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Bulletin of the

University of Minnesota Hospitals
and
Minnesota Medical Foundation

Cardiac Output During Activity

Volume XXVI | Friday, October 29, 1954 | Number 4

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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CONTENTS

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I. CARDIAC OUTPUT DURING OCCUPATIONAL THERAPY ACTIVITIES

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Jean M. Nelson, B. S., O. T. R.

Various occupational therapy activities have been evaluated for oxygen consumption and cardiac output during these activities. This study was undertaken because the work demands of the crafts in occupational therapy are not accurately judged by observation alone. It is essential in rehabilitation that a patient work to the limit of his capabilities, but it is just as important that fatigue and exhaustion should be avoided. This is especially true for patients with a low cardiac reserve or exercise tolerance such as patients with heart disease, tuberculosis, and other chronic debilitating diseases. Gordon[1] has measured the metabolic rates in various activities to determine the energy costs of physical activities in relation to pulmonary tuberculosis.

METHODS

Metabolism was estimated from the oxygen consumption with a McKesson Waterless Metabolor[2]. A nose clip was placed on the subject's nose and adjusted so that no air could escape through the nose. A standard mouthpiece with lugs and flange was connected by a six foot length of tubing of one inch diameter to the metabolor. The tubing and the mouthpiece were attached to a leather chest plate which hung around the subject's neck. This arrangement allowed the subject to carry out the activity without restriction and with relative ease.

The cardiac output was calculated using Grollman's[3] acetylene method for calculating artero-venous oxygen difference. In calculating the cardiac output, the solubility coefficient for acetylene as determined by Chapman[4] was employed.

A standard mouthpiece with lugs and flange was connected to a three way aluminum stopcock, in turn, connected to a rubber breathing bag or to room air. The stopcock had two small tubes through which the gas samples could be drawn.

A firm plastic tube, 14 inches long, one half inch in diameter and with 42 holes in it extended from the stopcock through the length of the rebreathing bag. This prevented any flutter valve action of the collapsing bag at the stopcock. A Haldane Apparatus was used for the analysis of oxygen, carbon dioxide and acetylene.[3]

We used as subjects nine occupational therapy students at the University of Minnesota. Their ages range from 19 - 25, and all were in apparently good health. Repeated tests were carried out on each subject.

The subjects were in a near-basal state, having had no food for at least four hours prior to the initial metabolism test, and having rested in the supine position for 30 minutes in a room as free from extraneous noises as possible. The oral temperatures, blood pressure, and pulse were recorded following the rest periods. Each metabolism test was for a six-minute period. A metabolism test was taken 30 minutes after reclining, 30 minutes after sitting in the position of work and during the activity. The metabolism taken during the activity was delayed 3-4 minutes while the subject was at work to allow time to establish a steady metabolic rate in that activity.

The gas samples for estimation of cardiac output were collected immediately after the metabolic rate was measured. The rebreathing bag contained 200 cc oxygen, 400 cc acetylene, and 1400 cc room air. Alveoler air samples were taken at 15 and 23 seconds after the beginning of the rebreathing for the lighter activities such as leather stamping, and leather tooling, and at 9 and 18 seconds for the heavier activities such as riding the bike grinder.

At least four deep breaths were taken before each gas sample was collected.

ACTIVITIES

Metabolic rates were measured for leather tooling, leather stamping, leather lacing, chip carving, leather carving, table loom weaving, using bicycle grinder, hand sawing, and printing with the platon press.

Cardiac outputs were measured for leather stamping, leather tooling, floor loom weaving, table loom weaving, bike grinding and printing.

1. Leather Tooling: The subject sat in a straight backed chair before a table and drew a design with a liner on a piece of calf hide three inches square which had been moistened and conditioned for tooling prior to the test. A conventional design had been drawn on the piece of leather which the subject followed. This assured a standard activity.

2. Leather Stamping: The subject was seated in a straight backed chair at a table. The subject hammered a standard design into a previously moistened and conditioned 3 by 4 inch piece of cowhide. A rubber headed mallet and background stamping tool was used. A metronome sounded once per second to meter the rate of stamping to assure a standard activity.

3. Leather Lacing: The subject used a 54 inch length of leather lacing on a commercial lacing needle to lace a double cordova stitch in a piece of cowhide, 3 by 4 inches, into which holes had previously been punched. The test was carried out in the sitting position.

4. Chip Carving: The subject was seated at a table and with a sharp Bard-Parker knife carved a diamond design which had previously been drawn on a basswood block.

5. Leather Carving: In the seated position at a table, using a sharp swivel knife, the subject carved a previcusly drawn design on a piece of 6 ounce cowhide.

6. Table Weaving: The subject was seated on a high stool before a small table upon which a Structo table loom was placed. The forearms rested upon the breast beam of the loom. The loom was strung with cotton carpet warp. An 18 inch shuttle wound with the same material was used for filler. The subject beat three times after each pick using both hands. The speed of work was controlled so that the subject used about 30 lengths of woof during the six-minute metabolism test.

7. Floor Loom: The subject sat on a 26 inch loom bench before a two harness floor loom strung with cotton carpet warp. The woof was three ply cotton rug roving. A 21 inch shuttle filled with the same material was used. Weaving was done at one pick every 15-20 seconds. Each pick was beaten three times, using the right on the beater and holding the shuttle in the left hand.

8. Bicycle Grinding: The subject was seated on a stationary bicycle with a grinder attachment. The pedals were adjusted to suit the individual height of each subject. No additional resistance was added to the grinder. Pedaling was regulated by a 5 second metronome to one complete revolution every 5 seconds. The grinder had considerable friction and inertia.

9. Hand Sawing: The subject was in the standing position and used a 10 point crosscut saw to saw a 3/4 inch oak board which was placed between two 24 inch saw horses. There were 30 strokes per minute. Timing was controlled by a 60 beat per minute metronome.

10. Printing: A foot-operated platen press was used. The press was ready for operation prior to the test. Four by six inch cards were placed to right of the press. A 5 second metronome was used to standardize the speed of work. The subject stood before the press and depressed the foot pedal of the press with the right foot at a rate of 4 times

during the 5 second period. The subject placed a card on the platen with the right hand and simultaneously pushed the throw lever with the left hand. The card made contact with the type and was printed. While the platen approached the chase for the second time, the subject removed the printed card with the right hand and pulled the throw lever back with the left.

RESULTS

Table 1 summarizes the data concerning the cardiac output during rest and during selected occupational therapy activities. It shows that the cardiac output while lying at rest was essentially the same as while sitting at rest. Leather stamping increased the cardiac output approximately 16 per cent over the cardiac output at rest. Leather tooling increased the cardiac output 21 per cent over the supine resting cardiac output. Printing increased the cardiac output 67 per cent and the floor loom weaving, 77 per cent over the supine resting cardiac output. The bicycle grinding activity increased the cardiac output 148 per cent over the cardiac output during supine rest. The ratio of cardiac output during the activity to the cardiac output at rest is shown in Figure 1. All of the cardiac outputs measured for all the activities are shown in Figure 2. The cardiac index during reclining, sitting, and work is shown on Figure 3.

The metabolic requirements at rest and during the various occupational therapy procedures are summarized in Table 11. Leather tooling, leather stamping, and leather lacing required 30-40 per cent more energy than did supine rest. Chip carving, leather carving, and table weaving, required 60-75 per cent more energy than did supine rest. Floor loom weaving increased the energy demand by 109 per cent, printing by 135 per cent, bicycle grinding by 196 per cent, and hand sawing by 233 per cent over the energy required during supine rest. Figure 4 plots the metabolic demand of supine rest, and the various activities in calories per square meter per hour.

Figure 5 presents the ratio of the metabolic requirements of selected occupational therapy activities to the requirement at rest.

COMMENT

It is evident that the cardiac index during rest and the various activities is more variable than is the metabolic demand.

The apparent discrepancies between cardiac output and metabolism in some of the tests raises the question as to what the mechanism can be. We do not know. Temporary emotional disturbances may be a factor. A self-controlled individual may have the keenest subjective experience of fear or other emotions and yet to outward appearance remain perfectly unmoved. Considering those things, it may be true that metabolic rest does not mean cardiac rest.

These studies may be more significant in demonstrating the low cardiac demand of light activities than in measuring the greater cardiac outputs during the heavier work.

Anxiety and restlessness are often seen in the cardiac patient kept inactive on a "bed rest" regime. These patients even though bedfast have many problems which prior to the illness were no problem at all. The patient may be worried about whether or not he will get well, whether he will be able to work, whether he will be able to meet financial obligations that he had incurred prior to his illness. Ward noises bother him, doctors bother him, and the anticipation of the next needle injection worries him.

The effect of emotions on cardiac output and on blood pressure is probably considerably greater than the demands of light physical activity. Although we have not yet done controlled studies of the effect of emotional disturbances on cardiac output, we have found that inability to obtain a basal cardiac output on our subjects was often associated with some psychic or emotional disturbance.

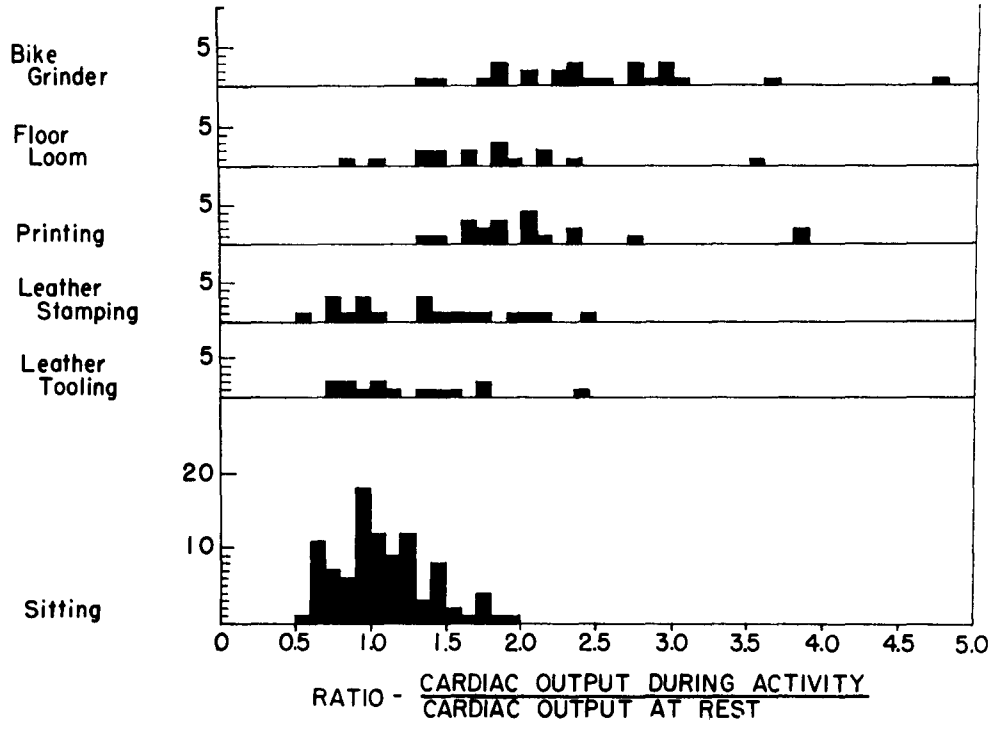
TABLE I.
THE EFFECT OF REST AND SELECTED OCCUPATIONAL THERAPY ACTIVITIES ON THE CARDIAC OUTPUT OF NORMAL SUBJECTS

Activity	No. of Subjects	No. of Tests	Mean Cardiac Output Liters/Min.	Standard Deviation	S.E.M.	% Increase Over Supine
Supine	9	100	3.98	1.039	0.104	
Sitting	9	100	3.92	0.985	0.0985	-1.51
Leather Stamping	2	21	4.61	1.30	0.29	15.83%
Leather Tooling	4	15	4.82	1.65	0.43	21.11%
Printing Press	5	20	6.64	2.28	0.510	66.83%
Floor Loom Weaving	2	18	7.05	2.09	0.49	77.14%
Bike Grinder	3	25	9.87	2.38	0.48	147.99%

Occupational therapy activities of the lighter type such as leather stamping, needle work, Indian bead work, or fly tieing, give the patient relief from these worries because these activities are diverting activities and allow the patient to take his mind off his problems. Activities in which the patient's arms are supported and in which he uses only his hands for an occupational activity place very little work upon the heart and actually may be more sedative to the patient than if the patient were allowed no activity whatsoever but lay in bed and fretted. A person who has had the chance to observe the sedative effect of physical effort upon men in states of anxiety needs no additional proof. We believe that the same outlet utilizing a light activity that puts very little increased demand on the heart is more resting to the heart than if no activity is permitted and the patient is allowed to become unduly upset.

SUMMARY

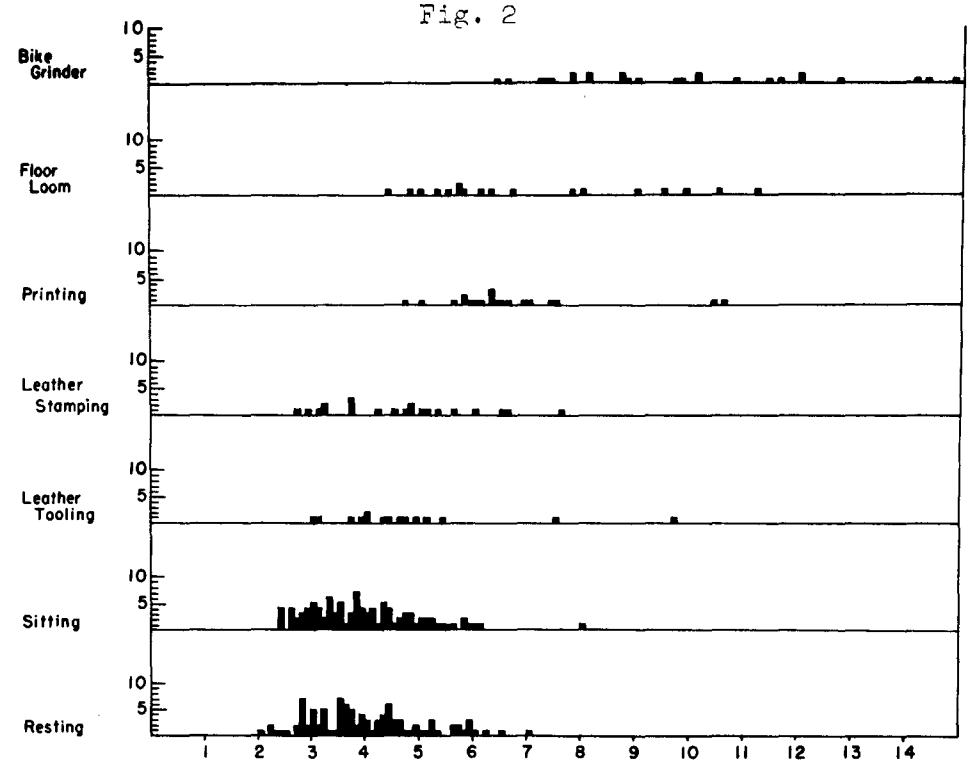
The cardiac output by Grollman's acetylene method and the metabolic work requirement measured by oxygen consumption have been studied on nine normal subjects when lying at rest, sitting at rest, and when doing an activity commonly used in occupational therapy. The energy requirements for the activities were found to increase in the following sequence: lying at rest, sitting at rest, leather tooling, leather stamping, leather lacing, chip carving, leather carving, table loom weaving, floor loom weaving, printing, bicycle grinding, hand sawing. The cardiac outputs in the various activities increased in the same order except that floor loom weaving and printing were reversed. Sitting did not increase the cardiac output above that required for lying supine. The cardiac output did not increase as much during light sedentary activities as did the metabolic demand.



The Ratio of CARDIAC OUTPUT DURING ACTIVITY / CARDIAC OUTPUT AT REST in Trained Subjects. Activities Were Selected Which Required Varying Degrees of Energy Consumption. (Numbers on ordinate refer to number of tests.)

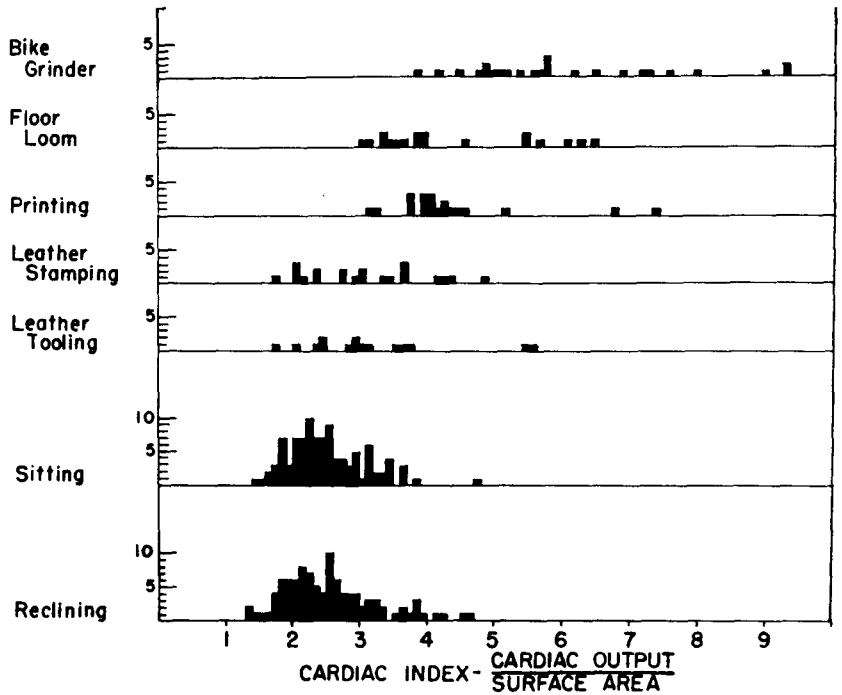
Fig. 1

Fig. 2



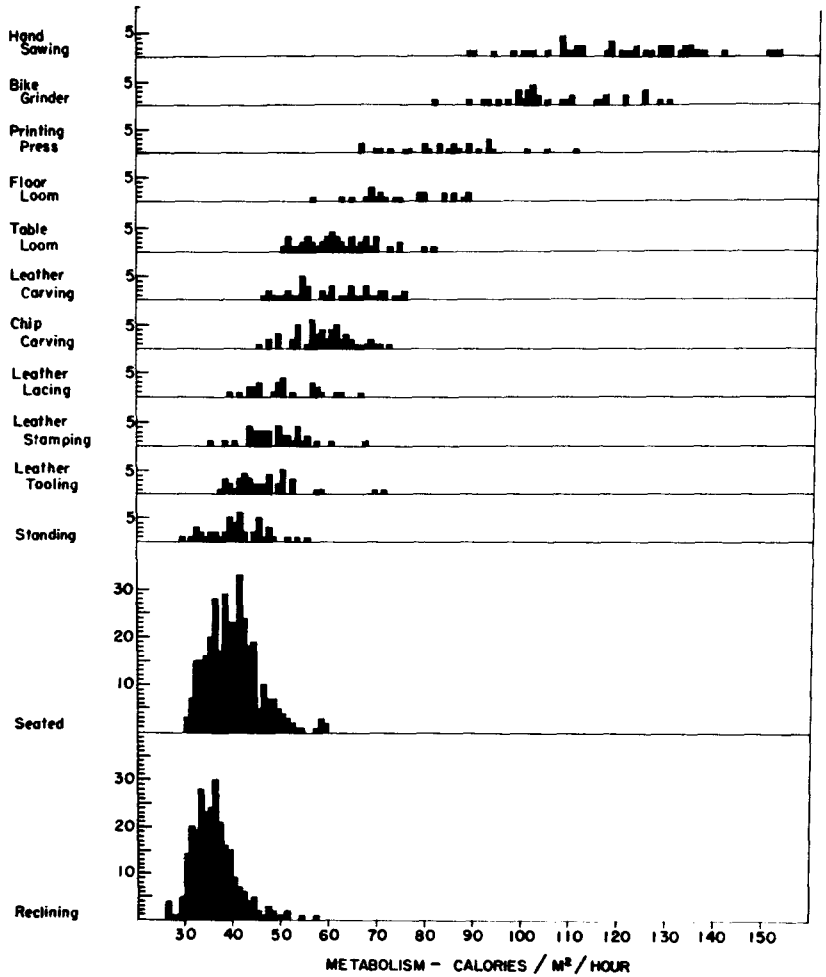
Cardiac Output in Liters Per Minute During Rest or During Selected Occupational Therapy Activities by Trained Subjects. Cardiac Output Was Measured by Grollman's Acetylene Method. (Numbers on ordinate refer to number of tests.)

Fig. 3



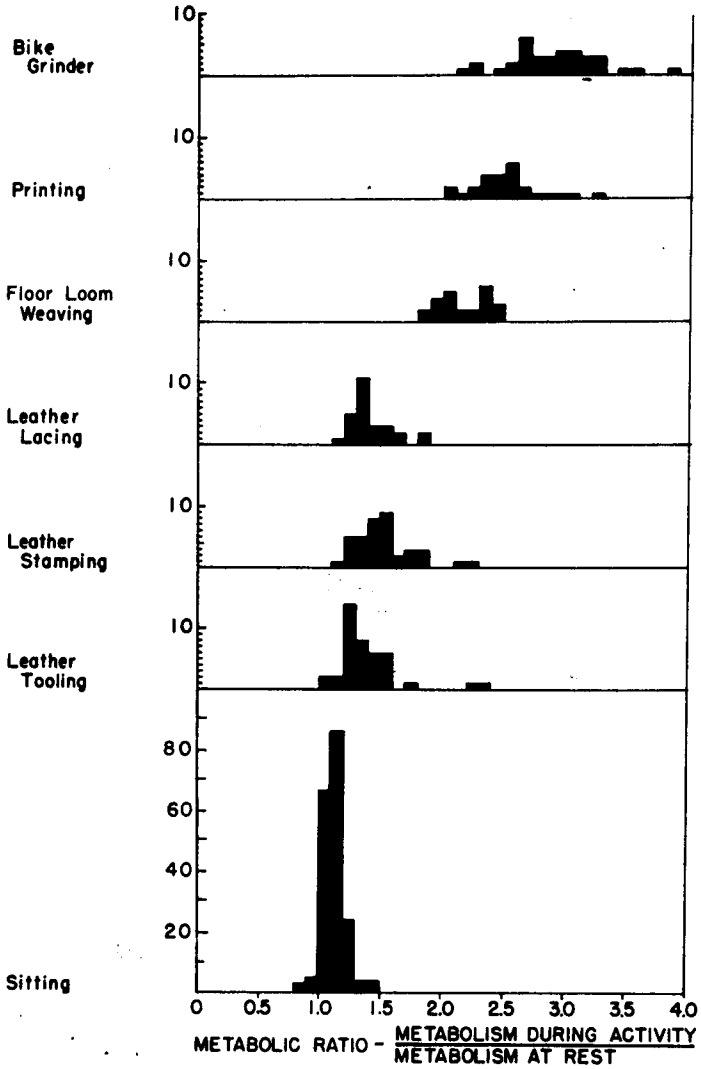
The Distribution of Cardiac Index During Rest or Selected Occupational Therapy Activities by Trained Subjects. Cardiac Output Was Measured by Grollman's Acetylene Method. (Numbers on ordinate refer to number of tests.)

Fig. 4



The Distribution of the Metabolic Demand of Rest or Selected Occupational Therapy Activities as Determined by Oxygen Consumption. (Numbers on ordinate refer to number of tests.)

Fig. 5



The Ratio of the Metabolic Requirement of Selected Occupational Therapy Activities to the Requirement at Rest. Resting Oxygen Consumption Was Measured after the Subject Had Been Lying Supine for 30 Minutes in a Quiet Room. (Numbers on ordinate refer to number of tests.)

TABLE II.
THE METABOLIC REQUIREMENT OF REST
AND OF SELECTED OCCUPATIONAL THERAPY ACTIVITIES

Activity	No. of Subjects	No. of Tests	Metabolic Requirement Average Cal/M2/Hr.	Standard Deviation	S.E.M.	% Increase Over Supine
Supine	49	265	35.77	4.782	0.2939	
Sitting	57	338	39.76	6.056	0.327	11.15%
Standing	16	47	40.45	5.07	0.739	13.08%
Leather Tooling	16	41	46.40	8.68	1.36	29.72%
Leather Stamping	14	38	48.38	5.97	0.97	35.25%
Leather Lacing	12	27	50.53	6.72	1.29	41.25%
Chip Carving	17	53	58.50	6.10	0.83	63.55%
Leather Carving	11	44	60.08	8.42	1.269	65.16%
Table Loom Weaving	17	47	61.60	7.30	1.06	72.21%
Floor Loom Weaving	2	24	74.63	8.63	1.78	108.63%
Printing	5	26	84.00	10.92	2.14	134.83%
Bike Grinder	6	35	105.91	11.67	1.95	196.09%
Hand Sawing	16	47	119.00	26.00	3.80	232.68%

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Journ. Clin. Invest. 29:651-59, June 1950.

II. MEDICAL SCHOOL NEWS

Coming Events

November 4 - 6	Continuation Course in Anesthesiology for General Physicians
November 9 - 13	Continuation Course in Radiology for Specialists
November 10	Leo G. Rigler Lecture; "Rachitic Response in Bone;" Dr. Edward B. D. Neuhauser, Radiologist-in-Chief, The Children's Hospital, Harvard Medical School; Mayo Auditorium; 8:15 p.m.
November 18 - 20	Continuation Course in Infectious Diseases for General Physicians
November 18	Journal-Lancet Lecture; "Mechanism of Action of Penicillin;" Dr. Harry Eagle, Chief, Section of Experimental Therapeutics, National Microbiological Institute, National Institutes of Health, U. S. Public Health Service, Bethesda, Maryland; Mayo Auditorium; 8:15 p.m.
November 22 - 24	Continuation Course in Fractures for General Physicians

* * *

Epilogue

The Dedication of the Mayo Memorial was an event that many of us had looked forward to for years. We are certain that all who attended the Dedication Exercises and Banquet last week found the addresses not only appropriate to the occasion, but stimulating and inspiring as well. Those who made the Mayo Memorial possible can take real pride in its official opening. In the future they will, we are confident, be able to take far greater pride in the scientific work accomplished in it -- work which will express our thanks even more eloquently than did the past week's Dedication Exercises.

Finally, we wish to pay tribute to the many people whose efforts contributed so much to the Dedication itself. To attempt to name them individually would be futile. To the distinguished guest speakers; to members of the Hospital Administration including housekeepers and engineers who put in many extra hours; to the ladies of the Hospital Auxiliary and the Hospital Volunteer Service who guided tours; to those members of our faculty who took time from their normal duties to answer the questions of the more than 2,500 visitors who toured the building; to the University Relations staff; to the people in the University printing and mimeographing shops; to our decorating consultant; and to three young ladies whose secretarial and clerical duties in relation to the Dedication extended well "above and beyond the call of duty" -- to all of these people we extend our profound thanks.

* * *

Minnesota Medical Foundation Meeting

The annual meeting of the Minnesota Medical Foundation was held on Thursday, October 21, at 12:00 noon in the Junior Ballroom of Coffman Memorial Union. The luncheon meeting was attended by approximately 100 Foundation members and 50 guests. Dr. Owen H. Wangensteen, President, welcomed the guests who included a number of contributors to the Mayo Memorial Fund, several of the distinguished participants in the Mayo Memorial Dedication Exercises, and 20 medical students who later in the day received Minnesota Medical Foundation Scholarships.

Dr. Robert B. Howard reported briefly on the distribution of the "Bulletin of the University of Minnesota Hospitals and Minnesota Medical Foundation;" Dr. Wesley

W. Spink gave the financial reports; and Dr. Donald J. Cowling spoke on the activities of the Scholarship Committee. Dr. N. Logan Leven presented the report of the Nominating Committee, which was adopted by unanimous vote. Dr. Donald J. Cowling, Dr. Francis W. Lynch, Dr. Wesley W. Spink, and Mr. Gerald T. Mullin were reelected to the Board of Trustees, and Mr. Malvin E. Herz was elected to replace Dr. Owen H. Wangensteen, who was ineligible for reelection. The Board of Trustees will meet within the next month to select officers for the coming year.

Three gifts were presented to the Foundation at the meeting. Dr. William C. Bernstein presented $500.00 in the name of the Southern Minnesota Medical Association, Dr. Arthur H. Pederson $250.00 given by the St. Paul Surgical Society, and Dr. O. J. Campbell $500.00 on behalf of the Minnesota Surgical Society.

The meeting adjourned following a few brief but entertaining and stimulating impromptu remarks by Dr. Robert R. Newell, Professor of Medicine (Radiology and Biophysics), Stanford University School of Medicine, San Francisco.

* * *

Minnesota Medical Alumni Association

The Minnesota Medical Alumni Association held its Homecoming in conjunction with the Dedication. The annual meeting was held at 1:30 on Friday, October 22, in the Mayo Auditorium. Dr. Sheldon M. Lagaard, Secretary, reviewed the past year's Alumni Association activities, and Dr. Robert B. Howard reported the status of the Alumni Directory which will be ready for distribution shortly.

The Nominating Committee's report was given by Dr. Lagaard. The following officers were unanimously elected: President, Dr. William C. Bernstein; First Vice President, Dr. Byron B. Cochrane; Second Vice President, Dr. Virgil J. P. Lundquist; Secretary, Dr. Sheldon M. Lagaard; Treasurer, Dr. James C. Mankey; Executive Board, Doctors Harold G. Benjamin, H. E. Drill, Glenn Petersen, Robert Quello, and John Linner.

A special feature of the meeting was the presentation of a Memorial Gift from the Class of 1929. Dr. E. T. Ceder, who served on the committee with Dr. Elmer M. Rusten, Chairman, and Doctors Alan Challman, Leonard A. Lang, and Roy A. Lundblad, presented $2,995.00 to the Minnesota Medical Foundation on behalf of his class to be used for scholarships or whatever other purpose Foundation officers deem advisable.

Alumni attended Homecoming Clinics on Friday afternoon. A dinner-dance, arranged by Dr. Lundquist, was held Friday evening in the Radisson Hotel, and more than 80 alumni and wives attended. The officers of the Medical Alumni Association felt that this dinner was a fitting climax to a very productive year.

* * *

Bacteriology Meeting

The North Central Branch of the Society of American Bacteriologists, comprising the states of Minnesota, Wisconsin, Iowa, North Dakota, and South Dakota, met in the Mayo Memorial Auditorium on Friday and Saturday, October 22 and 23. Scientific papers were presented on Friday from 2:30 to 4:30 p.m. and on Saturday from 10:00 a.m. to 12:00 noon. A banquet was held in the Junior Ballroom of Coffman Memorial Union on Friday evening. Dr. R. J. Dubos of the Rockefeller Institute spoke on "Metabolic Determinants of Infection."

Continuation Courses

Next November 4 to 6, 1954, the University of Minnesota will present a continuation course in Anesthesiology for General Physicians at the Center for Continuation Study. The course will deal with all types of anesthetic technics including those used in obstetrics. Newer anesthetic agents will be discussed. The faculty will include Doctors Douglas W. Eastwood, Associate Professor, Division of Anesthesiology, University of Iowa, Iowa City; F. E. Greifenstein, Professor and Chairman, Department of Anesthesiology, Wayne University College of Medicine, Detroit; and Rolland J. Whitacre, Director of Anesthesia, Huron Road Hospital, Cleveland, Ohio. The course will be presented under the direction of Dr. Frederick H. Van Bergen, Associate Professor and Acting Director, Division of Anesthesiology, University of Minnesota.

The University of Minnesota announces its annual continuation course in Radiology for Specialists which will be held at the Center for Continuation Study on the University campus next November 9 to 13, 1954. This year's course will deal with the pathology and roentgen diagnosis of diseases of bones and joints. Guest faculty will include Doctors C. Howard Hatcher, Professor of Orthopedic Surgery, University of Chicago School of Medicine; Paul C. Hodges, Professor, Section of Radiology, University of Chicago School of Medicine; John F. Holt, Professor, Department of Radiology, University of Michigan Medical School, Ann Arbor; Henry L. Jaffe, Director of Laboratories, Hospital for Joint Diseases, New York City; Gwilym S. Lodwick, Chief, Department of Radiology, Veterans Administration Hospital, and Clinical Assistant Professor, Department of Radiology, State University of Iowa College of Medicine, Iowa City; Edward B. D. Neuhauser, Associate Radiologist, Harvard Medical School, Boston; and Isidore Snapper, Director of Medicine and Medical Education, Beth-El Hospital, Brooklyn. The course will be presented under the direction of Dr. Leo G. Rigler, Professor and Head, Department of Radiology, and the remainder of the faculty will include members of the faculty of the University of Minnesota Medical School and of the Mayo Foundation.

* * *

Addendum

In the paper entitled "Agammaglobulinemia -- A Provocative Experiment of Nature", by Dr. Robert A. Good, which appeared in the October 8 issue of the "Bulletin of the University of Minnesota Hospitals and Minnesota Medical Foundation," Volume 26, Number 1, an omission occurred. The following acknowledgement should have appeared at that time.

"Patient L.L. was studied through the courtesy of Doctors Ananda Prasad and D. W. Koza who reported her case in the Annals of Internal Medicine, 41:629, September, 1954."

* * *

III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

November 1 - 6, 1954

Monday, November 1

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; W-612, U. H.

10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.

11:30 - Tumor Conference; Doctors Hitchcock, Zimmermann, and Stenstrom; Todd Amphitheater, U. H.

12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:30 Physiology Seminar; The Early Changes in Diet-Induced Heart Failure in the Mouse; Joseph T. King; 214 Millard Hall.

1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.

1:30 - 3:30 Dermatology Hospital Rounds; H. E. Michelson and Staff; Dermatology-Histopathology Room, M-434, U. H.

4:00 - 6:00 Anesthesiology Conference; F. H. Van Bergen and Staff; Room 100, Mayo Memorial.

4:30 - Public Health Seminar; (Subject to be announced); Dr. Ernst L. Abramson; Director, National Institute of Public Health, Sweden; 15 Owre Hall.

4:30 - Pediatric-Medicine Infectious Disease Rounds; Station 33, U. H.

5:00 - 6:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.

5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss and Staff; Eustis Amphitheater.

Ancker Hospital

8:30 - 10:30 Medical and Surgical Chest Conference; Dr. Gehlen and Staff; Auditorium.

10:00 - 12:00 Surgery Grand Ward Rounds; Begin Floor E4.

11:00 - 12:00 Medicine Resident Rounds.

12:30 - 2:30 Surgery Out-Patient Clinic; Room 8.

2:00 - 3:00 Routine EKG Interpretation; Dr. Sommers and House Staff; Medical Record Library.

2:30 - 3:00 Discussion of Problem Case; Auditorium.

3:00 - 4:00 Surgery Journal Club; Classroom.

3:00 - 4:00 Lectures on Electrocardiography; Ben Sommers; Auditorium.

Monday, November 1 (Cont.)

Minneapolis General Hospital

9:30 - Pediatric Rounds; Richard Raile; Station K.

10:30 - 12:00 Medicine Rounds; Thomas Lowry; Station F.

11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Station B.

11:00 - Pediatric Seminar; Erling Platou; Classroom, Station M.

12:30 - Surgery Grand Rounds; Dr. Zierold, Station E.

1:30 - 2:30 Tuberculosis Conference; J. A. Myers; Station M.

2:00 - Pediatric Rounds; Stations I and J.

Veterans Administration Hospital

9:30 - Infectious Disease Rounds; Drs. Zinnemann and Middlebrook.

1:30 - Cardiac Conference; Drs. Smith, Berman, Hoseth, Simonson, Swerdlow, Shapiro, and J. Brown; Conference Room, Bldg. I.; Rounds immediately following conference.

Tuesday, November 2

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Pediatric Conference; L. G. Rigler, Irvine McQuarrie and Staffs; Eustis Amphitheater, U. H.

12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 104 Jackson Hall.

12:30 - Bacteriology and Immunology Seminar; Nature of the Capsule; Robert Skarnes; 1050 Mayo Memorial.

12:30 - Anatomy Seminar; Immunohematology; Mary Jane Buckman; 226 Jackson Hall.

4:00 - 5:00 Pediatric Rounds on Wards; Irvine McQuarrie and Staff; U. H.

4:30 - 5:30 Clinical-Medical Pathological Conference; Todd Amphitheater, U. H.

5:00 - 6:00 X-ray Conference; Presentation of Cases from Mount Sinai Hospital; Drs. Friedman and Westley; Eustis Amphitheater, U. H.

Ancker Hospital

8:00 - 10:00 Visiting Staff Rounds.

11:00 - 12:00 Medical X-ray Conference; Auditorium.

4:00 - 5:00 Medical-Pathological Conference; W. F. Mazzitello; Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Elizabeth Lowry; Station J.

10:00 - Psychiatry Grand Rounds; R. W. Anderson, Station H.

11:00 - 12:00 Medicine-Surgery Conference; Classroom, Station M.

12:30 - 2:30 Dermatology Rounds on Clinic; Carl W. Laymon and Staff.

Tuesday, November 2 (Cont.)

Minneapolis General Hospital (Cont.)

12:30 - ECG Conference; Boyd Thomes and Staff; 302 Harrington Hall.

1:00 - Tumor Clinic; Drs. Eder, Coe, and Lipschultz; Classroom.

3:30 - Pediatric-Psychiatry Rounds; Jack Wallinga; Station I.

Veterans Administration Hospital

7:30 - Anesthesiology Conference; Surgical Conference Room, Bldg. 43.

8:30 - Hematology Rounds; Drs. Hagen and Wexler.

8:30 - Surgery Journal Club; Conference Room, Bldg. I.

9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.

10:30 - Surgery-Tumor Conference; D. Ferguson and J. Jorgens.

1:00 - Review of Pathology, Pulmonary Tuberculosis; Conference Room, Bldg. I.

1:30 - Combined Medical-Surgical Chest Conference; Conference Room Bldg. I.

2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.

4:00 - Thoracic Surgery Problems; Conference Room, Bldg. I.

Wednesday, November 3

Medical School and University Hospitals

8:00 - 9:00 Roentgenology-Surgical-Pathological Conference; Paul Lober and L. G. Rigler; Todd Amphitheater, U. H.

11:00 - 12:00 Pathology-Medicine-Surgery-Pediatrics Conference; Todd Amphitheater, U. H.

12:30 - 1:20 Radio-Isotope Seminar; Ralph Wollan; Betatron Room in Cobalt Underground Section, U. H.

1:00 - 2:00 Dermatology Clinical Seminar; F. W. Lynch; 300 North Clinic.

1:30 - 3:00 Pediatric Allergy Clinic; Albert V. Stoesser and Lloyd Nelson; W-211, U. H.

3:30 - 4:30 Dermatology-Pharmacology Seminar; 3rd Floor Conference Room, Heart Hospital.

4:30 - 5:50 Dermatology-Infectious Disease Seminar; 3rd Floor, Conference Room, Heart Hospital.

5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater, U. H.

5:00 - 6:00 Residents' Lecture; Medico-legal and Compensation Considerations; Harry B. Hall; Todd Amphitheater, U. H.

5:30 - 7:30 Dermatology Journal Club and Discussion Group; Hospital Dining Room.

7:30 - 9:30 Dermatology Seminar; Review of Interesting Slides of the Week; Robert W. Goltz; Todd Amphitheater, U. H.

Wednesday, November 3 (Cont.)

Ancker Hospital

8:30 - 9:30 Clinico-Pathological Conference; J. Noble; Auditorium.

11:00 - 12:00 Medicine Resident Rounds.

3:00 - 5:00 Infectious Disease Rounds; Wesley W. Spink; Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Henry Staub; Station I.

10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.

12:00 - Surgery Seminar; Arthur Zierold; Classroom.

12:15 - Pediatrics Staff Meeting; Classroom, Station I.

1:30 - Pediatric House Staff Seminar; Erling Platou; Station I.

1:30 - Pediatric Rounds; Erling Platou; Classroom, Station I.

Veterans Administration Hospital

8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Surgical Conference Room, Bldg. 43.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.

9:00 - Gastro-Intestinal Rounds; Drs. Wilson, Zieve, Ferguson, Brakel, O'Leary, Konig, and Swenson.

10:30 - Psychosomatic Conference; C. K. Aldrich; 7th Floor, Bldg. 43.

12:30 - Medical Journal Club; Doctors' Dining Room.

12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.

1:30 - 3:00 Metabolic Disease Conference; Drs. Flink and Latts.

3:30 - Urology Pathology Slide Conference; Dr. Gleason; Conference Room, Bldg. I.

7:00 - Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.

Thursday, November 4

Medical School and University Hospitals

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Room 3.148; Mayo Memorial.

11:00 - 12:00 Cancer Clinic; K. Stenstrom, A. Kremen, and B. Zimmermann; Todd Amphitheater, U. H.

12:30 - Physiological Chemistry Seminar; Role of Vitamin D in Calcification; Curtis Carlson; 214 Millard Hall.

12:30 - 1:30 Endocrine Seminar; Review of papers presented at the Symposium on Growth Hormone and at the Seventh Annual Meeting of the Detroit Institute of Cancer Research; Franz Halberg; 1342 Mayo Memorial.

12:30 - 1:30 Electrocardiography Conference; Ernst Simonson; Staff Room, Cardiac Clinic, Heart Hospital.

Thursday, November 4 (Cont.)

Medical School and University Hospitals (Cont.)

1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.

4:00 - 5:00 Anesthesiology Seminar; F. H. Van Bergen and Staff; Room 100, Mayo Memorial.

5:00 - 6:00 Radiology Seminar; Pulmonary Nodules; E. Robert Heitzman; Eustis Amphitheater, U. H.

7:30 - 9:30 Physiology 114A Seminar; Hemodynamic Problems; M. B. Visscher and Robert Evans; 271 Lyon Laboratories.

Ancker Hospital

8:30 - 9:30 Medical Grand Rounds; Auditorium; Visiting Staff Rounds immediately following Grand Rounds.

11:00 - 12:00 Medicine Resident Rounds.

2:00 - 3:00 Routine ECG Interpretation; Ben Sommers; Medical Record Library.

Minneapolis General Hospital

9:30 - Neurology Rounds; Heinz Bruhl; Station I.

9:30 - Pediatric Contagion Rounds; R. B. Raile; Station K.

10:00 - Psychiatry Grand Rounds; R. W. Anderson and Staff; Station H.

11:30 - 12:30 Clinical Pathological Conference; John I. Coe; Classroom.

12:30 - 2:30 Dermatology Rounds and Clinic; Carl W. Laymon and Staff.

1:00 - Fracture X-ray Conference; Drs. Zierold and Moe; Classroom.

1:00 - House Staff Conference; Station I.

Veterans Administration Hospital

8:30 - Hematology Rounds; Drs. Hagen and Williams.

8:30 - Experimental Surgery Laboratory Meeting; Conference Room, Bldg. I.

9:00 - Surgery Grand Rounds; Conference Room, Bldg. I.

9:00 - Surgery Ward Rounds; D. Ferguson and Staff; Ward 11.

11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room; Bldg. I.

1:00 - Infectious Disease Conference; Conference Room, Bldg. I. (Rounds immediately following conference.)

4:00 - Medical-Surgical Conference; Conference Room, Bldg. I.

Friday, November 5

Medical School and University Hospitals

8:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U.H.

10:30 - 11:50 Medicine Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

Friday, November 5 (Cont.)

Medical School and University Hospitals (Cont.)

10:30 - 1:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:00 - 12:00 Vascular Rounds; Davitt Felder and Staff Members from the Departments of Medicine, Surgery, Physical Medicine, and Dermatology; Eustis Amphitheater, U. H.

11:45 - 12:50 University of Minnesota Hospitals Medical Staff Meeting; The Development and Testing of a New Respirator; Doctors Schultz, Gordon, Van Bergen, Weatherhead, Buckley, and Field; Powell Hall Amphitheater.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

1:30 - 2:30 Dermatology Grand Rounds; Presentation of Cases from Grouped Hospitals (University, Ancker, General and Veterans) and Private Offices; H. E. Michelson and Staff; Eustis Amphitheater, U. H.

2:30 - 4:00 Dermatology Hospital Rounds; H. E. Michelson and Staff; Begin at Dermatological Histopathology Room, M-434, U. H.

3:00 - 4:00 Neuropathological Conference; F. Tichy; Todd Amphitheater, U. H.

3:30 - 4:30 Dermatology-Physiology Seminar; 3rd Floor Conference Room, Heart Hospital.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hanson and Staff; E-534, U. H.

5:00 - Urology Seminar and X-ray Conference; Eustis Amphitheater, U. H.

Ancker Hospital

3:00 - 4:00 Medical-Surgical-Pathological Conference; Auditorium.

4:00 - 5:00 Medical Journal Club; Conference Room, E5.

4:00 - 5:00 X-ray Surgery Conference; Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Elizabeth Lowry; Station J.

10:30 - Pediatric Surgical Conference; Tague Chisholm and B. Spencer; Classroom, Station I.

12:00 - Surgery-Pathology Conference; Drs. Zierold and Coe; Classroom.

1:00 - 3:00 Clinical-Medical Conference; Thomas Lowry; Classroom, Station M.

1:30 - Pediatric Contagion Rounds; L. Wannamaker; Station K.

Veterans Administration Hospital

10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.

12:30 - Urology X-ray Conference; X-ray Department.

1:00 - Autopsy Conference; E. T. Bell; Conference Room, Bldg. I.

2:00 - Pathology Slide Conference; E. T. Bell; Conference Room, Bldg. I.

Saturday, November 6

Medical School and University Hospitals

7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.

9:00 - 19:30 Pediatric Grand Rounds; Eustis Amphitheater, U. H.

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Heart Hospital Amphitheater.

9:15 - 10:00 Surgery-Roentgenology Conference; L. G. Rigler, J. Friedman, Owen H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:30 Surgery Conference; Todd Amphitheater, U. H.

10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

Ancker Hospital

8:30 - 9:30 Surgery Conference; Auditorium.

9:30 - 11:00 Medicine Grand Ward Rounds.

Minneapolis General Hospital

8:00 - Urology Staff Conference; T. H. Sweetser; Main Classroom.

9:00 - Psychiatry Grand Rounds; R. W. Anderson; Station H.

9:30 - Pediatric Rounds on all Stations; R. B. Raile.

11:00 - 12:00 Medical X-ray Conference; O. Lipschultz, Thomas Lowry and Staff; Main Classroom.

Veterans Administration Hospital

8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.

8:30 - Medical X-ray Conference; Conference Room, Bldg. I.