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Bulletin of the
University of Minnesota Hospitals
and
Minnesota Medical Foundation



Radioactive Cobalt
Beam Therapy Unit

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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I. THE RADIOACTIVE COBALT BEAM THERAPY UNIT - A VALUABLE NEW TOOL IN RADIATION THERAPY

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Historical Background

With the rapid developments in the fields of nuclear physics in the 1930's and early 1940's, the possible utility in radiation therapy of various radioactive materials became readily apparent.

Radioactivity could be induced by means of particle accelerators, such as cyclotrons, and, later, nuclear reactors or atomic piles. Properties of isotopes in which radioactivity had been induced indicated the suitability of a number of these substances for particular purposes.

The practicability of radioisotope use awaited production in suitable quan-

tity and form. Finally, the production of certain of the radioisotopes in multicurie quantities made feasible the use of gamma rays in a manner similar to X-rays.

Radium has been widely used interstitially and in body cavities following its discovery in 1898¹. However, it was in 1917 that Janeway first used his radium "pack" and increased the amount of radium used and the distance from the radium to the patient. During the 1920's, a number of radium teletherapy units were designed and used in Europe and the United States; in general, these units contained from 4 to 6 grams of radium and were used at distances of 5 to 10 cm. from the patient. There are now in existence units containing 50 grams of radium. Longer distances were unfeasible because of the length of treatment time, although greater distances were more desirable because of the increase in relative depth dose as one goes to greater distance. The improvement with distance can be illustrated by this table²:

VALUES OF $\frac{f^2}{(f+d)^2}$

f.s.d. in cm.	Depth in cm.					
	0	1	2	5	10	20
5	100	69.5	51.0	25.0	11.0	4.0
50	100	96.0	92.5	83.5	69.5	51.0

The development of teletherapy units which would be practical with working distances in excess of 50 cm. had to await production of radium or other materials in quantities equivalent to several hundred grams of radium. Among the suitable isotopes are Cobalt-60, Cesium-137, and Europium 152-154.

Nature of Cobalt 60

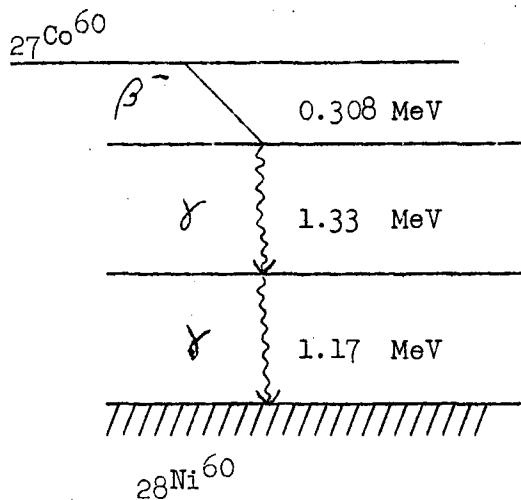
Cobalt-60, first suspected to exist in 1936³, was quickly recognized as a suitable material for replacement of radium in many of its uses. Cobalt element

is a grey, hard, metal with specific gravity of 8.8 and can be machined into various shapes and sizes suitable to the intended use. The stable isotope of Cobalt has an atomic weight of 59, with 6 radioactive isotopes. Neutron bombardment in a nuclear reactor converts Cobalt 59 to radioactive Cobalt 60.

Cobalt 60 possesses a number of the desirable characteristics for isotopic teletherapy units, namely (1) fairly cheap and easily handled raw material in abundant supply, (2) reasonably long half life of 5.3 years, and (3) high

energy gamma emission (1.17 MeV and 1.33 MeV) with weak beta particle emission (0.308 MeV).

The decay scheme of Cobalt 60 is as shown:^{4,7}



Compared to radium, cobalt has a number of advantages. Radium salt is in powder form and has a gaseous decay product, whereas cobalt is metallic and decays to stable Nickel-60. Radium emission must be filtered with platinum, gold, silver or lead to remove highly energetic beta particles; a thin coating of steel is adequate to filter out the weak Cobalt beta radiation. The gamma ray output of Cobalt 60 of 13.5 roentgens per millicurie per hour at one centimeter from a point source compares to a figure of 8.4 for filtered radium. Specific activity of radium is 1 curie per gram, whereas it is possible to have as much as 150 curies per gram of cobalt; specific activity is important in geometric design of the source and characteristics of the emitted beam.

The intensity of neutrons in the "pile", or neutron flux density, determines the final specific activity of the source. Until recently, the Chalk River, Canada, pile was the only one with sufficient intensity to produce an optimal source.

The Radioactive Cobalt Beam Therapy Unit at the University of Minnesota Hospitals was made by the Commercial Pro-

ducts Division, of Atomic Energy of Canada, Ltd. and Purchased with funds donated by an interested Minneapolis citizen. Essentially, it consists of a source of radioactive cobalt 60 enclosed in a lead barrel for controlling emitted radiations. The source is made up of 16 discs of cobalt, each 1 inch in diameter and 0.02 inch thick. These contain 35 grams of cobalt, of which approximately 2.4% is radioactive. At the time of delivery in early April, 1953, the discs contained an estimated 1050 curies of Cobalt 60.

The lead housing is approximately 2 feet in diameter and is solid except for a conical compartment immediately below the source which is filled with mercury. By turning on an air pump which brings air pressure to bear on the superior surface of the mercury pool, the mercury is forced out of the compartment into a reservoir in the upper part of the machine. The compartment then contains compressed air only, which is easily penetrated by the gamma ray beam as it emerges toward the patient. At the conclusion of a treatment, or in event of power failure, the air pressure is released and the mercury flows back into the compartment, cutting off the gamma ray beam.

The beam of gamma radiation applied to the patient is collimated with two pairs of 3-inch lead shutters. A light and mirror device reproduces with visible light the configuration of the radiation beam.

The room in which the unit is housed has 2-foot concrete walls for protecting operating personnel, and a periscope arrangement makes it possible to view the patient safely during treatment.

The gamma radiation from Cobalt 60 is essentially monochromatic⁵, a new type of radiation for clinical use, for both radium and X-rays have a rather broad spectrum. 14.9 mm. of Copper is necessary to reduce Cobalt-60 gamma radiation by one-half; beta radiation is eliminated by the design of the unit and a thin steel coating of the source discs.

Depth dose data⁵ indicate that the Co-

balt-60 unit radiation compares with that from a 3-million volt X-ray machine heavily filtered. Such an X-ray machine would cost from \$150,000 upwards and would necessitate a 2-story unit, compared to the cobalt unit cost of \$50,000

and a single room installation.

Advantage in penetration can be demonstrated by comparison of Cobalt-60 radiation to that from our 400 kilovolt X-ray machine.^{5,6}

Table II

RELATIVE DEPTH DOSES

100 Cm. Distance - 400 square centimeter field.

Depth	<u>400 KVP (HVL 4.0 mm. Cu.)</u>	<u>Co ⁶⁰ (HVL 14.9 mm. Cu.)</u>
0	100%	
0.6		100%
5	82%	82%
10	52%	62%
15	33%	46%
20	21%	33%

100 Cm. Distance - 25 square centimeter field.

	<u>400 KVP</u>	<u>Cobalt 60</u>
0 Cm (Skin)	100%	
0.6		100%
5	54%	77%
10	28%	52%
15	14%	35%

The measured output of our unit at the time of installation was approximately 17.5 roentgens in air per minute at one meter distance from the source. Because of decay, a correction of 1.1% per month is necessary. The usual treatment times vary from 11 to 20 minutes, depending on site and dosage.

The first teletherapy unit was put into operation in August, 1951, by Johns of the University of Saskatchewan. His source was produced in the Chalk River atomic pile, and he designed and produced locally the container.

Cobalt 60 for interstitial use clinically was first described by W. G. Myers in 1948.⁷

Subsequently, the Canadians have been very active in this development and up to July, 1953, to our knowledge, 10 Cobalt-60 teletherapy units were in use, 6 like ours, and 4 others of different design. All but 2 were made in Canada.

Investigations of depth dose data and isodose distribution carried out by several Canadians have been of fundamental importance.^{5,9}

Clinical Applications

Clinically, the more deep-seated the lesion and the smaller the field, the greater the advantage of Cobalt-60 gamma radiation over our previously existing equipment. This would indicate its advantage in lesions of head, chest, abdomen, and pelvis.

The University of Minnesota Unit was first used on April 8, 1953. Initially, it was decided that we should initiate a study of comparative effects between our X-ray equipment and the Cobalt unit. One large group of patients in which we could do this is those with carcinoma of the uterine cervix. The method of therapy devised by McKelvey and Stenstrom has been in use in this clinic since 1938, using X-irradiation externally followed by intracavitary radium.¹⁰

The method consists of external radiation delivered through 5 large portals, essentially girdling the pelvis: anterior, right lateral, left lateral, right posterior oblique, and left posterior oblique; a dose of 3000 roentgens to tissue in 30 days is calculated to the center of the pelvis in League of Nations Stage I, II, and IV, and 3500 roentgens to tissue in Stage III. The isodose distribution through the pelvis is illustrated on the slide.

This is followed by simultaneous intracervical and intravaginal radium application, giving 5000 milligram-hours in 100 hours.

Patients are hospitalized throughout the 5-week period of therapy.

This method is now adapted to the Cobalt Unit, and cases in each of the first three League of Nations stages are alternated between the 400 KVP X-ray machine and the Cobalt Unit. The only difference in therapy will be the equipment delivering the external irradiation. An increase of 10% in dosage of the gam-

ma radiation from the Cobalt Unit was introduced to make up for a probable difference in energy absorption and relative biological efficiency between the two machines.

Tabulation of the first 100 cases accepted for therapy is as follows:

Table III

DISEASES IN FIRST 100 PATIENTS
ACCEPTED FOR THERAPY

Carcinoma of Uterine Cervix	27
League of Nations Stage I	6
II	8
III	8
IV	2
Recurrent or Unclassified	3
Ovarian Malignancy	11
Other Gynecologic Tumors (Uterus, Vulva, Vagina)	7
Pelvic Metastases (Breast, Seminoma)	3
Carcinoma of Urinary Bladder	7
Carcinoma of Kidney	2
Carcinoma of Prostate	1
Carcinoma of Anus, Rectum, Colon (metastatic)	5
Carcinoma of Stomach; including post. op.	2
Pseudomyxoma Peritonei	1
Ascites from Carcinoma of Breast	1
Brain Tumors	3
Pituitary Tumor (Eosinophilic)	1
Carcinoma of Pharynx and Larynx	4
Cervical node metastasis, Soft Palate Carcinoma	1
Carcinoma of Lung	
Primary	6
Metastases from	2
Metastases to (Cervix, Palate, Melanoma, Uterus)	4
Carcinoma of Esophagus	
Primary	7
Post Operative	1
Metastases from	1
Lymphosarcoma of Mediastinum, Rt. Lung.	1
Metastases to Lumbar Spine, Primary Unknown	1
Rhabdomyosarcoma of Buttock	1

Many of the above patients were in a far advanced stage of their diseases when first seen and were accepted for treatment on an experimental basis. With a new type and energy level of radiation available, we have felt we should accept a number of relatively hopeless patients in an effort to investigate the potential value of this new agent. Certainly, we have seen palliation which we were previously unable to accomplish. If discomforting symptoms can be relieved, even for a short period of time, without producing undue reactions, we feel it is worthwhile to treat the patient.

Thus far, we have been distinctly impressed with the relative comfort of the patient receiving Cobalt 60 therapy. Radiation sickness has been a major problem in only one patient who received large abdominal fields for ovarian carcinoma. Nausea has not been pronounced; diarrhea has not been as severe as with X-ray therapy; and skin reaction has not been a limiting factor in any of our patients. The response of tumor masses has, in general, been good in the short time of observation.

Case Reports

Illustrative cases of results in patients with advanced cancers are as follows: (Patients in this group were not expected to benefit from X-ray therapy with voltages up to 400 K.V.)

- I. 11 year old boy, operated on March 11, 1953, for Glioma of Brain Stem. Torkildsen procedure carried out. Post-operative course poor. Arrived here for treatment with headache, left hemiparesis, nystagnus, almost constant emesis. Treated from 4/29/53 to 5/29/53, delivering approximately 4900 roentgens to the tumor through 4 fields. All symptoms had improved markedly by the end of treatment. Improvement continued until mid-August, at which time he remained about the same until mid-September, when a rapid downhill course began. Expired 9-25-53.
- II. 65 year old female. Gave history of dysphagia for few months in later 1952. Treated with X-ray for Squamous Carcinoma of Cervical Esophagus and probable left hilar metastasis in November and December, 1952. Tumor and dysphagia still remained when we started Cobalt-60 treatment on May 15, 1953 which continued until June 15, 1953. Dose of 5000 roentgens to tumor delivered through 3 fields. Dysphagia disappeared and tumor regressed markedly. Had gained 16 pounds and was feeling good by 9-1-53. Now some suggestion of stricture or recurrence.
- III. 53 year old female. Treated in February and March, 1953, for squamous carcinoma of posterior pharyngeal wall. No evidence of tumor on followup exam in May, 1953, but complaint of dysphagia for 1 month prompted X-ray study of esophagus which showed a Carcinoma of the Mid-Esophagus, which Dr. Rigler felt was too far from the pharyngeal primary to be extension. From 5-28-53 to 6-30-53, a dose of 4000 roentgens was delivered to the tumor through 3 fields. The tumor and dysphagia responded well initially, although subsequent studies show some narrowing of the lumen and she complains of mild dysphagia.
- IV. 74 year old female. History of progressive dysphagia from fall, 1952, until early March, 1953. Exploration showed Scirrhus Carcinoma of proximal half of Stomach involving distal esophagus with regional node and liver metastases. Ate and drank with progressive difficulty until early June, when she had trouble swallowing anything. Treated from 6-29-53 to 8-3-53, receiving a tumor dose of 3400 roentgens to tissue through 2 fields. After 2 weeks of therapy she was able to eat fairly well and at the end of treatment she had no dysphagia whatsoever. Did well until about

October 1. Evidence of recurrence seen on X-rays. Second course of therapy under way now.

V. 70 year old male. Progressive dysphagia for 14 months. Could not swallow solid foods, drank liquids with difficulty on admission. Biopsy showed Adenocarcinoma of Esophagus at level of aortic arch. Treated from 8-3-53 to 9-15-53, receiving a dose of 4500 roentgens to tumor through 3 fields. Dysphagia improved after 2 weeks of therapy and most solid foods could be swallowed at completion.

VI. 65 year old male. Epigastric discomfort for one month. X-ray showed bulky Carcinoma of lower Esophagus. Treated from 5-14-53 to 6-19-53, delivering a dose of 3700 roentgens to the tumor through 3 fields. Dysphagia cleared up. Got along well until early September. Recurrence seen and right supraclavicular metastasis noted. Now being treated for metastasis. Further therapy to primary under consideration.

VII. 50 year old male. Weakness and dry cough for 3 months. Biopsy of right supraclavicular node showed Metastatic Small Cell Carcinoma of Lung. Right lung contained primary. Liver metastases present. Lung treated from 7-9-53 to 8-21-53, delivering a dose of 3600 roentgens to the tumor through 2 fields. Mass regressed markedly. Liver also decreased in size under treatment. But in spite of excellent local response, dissemination of the tumor occurred and the patient expired in early October.

There are some lesions which we feel are not well suited to Cobalt-60 therapy, e.g., adenocarcinomas of the gastrointestinal tract because of their resistance to radiation; and Hodgkin's disease and carcinoma of the breast because they can be adequately treated on our X-ray machines.

There is no doubt that palliative results will be better, for the patients can be largely spared the discomfort of radiation sickness. Therefore, we may be able to extend palliation to patients who were previously felt to be poor risks even for palliative therapy.

Curative Aspects

Experience thus far is too limited to be able to predict improvement of curability of various lesions. Many of the lesions treated have been far advanced and regarded as incurable. Results in these cases indicate that Cobalt beam therapy is a better method of treatment, and we may reasonably expect better curative results in patients seeking treatment earlier in their disease.

Earlier cases will be necessary to enable us to explore the curative potential of the cobalt unit. It is our hope to have more patients referred before they are in the stage of extensive dissemination of their tumor. As an example of accomplishment in radiation therapy of lesions which respond poorly to surgery, one can cite Buschke and Cantrel, who had 3 patients out of 29 with carcinoma of the esophagus surviving 5 years following super voltage roentgen therapy.¹¹ Carcinoma of the larynx is another lesion which has responded well to radiation therapy, thereby preserving the larynx intact. There is a possibility that carcinomas of the urinary bladder and prostate may be more amenable to radiation therapy with this new agent.

Concomitantly with clinical study of methods and results in early cases, fundamental investigations into various physiological processes in the cancer patient are desirable, and we are happy to have had the opportunity of cooperating with Dr. B. J. Kennedy of the Department of Medicine in such studies during the past year. Further cooperative studies among the several departments interested in the cancer patient are fundamental to the cancer problem. Careful metabolic studies of hospitalized patients should provide helpful information about malignant processes in the body.

Conclusions

1. The addition of the University of Minnesota Cobalt Beam Therapy Unit provides a new, highly useful tool to our armamentarium in cancer therapy.

2. Cobalt 60 tele-therapy has proved useful in providing palliation for patients with far-advanced carcinoma beyond therapy with x-ray machines up to 400 kilovolts.

3. Curative treatments are better tolerated, and it is hoped that we will see earlier lesions in order that we may study curative effect.

4. Treatment has now been started or completed on more than 100 patients.

5. Further cooperative studies of cancer patients are desirable for advancing our knowledge of disease processes and effects of various treatment methods.

References

1. Glasser, Otto
The Science of Radiology.
Springfield, The Charles G. Thomas
Company, 1933.
2. Paterson, Ralston.
The Treatment of Malignant Disease
by Radium and X-rays.
Baltimore, The Williams & Wilkins
Company, 1949.
3. Sampson, M. D., Ridenour, L. N.,
and Bleakney, Walker.
The Isotopes of Cobalt and Their
Radioactivity.
Phys. Rev., 36:382, 1936.
4. Low-Beer, B. V. A.
The Clinical Use of Radioactive
Isotopes.
Springfield, Charles C. Thomas, 1950.

5. Dixon, W. R., Garrett, C., and
Morrison, A.
Cobalt-60 Teletherapy Unit: Output,
Depth Dose, and Isodose Distribu-
tions.
National Research Council of Canada,
Divisional Report No. PR-129, 1952
6. Glasser, Otto, et al.
Physical Foundations of Radiology.
2nd Edition. New York, Paul B.
Hoerber, 1952.
7. Myers, W. G.
Applications of Radioactive Isotopes
in Therapy.
I. Cobalt. Am. J. Roent., 60:816,
1948.
8. Johns, H. E., Bates, L. M., and
Watson, T. A.
1000 Curie Cobalt Units for Radia-
tion Therapy. I. Saskatchewan
Cobalt 60 Unit.
Brit. J. Radiol. 25:296, 1952.
9. Fedoruk, S. O., Johns, H. E., and
Watson, T. A.
Isodose Distributions for an 1100-
Curie Cobalt 60 Unit.
Radiology, 60: 348, 1953.
10. McKelvey, J. L., Stenstrom, K. W.,
and Gillam, J. S.
Results of an Experimental Therapy
of Carcinoma of the Cervix.
Am. J. Ob. and Gyn., 58:896, 1949.
11. Buschke, F. and Cantril, S. T.
Results of Supervoltage Roentgen-
therapy of Esophageal Carcinoma.
Journal of Thoracic Surgery, 26:105,
1953.

II. MEDICAL SCHOOL NEWS

Coming Events

- November 3 Elias P. Lyon Lecture; "Action of Sex Hormones on Experimental Diabetes"; Dr. Bernardo A. Houssay, Argentina; Owre Amphitheater; 8:00 p.m.
- November 5-6 Continuation Course in Medical Jurisprudence
- November 5-7 Homecoming Program
- November 16 Medical School Faculty Dinner; Coffman Memorial Union Main Ballroom; 6:30 p.m.
- November 16-18 Continuation Course in Fractures for General Physicians
- November 19-21 Continuation Course in Dermatology for General Physicians
- December 3-5 Continuation Course in Obstetrics for General Physicians

* * *

Homecoming Week Activities

Homecoming will again this year feature a number of events that will attract Minnesota Medical Alumni and other physicians of Minnesota to our campus. Activities planned for Homecoming Week will include the following:

Thursday, November 5, and

Friday morning, November 6 -- CONTINUATION COURSE IN MEDICAL JURISPRUDENCE
(Center for Continuation Study)

Friday noon, November 6 -- Staff Meeting -- SPECIAL HOMECOMING PROGRAM
(Powell Hall Recreation Lounge, University Hospitals)

Dr. O. J. Campbell, President, Minnesota Medical Association, will talk on
"The Responsibilities of Organized Medicine"

Immediately followed by: ANNUAL MEETING OF THE MINNESOTA MEDICAL ALUMNI ASSOCIATION

Friday afternoon, November 6, and

Saturday morning, November 7 -- HOMECOMING CLINICS (Eustis Amphitheater, University Hospitals)

The class of 1932-33 is holding its reunion and will take an active role in the Homecoming Clinics.

Saturday afternoon, November 7, 1:30 p.m. -- HOMECOMING FOOTBALL GAME
Minnesota vs. Indiana

Once again we wish to urge our Alumni and all other interested physicians to attend any or all of the above events.

* * *

Continuation Courses

A continuation course in Fractures will be presented by the University of Minnesota at the Center for Continuation Study next November 16 to 18. The program, which is intended primarily for physicians engaged in general practice, will emphasize management of the common types of fractures and some of the complications most frequently encountered. Two outstanding guest speakers will participate in the program: Dr. Edwin F. Cave, Chief of Fracture Service, Massachusetts General Hospital; Assistant Professor of Orthopedic Surgery, Harvard Medical School; and Chief Consultant in

Orthopedic Surgery for Veterans Administration Hospitals in New England; and Dr. Walter P. Blount, Chief of Orthopedics, Milwaukee Children's Hospital, and Consultant in Orthopedics, Milwaukee County Hospital, Milwaukee, Wisconsin. The course will be presented under the direction of Dr. Wallace H. Cole, Professor and Director, Division of Orthopedic Surgery, and the remainder of the faculty will include members of the staff of the University of Minnesota Medical School.

Dermatology will be the subject of a continuation course for physicians which will be presented by the University of Minnesota at the Center for Continuation Study next November 19 to 21. Intended primarily for physicians engaged in general practice, the course will stress the recognition and management of the common skin disorders. Guest speaker will be Dr. Clarence S. Livingood, Physician-in-Charge, Division of Dermatology, Henry Ford Hospital, Detroit. The program will be presented under the direction of Dr. H. E. Michelson, Professor of Medicine and Director of Dermatology; and the remainder of the faculty will be drawn from the University of Minnesota Medical School and the Mayo Foundation.

* * *

Publications of the Medical School Faculty

- Amatuzio, D.S., Weber, L.J., and Nesbitt, Samuel: Bilirubin and Protein in the Cerebrospinal Fluid of Jaundiced Patients with Severe Liver Disease with and without Hepatic Coma. *J. Lab. & Clin. Med.*, 41: 615, 1953.
- Amatuzio, D.S., Stutzman, F.L., Vanderbilt, M.J., and Nesbitt, Samuel: Interpretation of the Rapid Intravenous Glucose Tolerance Test in Normal Individuals and in Mild Diabetes Mellitus. *J. Clin. Investig.* 32: 428, 1953.
- Bacon, H.E. and Sherman, L.F.: Surgical Management of Congenital Malformations of the Anus and Rectum. *A.M.A. Archives of Surgery*, 64: 331, 1952.
- Baker, A.B., Schiele, B.C., Hastings, D.W., and Jensen, R.A.: Neurologic and Psychiatric Trends in Minnesota. *Minn. Med.*, 36: 384, 1953.
- Barnum, C.P. and Halberg, Franz: A 24-Hour Periodicity in Relative Specific Activity of Phosphorus Fractions from Liver Microsomes of Mice. *Metabolism*, 2: 271, 1953.
- Borychowska, Ada: The Determination of Evans Blue Using Zephiran as a Solvent. *Fed. Proc.*, 12: 181, 1953.
- Bosch, H.M.: Global Opportunity for a Better Environment. *Am. J. of Public Health*, 43: 20, 1953.
- Caster, W.O. (introduced by C. P. Barnum): Effect of X-ray on Salt and Water Balance in the Rat. *Fed. Proc.*, 11: 195, 1952.
- Caster, W.O. (introduced by W. D. Armstrong): A Simple Procedure for Preparing Anaerobic Plasma. *Proc. Soc. Exp. Biol. Med.*, 81: 578, 1952.
- Caster, W.O. (introduced by C. P. Barnum): Variation in Tissue DNA Following Total Body Irradiation. *Fed. Proc.*, 12: 188, 1953.
- Cohen, Morley, Hammerstrom, R.N., Spellman, M.W., Varco, R.L., and Lillehei, C.W.: The Tolerance of the Canine Heart to Temporary Complete Vena Caval Occlusion; Surgical Forum of the American College of Surgeons, W. B. Saunders Co., Philadelphia, 1952, pp. 172-177.

III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

November 2 - 7, 1953

Monday, November 2

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 Kremen, Moore, and Stenstrom; Todd Amphitheater, U. H.
- 11:30 - 12:30 Physical Medicine Seminar; Arthur B. Quiggle; Heart Hospital Auditorium.
- 12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.
- 12:30 - 1:30 Physiology Seminar 201; Studies on Methods Used to Preserve Spermatozoa; Edmund F. Graham; 214 Millard Hall.
- 1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 4:30 - Public Health Seminar; International Health Activities of the Foreign Operations Administration; Hershel Engler, Assistant Chief, Health Services Branch, Division of International Health, Department of Health, Education and Welfare, Public Health Service, Washington, D.C.; 15 Owre Hall.
- 5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss, and Staff; Eustis Amphitheater.

Ancker Hospital

- 8:30 - 10:00 Tuberculosis and Chest Conference; Auditorium.
- 2:00 - 3:00 Surgery Journal Club; Classroom.

Minneapolis General Hospital

- 9:30 - Pediatric Rounds; Eldon Berglund; Newborn Nursery, Station C.
- 10:30 - 12:00 Tuberculosis and Contagion Rounds; Thomas Lowry; Station M.
- 11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Sta. A.
- 11:00 - Pediatric Rounds; Erling Flatou; Station K.
- 12:30 - Surgery Grand Rounds; Dr. Zierold; Sta. A.
- 1:00 - X-ray Conference; Classroom, 4th Floor.
- 2:00 - Pediatric Rounds; Robert A. Ulstrom; Stations I and J.

Monday, November 2 (Cont.)

Veterans Administration Hospital

1:30 - Cardiac Conference; Drs. Berman, Weisbart, and Smith; Rounds immediately following conference.

Tuesday, November 3

Medical School and University Hospitals

- 9:00 - 9:50 Roentgenology-Pediatric Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.
- 9:00 - 12:00 Cardiovascular Rounds; Station 30, U. H.
- 12:30 - 1:30 Physiology 114C -- Respiration; E. B. Brown; 129 Millard Hall.
- 12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I. A.
- 3:30 - Pediatric Seminar; Atypical Tetralogy of Fallot; Paul Adams; Sixth Floor West, U. H.
- 4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.
- 4:30 - 5:30 Clinical-Medical-Pathological Conference; Todd Amphitheater, U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 5:00 - 6:00 X-ray Conference; Presentation of Cases from Ancker Hospital; Drs. Aurelius, Peterson, and Azad; Eustis Amphitheater, U. H.
- * 8:00 p.m. Elias P. Lyon Memorial Lecture; "Action of Sex Hormones on Experimental Diabetes"; Prof. Bernardo A. Houssay, Argentina; Owre Amphitheater.

Ancker Hospital

9:00 - 10:00 Medical X-ray Conference; Auditorium.

Minneapolis General Hospital

- 10:00 - Pediatric Rounds; Spencer F. Brown; Stations I and J.
- 10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station F.
- 12:30 - Grand Rounds; Fractures; Willard White, et al; Sta. A.
- 12:30 - Neuroroentgenology Conference; O. Lipschultz, J. C. Michael and Staff.
- 12:30 - EKG Conference; Boyd Thomes and Staff; 302 Harrington Hall.
- 1:00 - Tumor Clinic; Drs. Eder, Cal, and Lipschultz.
- 1:00 - Neurology Grand Rounds; J. C. Michael and Staff.

Veterans Administration Hospital

- 7:30 - Anesthesiology Conference; Conference Room, Bldg. I.
- 8:45 - Surgery Journal Club; Conference Room, Bldg. I.
- 9:30 - Infectious Disease Rounds; Drs. Hall, Zinneman and Brown.
- 9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.

Tuesday, November 3 (Cont.)

Veterans Administration Hospital (Cont.)

- 10:30 - Surgery-Tumor Conference; L. J. Hay, J. Jorgens and Donn Mosser; Conference Room, Bldg. I.
- 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 4

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 Conference; Surgery Case; O. H. Wangenstein, C. J. Watson, and Staffs; Todd Amphitheater, U. H.
- 12:30 - 1:30 Physiology 114B -- Transport Seminar; Nathan Lifson and M. B. Visscher; 214 Millard Hall.
- 12:30 - 1:30 Radioisotope Seminar; Red Cell Volume and Turnover Studies with Chromium 51; Raymond Read; 12 Owre Hall.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater.
- 8:00 - 10:00 Dermatological-Pathology Conference; Review of Histopathology Section; R. Goltz; Todd Amphitheater, U. H.

Ancker Hospital

- 8:30 - 9:30 Clinico-Pathological Conference; Auditorium.
- 12:30 - 1:30 Medical Journal Club; Library.

Minneapolis General Hospital

- 8:30 - 9:30 Obstetrical and Gynecological Grand Rounds; William P. Sadler and Staff; Station C.
- 9:30 - Pediatric Rounds; Max Seham; Stations I and J.
- 10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.
- 11:00 - Pediatric Seminar; Arnold Anderson; Classroom, Station I.
- 11:00 - Pediatric Rounds; Erling S. Platou; Station K.
- 12:00 - Surgery Seminar; Arthur Zierold; Classroom.
- 12:15 - Pediatric Staff Meeting; Classroom, Station I.
- 1:30 - Visiting Pediatric Staff Case Presentation; Station I, Classroom.

Wednesday, November 4 (Cont.)

Veterans Administration Hospital

- 8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Conference Room; Bldg. I.
- 8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.
- 9:00 - Gastro-Intestinal Rounds; Drs. Wilson, Zieve, Hay, Brakel and Nesbitt.
- 12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.
- 1:30 - 2:30 Infectious Disease Conference; Wesley W. Spink; Conference Room, Bldg. I.
- 2:30 - 4:30 Infectious Disease Rounds; Main Conference Room, Bldg. I.
- 4:00 - Combined Medical Surgical Conference; Drs. Flink and Hay; Conference Room, Bldg. I.
- 5:00 - Medical Journal Club; Conference Room, Bldg. I.
- 7:00 p.m. Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.

Thursday, November 5

Medical School and University Hospitals

- 9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Todd Amphitheater, U. H.
- 12:00 - 1:00 Medical Journal Club; New Chemotherapeutic Agents; James Brown; Dean's Conference Room, Millard Hall.
- 12:30 - Physiological Chemistry Seminar; Recent Studies on Thyroid Hormone; William Batten; 214 Millard Hall.
- 1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.
- 4:00 - 5:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 5:00 - 6:00 Radiology Seminar; Report of International Congress of Radiology; Drs. Borman and Merner; Eustis Amphitheater, U. H.
- 7:30 - 9:30 Pediatric Cardiology Conference and Journal Club; Review of Current Literature 1st hour and Review of Patients 2nd hour; 206 Temporary West Hospital.

Ancker Hospital

- 8:00 - 10:00 Medical Grand Rounds; Auditorium.

Minneapolis General Hospital

- 9:30 - Neurology Rounds; Heinz Bruhl; Station I.
- 10:00 - Pediatric Rounds; Spencer F. Brown; Station K.
- 10:00 - Psychiatry Grand Rounds; J. C. Michael and Staff; Sta. H.
- 11:30 - 12:30 Clinical Pathological Conference; John I. Coe; Classroom.