



PROGRAM

11th ANNUAL

CONFERENCE

on

ELECTRICAL TECHNIQUES

in

MEDICINE *and* BIOLOGY

NOVEMBER 19-20-21, 1958

MINNEAPOLIS, MINN. • PICK-NICOLLET HOTEL

CONFERENCE ON ELECTRICAL TECHNIQUES
IN MEDICINE AND BIOLOGY
November 19-20-21, 1958

Nicollet Hotel, Minneapolis, Minn.

The Eleventh Annual Conference on Electrical Techniques in Medicine and Biology is sponsored by the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Instrument Society of America through their Joint Executive Committee on Medicine and Biology.

This year the conference will spotlight the theme of Electronic Computers in Medicine and Biology and will feature three special symposia of invited papers; 1) Computers and the Electroencephalogram, 2) Computers in Electrocardiology and Circulatory Studies, and 3) Living Computers, in addition to five sessions of contributed papers. The meetings are planned to emphasize not only the contributions that computer technology can bring to biology and medicine but also the potential advances in computer theory and design that can be foreseen through examination of biophysical and biochemical mechanisms found in living organisms.

It is a pleasure to acknowledge support of the three special symposia by a grant (H-4266) from the National Heart Institute, Public Health Service.

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General Information

The meeting is open to all scientists, engineers, physicians, students, and others who have a serious interest in the field of electrical technology as applied to biology and medicine. All technical sessions will be held in the Nicollet Hotel which is in downtown Minneapolis, convenient to municipal transportation, shopping, restaurant and other facilities.

Hotel Accommodations

The Nicollet Hotel hopes to have adequate space available to accommodate all conference participants. Make reservations directly with the Hotel Nicollet, Minneapolis 1, Minnesota, mentioning the 11th Annual Conference. Other good hotels are available within easy walking distance should there be an unexpectedly large registration.

Registration

The Conference registration desk in the lobby of the Nicollet Hotel will be open at 8:00 a.m. on Wednesday, November 19, and will be open on each of the conference days until 4:00 p.m. A special desk will be open on November 19, and on the evening of November 18 if sufficient demand exists, where registration material can be picked up without delay by those having preregistered by mail. A convenient preregistration form is included with this program. Registration fee for those preregistering by mail before November 15 is \$5.00, at the conference, \$6.00. Students may register in advance or at the conference for \$2.00. Wives and guests of participants may register without charge if they do not wish to attend technical sessions but they will not receive abstracts and preprints of papers.

Conference Dinner, Luncheon, and Hospitality Hour

Tickets for the Wednesday evening Conference Dinner and for the Thursday Conference Luncheon will be on sale at the conference registration desk. Dinner tickets will cost \$5.00 including gratuity and must be purchased before 2:00 p.m. Luncheon tickets will cost \$3.10 and will be on sale until 9:00 a.m. Thursday. The hospitality hour will be open to all participants. A bar will be available for those who wish to purchase drinks.

Press Room

A press room will be maintained in the Nokomis Room of the Nicollet Hotel.

Tours

A series of tours has been arranged for Friday afternoon, November 21, and for Saturday, November 22, which will include a choice of visits to several research installations on the University of Minnesota campus and to other medical and industrial facilities. Full details regarding these tours may be had at the registration desk but a summary of tours is included at the back of this program. Round trip transportation for the Friday afternoon tours to the University of Minnesota campus has been arranged at a cost of 75¢ per person but tickets must be bought on Wednesday, November 19.

The Mayo Clinic and the IBM Corporation in Rochester, Minn. have very generously agreed to open their research and new computer laboratories on Saturday, November 22, so that participants may visit these facilities. Special bus transportation to and from Rochester has been arranged at a cost of \$3.00 per person round trip. Our visitors will be guests of IBM for lunch. Busses will leave the Nicollet Hotel at 8:00 a.m. and will return at 5:30 p.m. Tickets must be purchased before 4:00 p.m. Thursday.

Ladies' Activities

Lady registrants not interested in the technical sessions may wish to visit some of the numerous cultural exhibits, industrial tours for women, shopping centers, fashion shows, or points of historical interest in which the Twin Cities abound. General information regarding a number of these attractions will be included in the ladies' registration packet and there will be a person at the registration desk who will be happy to help in making arrangements. Ladies are welcome to attend the Conference Dinner, Luncheon, and Hospitality Hour.

If registering by mail (when registration form is not available) we must know your:

Name
Institution or Company if applicable
Street address, City, Zone, State

Registration Fees are shown on Page 2

Make checks payable to: R.K.Erskine Treas.
Mail to: Mr.R.K.Erskine, 222
Mpls-Honeywell Reg.Co.
2753 4th Ave., So.
Minneapolis 8, Minn.

PROGRAM

Wednesday, November 19

I OPENING SESSION

9:45 a.m. Lakeland Room

- (1) Opening Address
9:45 Otto H. Schmitt, Univ. of Minnesota, Minneapolis, Minn.
- (2) "A Biochemist's View of Applications of Computational Skills to Biology"
10:10 DeWitt Stetten, Jr., National Institute of Arthritis and Metabolic Diseases, N.I.H., Bethesda, Md.
- (3) "New Problems in Electrocardiology"
10:40 Hans H. Hecht, College of Medicine, Univ. of Utah, Salt Lake City, Utah
- (4) "Using Electronic Computers in Medical Diagnosis"
11:00 Robert S. Ledley and Lee B. Lusted, George Washington Univ., Washington, D.C. and Univ. of Rochester School of Medicine, Rochester, N. Y.
- (5) "Computer Design in Relation to Requirements in the Biologic Field"
11:25 Richard M. Taylor, IBM, New York
- (6) "Computational Aspects of Brain Function"
11:45 R. G. Bickford, Mayo Foundation, Rochester, Minn.

Wednesday, November 19

II COMPUTERS AND THE ELECTROENCEPHALOGRAM

Special Symposium Session

2:00 p.m. Lakeland Room

Chairman - R. G. Bickford, Mayo Foundation, Rochester, Minn.

- (7) "Problems in EEG Analysis" ?
2:00 Michael Saunders, Winnipeg General Hosp., Winnipeg, Manitoba, Canada
- (8) "Applications in EEG of Transfer Impedance Methods for Representing and Localizing Dipolar Sources"
2:20 Otto H. Schmitt, University of Minnesota, Minneapolis, Minn.

- (9) "Autocorrelation and Crosscorrelation Analysis in Electroencephalography"
2:40 J. S. Barlow, Massachusetts General Hosp., Boston and M.I.T., Cambridge, Mass.
- (10) "Application of Harmonic Analysis"
3:00 Discussant - John Knott, Dept. of Psychiatry, State University of Iowa, Iowa City, Iowa
- (11) "EEG Analysis by Means of Toposcopic Display"
3:10 Discussant - Harold Shipton, State University of Iowa, Iowa City, Iowa
- 3:20 Break
- (12) "Statistical Characteristics of Evoked Cortical Activity"
3:30 T. Sandel and T. Weiss, Research Lab. of Electronics, M.I.T., Cambridge, Mass.
- (13) "A Summary Description of EEG Data with the Aid of a Digital Computer"
3:50 B. G. Farley, L. S. Frishkopf, M. Freeman, C. Molnar, and T. Weiss, Lincoln Lab. and Research Lab. of Electronics, M.I.T., Cambridge, Mass.
- (14) "Simulation of Neurone Networks"
4:10 Wesley A. Clark, Lincoln Lab. and Dept. of Elec. Eng., M.I.T., Cambridge, Mass.
- (15) "The Use and Misuse of Digital Models in the Study of the Nervous System"
4:30 Peter Elias and Walter A. Rosenblith, Research Lab. of Electronics and Dept. of Elec. Eng., M.I.T., Cambridge, Mass.

Wednesday, November 19

HOSPITALITY HOUR

5:30 p.m. East Room

III CONFERENCE DINNER

6:30 p.m. International Room

- (16) Dinner Speaker - Donald R. Griffin
Biological Laboratories, Harvard Univ.
Subject - "Bats"

Thursday, November 20

IV-COMPUTERS IN ELECTROCARDIOLOGY AND CIRCULATORY STUDIES

Special Symposium Session

- 9:00 a.m. Jr. Ballroom
- Chairman - Otto H. Schmitt, University of Minnesota, Minneapolis, Minn.
- (17) "A New System for Electrocardiographic Recording, Analysis, and Diagnosis"
9:00 J. Martinek, G. C. K. Yeh, and R. Carnine, Reed Research Foundation, Washington, D.C.
- (18) "A Project of the U.S. Veterans Administration for the Electronic Computation of Electrocardiographic Data"
9:20 Hubert V. Pipberger and Edward D. Freis, Veterans Administration Hospital, Washington, D.C.
- (19) "A Study of the Advantages of Displaying the Heart's Electrical Activity as Linear Time Scale Curves of Spatial Magnitude and Orientation"
9:40 J. A. Abildskov, E. D. Jacobson, and S. Rush, State Univ. of New York, Syracuse
- (20) "An Electronic Computer Program for Calculating Figures of Merit and Orthogonalization Constants of Electrocardiographic Lead Systems from Transfer Impedance Data"
10:00 Bhashini Rao, Raymond Allard, and Otto H. Schmitt, Biophysics Group, Univ. of Minn., Minneapolis, Minn.
- (21) "A Multi-Channel Analyzer for Heart Potentials"
10:20 C. V. Nelson and Leonard Bowles, Maine Medical Center, Portland and Dept. of Elec. Eng., Univ. of Maine, Orono, Maine
- 10:40 Break
- (22) "A Technique for Digital Computer Analysis of Electrocardiograms"
10:50 A. K. Hawkes, Armour Research Foundation, Illinois Institute of Technology, Chicago
- (23) "Auto-Correlation Analysis of the High Frequency Electrocardiogram"
11:10 Ernst K. Franke and John R. Braunstein, Univ. of Cincinnati, Cincinnati, Ohio

- (24) "The Use of an Analog Computer for Analysis of Control Mechanism in the Circulation"
 11:30 Homer R. Warner, Dept. of Physiology, Latter-Day Saints Hospital, Salt Lake City
- (25) "Analog Computer Heart Rate Simulation - Dynamic Analysis of the Effect of Respiration on Heart Rate in the Resting State; A Neurophysiological Reflex Study"
 11:50 M. E. Clynes, Rockland State Hospital, Orangeburg, N. Y.

Thursday, November 20

V CONFERENCE LUNCHEON

12:30 p.m. Lakeland Room

- (26) Luncheon Speaker - L. F. Stutzman
 Director of Research, Remington Rand Univac, St. Paul, Minn.
 Subject - "Advanced Concepts in Logic and Design and their Possible Implications for the Bio-medical Fields"

Thursday, November 20

VI ELECTROENCEPHALOGRAPHY

Contributed Papers

2:00 p.m. Session A

- (27) "A Special Purpose Computer for the Period Analysis of the Electroencephalogram"
 2:00 Harold Childers and Neil R. Burch, Baylor Univ. College of Medicine, Houston, Texas
- (28) "Some Considerations in the Design of Computers"
 2:20 James F. Kaiser, M.I.T., Cambridge, Mass.
- (29) "A Simple Recognition Write-Out System for the Electrographic Spike-and-Wave Discharge"
 2:40 Anders Ness and R. G. Bickford, Mayo Foundation, Rochester, Minn.
- (30) "The Frequency Spectrum of EEG Signals"
 3:00 Edwin Lowenberg, Dept. of Elec. Eng., State University of Iowa, Iowa City, Iowa
- 3:20 Break
- (31) "Analysis of Electroencephalographic Data by the Use of Cross Spectrum Analyzer Techniques"
 3:30 Ezra S. Krendel, Lab. for Research and Development, Franklin Institute, Philadelphia, Pa.

- (32) "The Logic of Simple Models for Biological Coding: EEG Period Analysis and Small Group Interaction"
 3:50 Neil R. Burch, Robert Edelberg, and Harold Childers, Baylor Univ. College of Medicine, Houston, Texas
- (33) "Factorial Classification of Autonomic and EEG Relationships with Varying Age"
 4:10 Christine Kris, Cambridge, Mass.
- (34) "Ten Year Report on the Use of Manual Punch Card Systems for Correlating Clinical and Electroencephalographic Data"
 4:30 Robert S. Schwab, Massachusetts General Hospital, Boston, Mass.

Thursday, November 20

VII COMPUTERS

Contributed Papers

2:00 p.m. Session B

- (35) "A Simple Device to Control the Strayfield of Electrolytic Cells Useful in Biological Impedance Work"
 2:00 Herman P. Schwan and J. Maczuk, Electro-medical Division, Moore School of Elec. Eng., Univ. of Pennsylvania, Philadelphia
- (36) "The Use of Electronic Computers in Bio-medical Research"
 2:20 Robert S. Ledley, George Washington Univ., Washington, D.C.
- (37) "A Univac Program for Representing the Kinetic Behavior of Chemical and Biological Systems"
 2:40 D. Garfinkel, J. J. Higgins, and J. D. Rutledge, Johnson Research Foundation, Univ. of Pennsylvania, Philadelphia, Pa.
- (38) "Computers Applied to Ballistocardiography"
 3:00 S. A. Talbot, Johns Hopkins Hospital, Baltimore, Md.
- 3:20 Break
- (39) "A Proposed Data Handling System for Human Metabolic Studies"
 3:30 R. Moore, R. H. Thompson, E. R. Buskirk, and G. D. Whedon, National Institute of Arthritis and Metabolic Diseases, N.I.H., Bethesda, Md.

- (40) "Some Novel Analog Computer Techniques for Respiratory and Other Biological Studies"
3:50 David C. Hughes, Martin L. Scheiner, and John J. Osborn, Electronics for Medicine, Inc., White Plains, N. Y. and Stanford Univ. School of Medicine, San Francisco

- (41) "Sensors for Physiological Variables"
4:10 Max Traite, Carmen Purpuro, John Kilduff, and Walter Welkowitz, Vibro-Ceramics Div., Gulton Industries, Inc., Metuchen, N. J.

- (42) "Multi-Channel Recording on Inexpensive Tape Recorders Using Telemetering Techniques"
4:30 DeWitt Hendee Smith, Ballistocardiograph Lab., New Jersey Neuro-Psychiatric Institute, Princeton, N. J.

Thursday, November 20

VIII PHYSIOLOGY AND BIOPHYSICS

Contributed Papers

2:00 p.m. Session C

- (43) "Analog Computer Techniques in the Control and Measurement of Nerve Membrane Responses"
2:00 John W. Moore, Lab. of Biophysics, National Institute of Neurological Diseases and Blindness, N.I.H., Bethesda, Md.

- (44) "The Computation of Muscle Activity by Integration of the Electromyogram"
2:20 Raymond B. Fink and Martin L. Scheiner, College of Physicians and Surgeons, Columbia Univ., New York and Electronics for Medicine, Inc., White Plains, N. Y.

- (45) "A Method of Measuring the Dynamic Characteristics of Muscular Rigidity, Strength, and Tremor in the Upper Extremity"
2:40 David D. Webster, Dept. of Neurology, Veterans Administration Hosp., Minneapolis

- (46) "Continuous Registration of Phasic Cardiac Output in the Active Dog: The Chronically Implanted Electromagnetic Flowmeter"
3:00 Frederick Olmsted, Research Div., Cleveland Clinic Foundation and the Frank E. Bunts Educational Institute, Cleveland, O.

3:20 Break

- (47) "Analog Computations of Blood Flow"
3:30 A. Czerwinski and H. Lobel, Creighton Univ. School of Pharmacy and H. and H. Lobel Electric Co., Omaha, Nebraska

- (48) "Volume and Flow Computations from Observed Electrical Impedance Characteristics of the Body Segments and the Blood"
3:50 Jan Nyboer, Dept. of Cardiovascular Physiology, Harper Hospital, Detroit, Mich.

- (49) "An Electrical Impedance Spirometer"
4:10 L. Zablow and E. Goldensohn, Dept. of Neurology, College of Physicians and Surgeons, Columbia Univ. and the Neurological Institute, Presbyterian Hosp., New York

- (50) "Fetal Heart Rate Patterns During Labor"
4:30 Edward H. Hon, Yale University School of Medicine, New Haven, Conn.

- (51) "A Statistical Study of the Effects of Electric Fields on the Movements of Mammalian Sperm Cells"
4:50 John W. Trank, Biophysics Group, Univ. of Minnesota, Minneapolis, Minn.

Thursday, November 20

IX ULTRASONICS AND PUPILLOMETRY

Contributed Papers

8:30 p.m. Session A

- (52) "A Proposed Ultrasonic Visualizing System for Medical Diagnosis and its Present Limitations"
8:30 E. E. Suckling, State Univ. of New York, Brooklyn, N. Y.

- (53) "The Transmission of Ultrasound through the Living Human Thorax"
8:50 H. D. Crawford, P. I. Wolf, J. S. Fink, and J. J. Wild, Medico-Technological Research Dept., St. Barnabas Hospital, Minneapolis, Minn.

- (54) "An Automatic Recording Pupillometer"
9:10 W. E. Sullivan and W. E. Tolles, Airborne Instruments Laboratory, Mineola, N. Y.

- (55) "Noise and Oscillations in the Pupil Servomechanism"
9:30 Lawrence Stark, Dept. of Neurology, Yale University, New Haven, Conn.

- (56) "The Electro-oculographic Technique for Continuously Recording Eye Position and Eye Movements, and its Use for Determining the Rate, Frequency, and Accuracy of Perception as a Function of Direction and Regard"
9:45 Christine Kris, Cambridge, Mass.

Thursday, November 20

X

INSTRUMENTATION

Contributed Papers

8:30 p.m.

Session B

- (57) "Automatic Reading and Recording of Digital Data in the Analysis of Primate Behavior"
8:30 David McConnell, Lab. of Comparative and Physiological Psychology, Ohio State Univ., Columbus, Ohio
- (58) "An Automatic Digital Recorder for Motion Study Research"
8:50 Stanley M. Block, Mechanical Eng. Dept., Univ. of Minnesota, Minneapolis, Minn.
- (59) "Instrumentation for Zero Gravity Research in Manned Aircraft"
9:10 Horace T. Castillo, Aero Medical Field Laboratory, Holloman Missile Development Center, Alamogordo, New Mexico
- (60) "A New Ozone Sensor"
9:30 Gifford M. Mast, Mast Development Co., Inc., Davenport, Iowa

Friday, November 21

XI

LIVING COMPUTERS

Special Symposium Session

9:00 a.m.

Lakeland Room

Chairman - J. F. Herrick, Mayo Foundation, Rochester, Minn.

- (61) "Some Characteristics of the Human Organism as a Meter and as a Stimulus-Response Mechanism"
9:00 Harry Helson, Dept. of Psychology, Univ. of Texas, Austin, Texas
- (62) "The Oscillatory Nature of Physiological Processes"
9:20 Colin S. Pittendrigh, Princeton Univ., Princeton, N. J.
- (63) "Circadian Rhythms at Several Physiologic Organization Levels"
9:40 Earl E. Bakken and Franz Halberg, Medtronic, Inc., Univ. of Minnesota Medical School, Minneapolis, and Cambridge State School and Hospital, Cambridge, Minn.

(64) "Speech Recognition Studies at Lincoln Laboratory"

10:00 James W. Fergie, Lincoln Laboratory, M.I.T., Lexington, Mass.

(65) "The Resistance of Bats to Jamming"

10:20 Donald R. Griffin, Biological Lab., Harvard University, Cambridge, Mass.

10:40 Break

(66) "Feedback Control of the Heart"

10:50 James W. Dow, Circulation Laboratory, Presbyterian Hosp., Philadelphia, Pa.

(67) "The Human Being as a Link in an Automatic Control System"

11:10 T. J. Higgins and D. B. Holland, Univ. of Wisconsin, Madison, Wis.

(68) "Adaptive Servomechanisms"

11:30 Charles W. Johnson, Aero Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

(69) "New Instrumentation Complex for High Performance Aircraft"

11:50 Lawrence J. Fogel, Convair, San Diego, California

Friday, November 21

XII

TOURS

University of Minnesota Tour

Tickets, 75¢ each, must be purchased on Wednesday, November 19. (Round-trip transportation)

1:15 p.m. Buses leave Nicollet Hotel for University of Minnesota campus.

4:30 p.m. Buses leave campus for hotel.

Visitors to the University will be able to choose several combinations of campus tours but will not be able to see all of the exhibits.

Physics, Biophysics, and Electrical Engineering

1. Linear accelerator (Linac) - L. H. Johnston
Individuals interested in this exhibit should leave their names at the registration desk.
2. a) Three dimensional electrocardiography.
b) Transmission line computer for measuring nerve characteristics.
49 Physics Building - Otto H. Schmitt
3. University scientific computer center.
230 Experimental Engineering Building - Marvin Stein

Medical School

1. Pulsatile flow through a distensible tube.
301 Millard Hall - Robert Evans
2. Carotid sinus nerve action potentials (a
biological pressure transducer).
501 Owre Hall - John Trank
3. Electronic actometer.
271 Lyon Hall - Franz Halberg
4. Artificial heart-lung system.
B181 Mayo (Univ. Hospitals) - D. M. Long
5. Computer for continuous recording of oxygen
consumption rate.
833 Mayo (Univ. Hospitals) - W. G. Kubicek

Tours by Arrangement

1. a) Transmission of ultrasound through the
human heart and chest.
b) Automatic ultrasonic breast cancer detector.
St. Barnabas Hospital, 920 South Seventh St.,
Minneapolis - John J. Wild
2. IBM computer, intermediate class No. 650.
1200 Second Ave. South, Minneapolis -
J. Merquardt and J. Smith

Saturday, November 22

XIII ROCHESTER TOUR

Tickets for round-trip transportation, \$3.00
each, must be purchased before 4:00 p.m. Thurs-
day, November 20.

- 8:00 a.m. Leave Minneapolis from Nicollet Hotel
(Nicollet Avenue entrance)
- 10:00 a.m. Arrive Rochester - Medical Science
Building, Mayo Clinic
Richard Jones - tour chairman
- 12:15 p.m. Leave Medical Science Building
- 12:30 p.m. Arrive IBM Plant for lunch (courtesy
IBM Corporation)
Charles McCarthy - tour chairman
- 1:30 p.m. Tour IBM Plant
- 3:30 p.m. Leave Rochester from IBM Plant
- 5:30 p.m. Arrive Minneapolis, Nicollet Hotel

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T = Tour

8 AM	Wednesday Nov. 19	Thursday November 20	Friday November 21	Saturday Nov. 22	8 AM
9 AM	Registration from 8 AM each day	Registration	Registration		9 AM
10 AM	I Opening Session Invited Speakers 9:45-12:15 Lakeland Room	IV Symposium: Computers in E.F.G. and Circulatory Studies 9:00-12:10 Junior Ballroom	XI Symposium Living Computers 9:00-12:10 Lakeland Room	XIII Tour-Rochester 8 AM Lv Mpls. 10 AM Mayo Clinic 12:30 Lunch IBM 1:30 IBM Plant 5:30 Arr Mpls.	10 AM
11 AM					11 AM
12 M		V Conference Luncheon 12:30 Lakeland Room			12 M
1 PM					1 PM
2 PM	II Symposium: Computers Electroencephalogram 2:00-4:50 Lakeland Room	VII B Computers 2:00-4:50	XII Tours-Minneapolis 1:15-4:45 Univ. of Minn. St. Barnabas Hosp IBM		2 PM
3 PM		VI A E.F.G. 2:00-4:50	VIII C Physiology Biophysics 2:00-5:20		3 PM
4 PM					4 PM
5 PM					5 PM
6 PM	Hospitality Hour				6 PM
7 PM	III Conference Dinner 6:30 International Room				7 PM
8 PM					8 PM
9 PM		IX A Ultrasonics & Pupillometry	X B Instrumentation		9 PM
10 PM					10 PM