah Macy Jr.  
Professor, Yeshiva University, New York.

Analyses of ECG and EEG.  
Spectral Analysis Techniques and Pattern Recognition Methods for Electroencephalographic Data
Organization Committee:

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Professor of Internal Medicine,
Rigshospitalet, Copenhagen B, Denmark

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Dr. F. Hall
Senior Physician, Karolinska Sjukhuset,
Stockholm, Sweden

Dr. T. Hauen
Senior Physician, National Board of Health,
Oslo, Norway

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Director, International Institute for Medical
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Analyses of ECG and EKG

Spectral Analysis Techniques and Pattern
Recognition Methods for Electroencephalographic
Data
Friday 22nd April
Chairman: Dr. A. Rémont

W. Ross Adey
Professor, Univ. of California, Los Angeles
Computer Analysis of Medical Signals in Hospital Practice
G. A. Caceres
M.D., Public Health Service, Washington, D.C.
Computer Classifications of Electrocardiograms
Hubert Pipberger
Professor, V.A. Hospital and Georgetown Univ., Washington, D.C.

Friday 23rd April
Chairman: Professor A. Tybjaerg Hansen

Professor, M.D., Deutsches Krebsforschungszentrum Heidelberg

Computer Aid for Hospital Planning
James Sounder
M.D., Bolt Beranek and Newman Inc., Van Nuys

Input and Output Hardware
J. F. Davis
M.D., International Institute for Medical Electronics and Biological Engineering, Paris

The Feasibility of Automated Data Processing in Hospitals
Erling Dessau
Cand. Polit. Mathematical and Statistical Dept. Datacentralen, Copenhagen

The Computer in our Modern Hospitals
Paul Hall
M.D., Karolinska Sjukhuset, Stockholm

Closing of the conference.
Friday 22nd April
Chairman: Dr. A. Raymond

W. Ross Adey
Professor, Univ. of California, Los Angeles

Computer Analysis of Medical Signals in Hospital Practice
C. A. Caceres
M.D., Public Health Service, Washington, D.C.

Computer Classifications of Electrocardiograms
Hubert Pipberger
Professor, V. A. Hospital and Georgetown Univ.,
Washington, D.C.

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Paul Hall
M.D., Karolinska Sjukhuset, Stockholm

Closing of the conference.

Man-Machine Communications in a Hospital
G. Otto Barnett
M. D., Massachusetts General Hospital, Boston

The Information Problem in Medicine
G. Wagner
PROGRAM II

INTERNATIONAL ADVANCED SYMPOSIUM ON DATA PROCESSING IN MEDICINE

April 25th - May 3rd 1966
Hotel Prins Hamlet, Elsinore, Denmark.

Themes:
- Computer Assisted of Bio-medical Information
- Cybernetics in Medicine
- Computers and Patient Management - The Use of Operations Research Methods
- Analog Information
- Man-Machine Communication in the Hospital
- Education through Computers
- Instruction in ADP for Hospital Personnel

Organized by: Professor, Dr. Med. A. Tybjaerg Hansen
Rigshospitalet, University Hospital of Copenhagen
Cand. Polit. Erling Dessau
Head of Mathematical and Statistical Department
Datacentralen, Copenhagen

Subsidized by: NATO Science Committee, Paris.

Monday 25th April
Chairman: Dr. Antoine Remond, La Salpêtrière, Paris

Information Processing in Medicine
a. What are we aiming at by the Information Processing
   Procedures: A Statement
   Cand. Polit. Erling Dessau
   Datacentralen, Copenhagen

b. Processing and Evaluation of Hospital Laboratory Data
   Professor Donald A.B. Lindberg
   University of Missouri, Columbia, Mo.

c. The Digital Computer as a Tool for Analysis of Physiological Systems
   Professor Homer R. Warner
   University of Utah, Salt Lake City, Utah

d. A Clinician's Wishes and Expectations of the Automated Information Processing
   Professor A. Tybjaerg Hansen
   University of Copenhagen, Denmark

Tuesday 26th April
Chairman: Professor C. Caceres, Public Health Service, Washington, D.C.

1. Hybrid Systems - Pattern Recognition
   a. Professor Josiah Macy, Jr.
   Yeshiva University New York
   b. Professor D.H. Beekering
   Medisch-Fysich Instituut, Utrecht, Holl

2. Intensive Observations and Care Units
   a. Dr. Erik Sande
   University Hospital of Copenhagen
   b. Professor Max Harry Well
   University of Southern California, Los Angeles

Discussions:
Dr. Mogens Jørgensen, Copenhagen County Hospital
Professor Wesley Clark, Washington University, St. Louis, Missouri

Wednesday 27th April
Chairman: Professor A. Tybjaerg Hansen, University of Copenhagen

Analog Data Acquisition and Processing
1. Automated Analysis of ECG and EEG
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Professor Wesley Clark, Washington University, St. Louis, Missouri

Wednesday 27th April
Chairman: Professor A. Tybjaerg Hansen, University of Copenhagen

Analog Data Acquisition and Processing
1. Automated Analysis of ECG and EEG
a. Professor Hubert V. Pipberger
Georgetown University Hospital, Washington, D.C.
b. Docent O. Arvedson
University of Umeå, Sweden
c. Docent Ingemar Petersén
Sahlgrenska Sjukhuset, Gothenburg
Engineer E. Kaiser
Kaiser’s Laboratory, Copenhagen
d. Dr. Chr. Guld
University of Copenhagen Neurophysiological Institute

2. Pattern Recognition
Professor Lawrence Stark
University of Chicago, Illinois

3. e. Demonstration of On-line time sharing;
Storage retrieval and updating of large Data bases (Santa Monica - Elsinore)
by Dr. Anne Summerfield, SDC

Tuesday 26th April
Chairman: Dr. Ilkka Väänänen, Helsinki, Finland

1. The Patient Record
   a. Dr. Paul Hall
      Karolinska Sjukhuset, Stockholm
   b. Dr. Julius Korein and Dr. Leo Tick
      New York University Medical Center, New York
   c. Dr. A. E. Bennett
      St. Thomas’s Hospital, London
   d. Dr. Jørg. Nøsboech
      National Health Service, Copenhagen
   e. Engineer Werner Schneider
      Uppsala Data Center, Uppsala, Sweden

f. Dr. P. Dragsted
   Hjørring Central Sygehus, Denmark

2. Cybernetics in Medicine
   a. Professor Aldo Masturzo
      International Society of Cybernetic Medicine, Naples
   b. Dr. Joseph Wartak
      Computation Centre of Polish Academy of Sciences, Warsaw
   c. Dr. Kosei Takahashi
      University of Tokyo, Japan

3. Computers in Medical Teaching
   Professor J.C. Pages and
   Professor Grening
   University of Paris, France

Friday 29th April
Chairman: Professor Arne Jensen, Technical University of Denmark

1. Operations Research - A Survey of Methods and Procedures
   Docent Tore Dalenius
   University of Stockholm

2. Operations Research in Medical Work
   Docent Tore Dalenius
   University of Stockholm

3. The OR-unit in a Hospital
   Professor Charles D. Flagle
   Johns Hopkins University, Baltimore, MD.

4. Operational Research and the National Health Service
   Mr. J. E. Cornish
   Ministry of Health, London
1. Pattern Recognition
   Professor Lawrence Stark
   University of Chicago, Illinois

2. Demonstration of On-line time sharing;
   Storage retrieval and updating of large data bases (Santa Monica - Elsinore)
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   c. Dr. A. E. Bennett
      St. Thomas's Hospital, London
   d. Dr. Jørgen Mosbech
      National Health Service, Copenhagen
   e. Engineer Werner Schneider
      Uppsala Data Center, Uppsala, Sweden

f. Dr. P. Dragsted
   Hjørring Centralsygehus, Denmark

2. Cybernetics in Medicine
   a. Professor Aldo Masturzo
      International Society of Cybernetics Medicine, Naples
   b. Dr. Joseph Wartak
      Computation Centre of Polish Academy of Sciences, Warsaw
   c. Dr. Kosei Takahashi
      University of Tokyo, Japan

3. Computers in Medical Teaching
   Professor J.C. Pages and Professor Grenning
   University of Paris, France

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   University of Stockholm

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4. Operational Research and the National Health Service
   Mr. J. E. Cornish
   Ministry of Health, London
5. Cybernetics in Medicine

Professor Lee B. Lusted
University of Oregon Medical School,
Portland, Oreg.

Saturday 10th April
Chairman: Cand. Polit. Erling Dessau, Datacentralen, Copenhagen

1. Models in Medicine

Dr. Julian Bigelow
Institute of Advanced Study
Princeton, New Jersey


The Panel: Chairman: Prof. Arne Jensen, Copenhagen
Professor Charles D. Flagle, Baltimore
Mr. J.B. Cornish, London
Professor Florian Serbanescou, Pisa
Docent Tore Dalenius, Stockholm
Vice-Director Aksel Marchmann, Copenhagen
Head Physician Paul Hall, Stockholm
Dr. Paul Marke, Copenhagen
Head Physician Gunnar Jungner, Gotenburg

Monday 2nd May
Chairman: Vice-Director Aksel Marchmann, Copenhagen, Hospital Board

1. Planning for an Extensive Automated Medical Information System

a. Mr. Armando Lassus
Puerto Rico Medical Center, San Juan

b. Mr. Jordan J. Baruch

c. Mr. Stephen J. Siegel
State University of New York

d. Mr. P.J. Budd
Veterans Administration, Dept. of Data Management, Washington, D.C.

e. Mr. R. Edwin Hawkins
El Camino Hospital, Mountain View, California

2. Discussions

Chairman: Erling Dessau

3. Learning by Computers

Professor J.C. Pages
IBM France, Paris

Tuesday 3rd May
Chairman: Professor Rudi Keiding, Århus County Hospital

1. Automated Data Processing in the Clinical Laboratory

a. Dr. W. Kirkham
National Institutes of Health, Bethesda, Md.

b. Dr. J. Guigan
The Guigan Laboratories, Paris

c. Dr. Gunnar Jungner
University of Gothenburg

2. Bio-medical Telemetry

Professor C. Caeceres
Public Health Service, Washington, D.C.

Chairman: Dr. Paul Hall, Karolinska Sjukhuset, Stockholm

1. Systems Work and Data Bases

a. Vice-Director Aksel Marchmann
Copenhagen County Hospital Board
5. Cybernetics in Medicine

Professor Lee B. Lusted
University of Oregon Medical School, Portland, Oreg.

Saturday 10th April
Chairman: Cand. Polit. Erling Dessau, Datacentralen, Copenhagen

1. Models in Medicine
Dr. Julian Bigelow
Institute of Advanced Study
Princeton, New Jersey

2. How to manage Health Care: A Panel Discussion on Systems Work, Operations Research, and Cybernetics in Health Care Procedures
The Panel: Chairman: Prof. Arne Jensen, Copenhagen
Professor Charles D. Flagle, Baltimore
Mr. J.B. Cornish, London
Professor Florian Serbanescu, Pisa
Docent Tore Dalenius, Stockholm
Vice-Director Aksel Marchmann, Copenhagen
Head Physician Paul Hall, Stockholm
Dr. Paul Marke, Copenhagen
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Chairman: Dr. Paul Hall, Karolinska Sjukhuset, Stockholm

1. Systems Work and Data Bases
a. Vice-Director Aksel Marchmann
Copenhagen County Hospital Board
b. Dr. Anne Summerfield  
System Development Corporation, Santa Monica, California

2. Summary

a. Cand. Polit. Erling DeSauu  
Datacentralen, Copenhagen

b. Professor A. Tybjaerg Hansen  
University Hospital, Copenhagen

3. Closing of the Symposium.

THE ROLE OF COMPUTERS IN THE HOSPITAL - THE INTERFACE PROBLEMS IN
MEDICAL AND ADMINISTRATIVE PATIENT MANAGEMENT

By A. Tybjaerg Hansen, M.D. Professor, University of Copenhagen, Denmark

Although the computer has been underway for more than a 100 years, it
has been quickly developing only the last twenty years through the
subtle interaction between developing technology and developing demand
for the services that the computer has to offer.

The automated data processing has already turned out to be of immense
practical significance in banking, business, administration, process
control in factories and in big science as atomic research, astronomy,
space research etc.

In hospitals and in the health services the new technology has come
rather late probably because its capabilities outside the field of pure
calculations have not been fully realized.

Now when it has become apparent that the health services and particu-
larly the hospitals may have some of their most pressing problems solved
by applying computer systems a rapid development is to be expected.

As an introduction to our transactions I shall try to sketch the out-
lines of the theme we are to deal with, I shall do it as a medical doc-
tor i.e. in this context as an informed layman - so I hope - reminding
you that it hinges on the doctor's attitude and depends much on his un-
derstanding of the essential problems whether automated data processing
will be unduly delayed or for that matter unduly hastily introduced in
the hospitals and in the health system. That the computer eventually
will find its proper place I do not doubt.

Actually I think nobody does - only one can look at it as a pessimist
viewing all the real and all the imaginary dangers or as an optimist
only perceiving the real bright sides and in addition some fatal morganas.