

**Staff Meeting Bulletin
Hospitals of the » » »
University of Minnesota**

Meningitis

STAFF MEETING BULLETIN
HOSPITALS OF THE . . .
UNIVERSITY OF MINNESOTA

Volume X

Friday, February 17, 1939

Number 17

INDEX

	<u>PAGE</u>
I. LAST WEEK	233
II. MOVIE	233
III. ANNOUNCEMENTS	
1. BABY GIRL	233
2. CENTER FOR CONTINUATION STUDY	233
IV. MENINGITIS - - A REVIEW W. S. Sako, E. C. Perlman, and E. S. Platou .	234 - 252
V. GOSSIP	253 - 254

Published for the General Staff Meeting each week
during the school year, October to May, inclusive.

Financed by the Citizens Aid Society.

William A. O'Brien, M.D.

I. LAST WEEK

Date: February 10, 1939
Place: Recreation Room
 Powell Hall
Time: 12:15 to 1:05
Program: Movie: "The Moth and the
 Flame"

Announcements

Out-Patient Department
 Macnider Wetherby

Discussion

H. B. Sweetser
 Ruth Boynton
 J. C. McKinley

Present: 135

Gertrude Gunn
 Record Librarian

II. MOVIE

Title: "How To Read"

Released by: M-G-M

III. ANNOUNCEMENTS1. BABY GIRL

Mary, daughter of
 Dr. and Mrs. Milan Novak, born February
 17 at 1:00 A.M. Weight 7-3/4 pounds.

" Congratulations!

2. THE CENTER FOR CONTINUATION
 STUDY

The next course in
 the medical and hospital series will be
 held February 22, 23, and 24 on the
 subject of Medical Social Service.
 Program arrangements are in charge of
 Miss Frances Money, Director of Social
 Service, University of Minnesota Hospitals.
 The program will follow three main dis-
 cussion lines: Emotional Elements in Ill-

ness; Interpretation of Medical Social
 Work to Other Agencies and the Public;
 and Interviewing and Unrecorded Social
 Contacts. Harriett M. Bartlett, Educa-
 tional Director, Social Service Depart-
 ment, Massachusetts General Hospital,
 Boston; Elizabeth T. Mills, Director So-
 cial Service Department, University Hos-
 pitals, Iowa City, and Grace Beals
 Ferguson, Professor of Division of Social
 Administration, University of Iowa, will
 be assisted by Mary Gold, Director of
 Social Service, Minneapolis General Hos-
 pital, and Miss Money, who will represent
 the Medical Social Service Faculty.
 Among others, Mollie F. Palmer, Assistant
 Professor of Preventive Medicine and Pub-
 lic Health and Gertrude Vaile, Associate
 Director Graduate Course in Social Work
 will present the views of those working
 in related fields (Public Health Nursing
 and Public Assistance). Dr. J. C. McKin-
 ley will open the discussion on "Emotion-
 al Elements in Illness." This will be
 followed by a discussion of the "Medical
 Social Workers' Responsibility." Round
 table discussions on the Emotional Ele-
 ments in Surgical, Cancer, Obstetric, and
 Gynecological Patients" will be lead by
 Drs. McKelvey and Peyton. The "Medical
 Patient" by Dr. Walter Alvarez of the
 Mayo Clinic; "The Blind" by Dr. Charles
 E. Stanford, and "The Tuberculous" by Dr.
 F. F. Callahan, Medical Director Long-
 street Taylor Foundation, Pokegama, Minn.
 On Friday the group will have lunch with
 us and attend the meeting of the general
 medical staff. This will be followed by
 a tour thru the University of Minnesota
 Hospitals to inspect the newer therapeutic
 developments. The group of medical social
 workers of Minnesota and surrounding
 states, while not as numerous as some of
 the other hospital groups, is a very ac-
 tive body. They are interested in know-
 ing of ways and means of assisting the
 physicians in the care of their patients
 by aiding the patients and their families
 in making the necessary social adjustments
 when illness comes. This is course No.
 29 in the current medical and hospital
 series which started in January, 1937
 with the opening of the Center for Con-
 tinuation Study. Courses in medical
 subjects will occupy the program for
 the balance of the fiscal year.

* * * *

IV. MENINGITIS -- A REVIEW

W. S. Sako, E. C. Perlman, and
E. S. Platou

From the Department of Pediatrics
Service at the Minneapolis General
Hospital.

coccic meningitis. A review of the literature and an analysis of the cases admitted to the Minneapolis General Hospital from 1922 to 1938 are given. Only those cases are included in which the organisms have been isolated and identified from the cerebrospinal fluid. To conserve time and space, the data is presented in more or less outline form.

Introduction

Recent trends in the management of meningitis prompted us to review this subject with particular emphasis on treatment. We shall confine our discussion to meningococcic, pneumococcic, streptococcic, influenzal, and staphylo-

Incidence

Etiologically the types of meningitis vary from year to year depending upon factors such as the incidence of respiratory infections and the presence or absence of epidemics. Analysis of large series of cases by other workers as well as our own is given in Table I.

TABLE I Incidence of Meningitis

	Neal ¹	Tripoli ²	Fothergill ³	Levinson ⁴	Huntington ⁵ & Wilkes- Weiss	MGH
Meningococcic	1216	221	27	1304	160	255
Tuberculous	961	51	31	677	---	95
Pneumococcic	209	111	38	(62	91
Streptococcic	203	24	36	(530	74	137
Influenzal	111	20	51	(51	17
Staphlococcic	27	9	--	(22	15
Others	--	--	38		--	6

Etiology

1. Meningococcic meningitis is regarded as an infection resulting from meningococcemia. Opinion is divided as to whether influenzal meningitis is primary or secondary. Some consider it a complication of respiratory infection. Rivers⁶ found that 74% of his cases were primary infections. Staphylococcic

meningitis in our experience has usually occurred in the course of a general septicemia. The other forms of meningitis are usually secondary to some other disease: otitis media, sinusitis, pneumonia, upper respiratory infection, etc. The causative organisms are isolated from the cerebrospinal fluid. The primary focus in our series of cases of secondary meningitis are tabulated in Table II.

TABLE II Primary Focus in Secondary Meningitis

	Streptococcic	Pneumococcic	Influenzal	Staphylococcic
Otitis media, mastoiditis	87 cases	40 cases	5 cases	1 cases
Sinusitis	4	4	1	0
Pneumonia	11	33	3	0
Pneumonia, otitis, sinusitis	0	2	0	0
Pharyngitis	4	1	0	0
Cellulitis	1	0	0	0
Abscesses:				
Mediastinal	0	0	0	1
Parotid	2	0	0	0
Paravertebral	0	0	0	2
Carbuncle	0	0	0	4
Peritonsillar	1	0	0	1
Scalp	0	0	0	1
Fracture skull	9	6	0	3
Subacute bacterial endocarditis	2	0	0	0
Spina bifida	2	0	0	0
Infectious arthritis	1	0	0	0
Osteomyelitis	0	0	0	1
Erysipelas	1	0	0	0
Surgery of head or spine	4	0	0	1
Unknown	<u>8</u>	<u>5</u>	<u>8</u>	<u>0</u>
Total	137 cases	91 cases	17 cases	15 cases

2. Predisposing Causes

A. Age. All types of meningitis are more common in childhood. In adults, the disease is more common among the young and middle aged than among the senile. The age

incidence of meningitis in the Minneapolis General Hospital during the years 1922 to 1938 and of meningococcic meningitis in the State of Minnesota and the City of Minneapolis during the years 1922 to 1937 are summarized in Table III.

TABLE III. Age Incidence of Meningitis by Standard Age Group

	Streptococcic	Pneumococcic	Influenzal	Staphylococcic	Meningococcic		
					MGH 1922 -1938	Minn 1922- 1937	Mpls 1922- 1937
Under 1	22	12	5	1	18	111	19
1 - 4	21	11	10	0	47	227	59
5 - 9	18	6	0	0	35	192	56
10-- 14	10	1	0	0	39	172	53
15 - 19	8	1	0	1	21	145	30
20 - 24	7	2	0	1	16	105	26
25 - 34	6	12	0	6	33	116	42
35 - 44	10	13	1	2	18	67	17
45 - 54	11	18	1	2	11	37	7
55 - 64	14	11	0	0	7	25	8

TABLE III. Age Incidence of Meningitis by Standard Age Group (Cont.)

	Streptococcic	Pneumococcic	Influenzal	Staphylococcic	Meningococcic		
					MGH 1922- -1938	Minn 1922- 1937	Mpls 1922- 1937
65 & Over	2	3	0	2	2	6	4
Unknown	<u>8</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>8</u>	<u>0</u>	<u>0</u>
Total	137 cases	91 cases	17 cases	15 cases	255 c.	1403 c.	321 c.

B. Sex. All forms of meningitis in females as revealed in Table IV. are more frequent in males than

TABLE IV. Sex Incidence and Ratio in Meningitis

	Male	Female	M:F Ratio
Meningococcic:			
MGH 1922-1938	163	92	1.77 : 1
Minnesota 1922-1937	781	491	1.59 : 1
Minneapolis 1922-1937	203	120	1.69 : 1
Streptococcic	75	62	1.21 : 1
Pneumococcic	56	35	1.60 : 1
Influenzal	12	5	2.40 : 1
Staphylococcic	12	3	4.00 : 1

C. Race. There is no racial predilection in meningitis. There are some reports which indicate that the incidence of meningococcic meningitis is more common among negroes than among whites but this has been attributed to lower standards of living rather

than to racial susceptibility.

D. Season. Meningitis is more frequent during the colder months, particularly winter and spring. The seasonal incidence of meningococcic meningitis in Minnesota from 1918 to 1937 is shown in Table V.

TABLE V. Seasonal Incidence of Meningococcic Meningitis

January	211 cases	July	161 cases
February	231	August	134
March	254	September	108
April	210	October	123
May	238	November	113
June	186	December	168

Pathogenesis

A. Route of Infection. There are three routes by which the meninges may be invaded.

1. Hematogenous. This is the route by which the meningococcus invades the meninges. Most of

our cases of staphylococcic meningitis have followed a generalized septicemia.

2. Direct extension from the ears, nose, sinuses, osteomyelitis of the cranial bones, or paravertebral abscess. This has been the most common method of invasion of the streptococcus and pneumococcus.

3. Direct invasion. This has usually followed fractures of the skull or surgical procedures involving the head or spinal column. Spina bifida is a common cause in infants. The organisms usually present are the streptococcus or the pneumococcus.

4. Unknown. There has been considerable discussion as to how the influenzal bacillus invades the meninges. Occasionally it results from direct extension from the ears, nose, or sinuses. Rivers⁶ believes that influenzal meningitis is a primary infection.

Laboratory Examination

1. Blood

- a. Polymorphonuclear leucocytosis.
- b. May be leucopenia in influenzal meningitis.
- c. Secondary anemia.
- d. Blood culture often positive in septicemic cases. Petechial smears may often be extremely helpful for immediate diagnosis.
- e. Blood sugar is increased, and the chlorides decreased.

2. Spinal fluid

- a. Amount of fluid and pressure increased.
- b. Fluid cloudy.
- c. Cell count is markedly increased.
- d. Protein is increased.
- e. Sugar and chlorides are decreased.

f. Organisms are found on smear or culture of fluid.

TREATMENT OF MENINGITIS MENINGOCOCCIC MENINGITIS

I. PRELIMINARY CONSIDERATIONS

A. Organism.

Gram negative biscuit-shaped diplococcus occurring in pairs typically intracellular but also extracellular.

B. Cultural Characteristics.

The meningococcus grows best on brain broth, blood agar, and ascitic dextrose agar, at a temperature of 36 to 37 degrees C. It is very sensitive to changes in temperature, its growth being arrested at temperatures above 42 degrees C. and below 25 degrees C. It produces acid without gas formation in glucose and maltose, but no change in lactose, saccharose, and mannose.

C. Toxin.

Recent investigations have shown that the meningococcus produces both an endotoxin and exotoxin, and that the toxin plays an important part in the pathology of the disease.

D. Types.

Seven different types of meningococcus have been recognized, according to their serologic reactions. Four of these have been definitely established and classified by Gordon and Murray.⁷ Branham and Carlin⁸ studied 409 strains of meningococci isolated from the spinal fluid and blood of patients with meningococcic infections and 42 strains from carriers, received from various parts of the United States between 1930 and 1937. They found that Type II was relatively unimportant as a cause of epidemic meningitis in the United States, while it was prevalent among carriers

and in individuals with the active infection during endemic times. Their findings are classified into the following Gordon-Murray types:

	<u>Active Infection</u>	<u>Carriers</u>
Types I - III	352 (86.0%)	12 (28.5%)
Type II	48 (11.7%)	24 (57.0%)

Types II and IV are easily separated from the others but Types I and III are often difficult to identify. In an epidemic more than one type may be found.

E. Distribution

The meningococcus is known to exist only in man. In carriers it is found in the nasopharynx. During an active infection, it is present not only in the meninges but circulates in the blood to all organs, especially the heart, joints, skin, and the nasopharynx.

F. Carriers

During epidemics the number of meningococcus carriers is very high, ranging from 40 to 70% of the population in affected areas. At all other times the number of carriers is about 3% of the population. These are persons who harbor the meningococci in their nasopharynx following recovery from infection, or who may harbor the organisms without themselves contracting the disease.

G. Immunity

Patients recovering from the disease develop immune bodies in their blood stream. The question of natural immunity is raised by the fact that carriers do not themselves develop the disease. It may be that immunity enjoyed by the carriers is also acquired as a result of repeated exposures to meningococci of low virulence. The fact that only a few instances have been reported of more than one case of infection in the same family would suggest that most persons possess a natural immunity to the disease.

II. SPECIFIC TREATMENT

A. Antiserum

1. Discovery. In 1906 Flexner⁹ discovered antimeningococcus serum. Kolle and Wassermann¹⁰ in Germany also independently prepared a similar serum about the same time.
2. Preparation. The antimeningococcus serum now in use is prepared by repeated injections in a horse of dissolved meningococci followed by injections of live meningococcus cultures. The cultures used are of various strains of meningococci, so that the serum is polyvalent. The serum is tested before it is put up in packages by one of several methods. The complement fixation method, the agglutination method, the opsonin content, and the animal protection test. In England, the agglutination test is most frequently used. In the United States, all four methods are used by various manufacturers.
3. Preservation of Serum. The antimeningococcus serum is usually preserved with 0.2 to 0.3% of tricresol. The use of this preservative has given rise to a number of objections. Kramer¹¹ ascribes some of the deaths that had occurred after the infection of antimeningococcus serum to the use of tricresol, which he claims has a very depressing effect on the medullary center. Goldman¹² has shown that tricresol alone in a concentration present in serum can cause meningeal irritation. However, of the different preservatives used, tricresol exerts the most marked bactericidal effect and is a much less irritating preservative than chloroform. It has, therefore, been almost exclusively used in the United States as a preservative for antimenin-

gococcus serum. Recently methio- late 1: 10,000 has been used to preserve serum.

4. Route of administration. There has been no uniformity of opinion as to the route of administration. Most workers have used it exclusively intrathecally. Other workers use it both intrathecally and intravenously. Neal¹³ uses it intravenously only in septicemic cases.
 - a. Intravenous. Antiserum has been given intravenously in conjunction with intrathecal therapy but never alone. The serum should be diluted with at least an equal volume of normal saline or 10% glucose solution, and adrenalin 1:1000 solution minims V to X are added as an additional precaution to prevent reactions. Sensitivity of the patient to horse serum should be determined.
 - b. Ventricular. This method of administration has been used occasionally in infants but is a dangerous procedure.
 - c. Intrathecally. This is the usual route of administration.
 - d. Intramuscular. This method is used by some in conjunction with other routes of administration, but is usually ineffective.
5. Frequency of Administration. Some physicians prefer to give the serum intrathecally every 12 hours, others not more frequently than every 24 hours. The arguments in favor of the 8 or 12 hour intervals are based mainly on the work of Amoss¹⁴, who found that agglutinins are diminished 8 hours after immune serum is injected intraspinally into monkeys, and practically disappear after 12 hours. Those who advocate the 24 hour administration of serum claim that the serum acts directly on the organism and stimulates the phagocytic action of the cells. Frequent removal of cerebrospinal fluid would therefore remove the phagocytic cells, so important in the recovery from meningitis.
6. Dosage of Serum.
 - a. Intrathecally. Ten to 60 cc. of serum with an average of 30 cc. are usually used. The amount of serum injected should always be less than the amount of fluid removed. The gravity method only should be used.
 - b. Intravenous. Sixty to 120 cc. of serum diluted with normal saline or glucose solution are injected slowly at the rate of 30 to 60 drops per minute.
7. Total Amount of Serum. This depends on the severity of the disease and on the patient's response to treatment. In most cases 120 to 180 cc. of serum intrathecally seem sufficient, in other cases as high as 500 cc. of serum have been necessary. One to two hundred cc. of serum intravenously suffice in the average case, when used in conjunction with serum intrathecally.
8. Discontinuance of Serum. This depends on several factors such as the condition of the patient, temperature, symptoms, the character of the cerebrospinal fluid, and persistent negative cultures from the spinal fluid.
9. Effectiveness of Given Serum. Agglutination of meningococci by the serum used has been advocated as the method for the determination of the effectiveness of the serum. However, some sera that agglutinate bacteria have been of no avail, and others that do not agglutinate have been effective. The

best proof of the effectiveness of the serum used is the response of the patient treated with it. It is, however, preferable to use a serum which agglutinates the meningococci obtained from the cerebrospinal fluid.

10. Untoward Reactions.

- a. Immediate reaction due to:
 1. Increased intracranial pressure.
 2. Cool serum.
- b. Anaphylactic shock.
- c. Delayed reaction; fever, urticaria. This usually occurs from the seventh to the ninth day.

B. Meningococcus Antitoxin

In 1931 Ferry, Norton, and Steele¹⁵ demonstrated that bouillon filtrates of young cultures of the meningococcus contain extracellular or soluble toxins specific to the various types of this organism, and that when such toxins are injected into animals they stimulate the formation of homologous antitoxin. Ferry¹⁶ further showed in 1933 that such antitoxin, prepared by immunizing the horse with meningococcus soluble toxin obtained from all four recognized Gordon types of the organism, protected guinea pigs prophylactically and therapeutically against fatal doses of live meningococcus cultures. Antimeningococcus serum prepared as an antibacterial serum by immunizing the horse with the same live cultures of the four Gordon types failed to protect in like manner when used either as a prophylactic or a therapeutic measure. Ferry, therefore, does not use the accepted method of protection where the horse is injected with live meningococci.

Ferry and Schmornack¹⁷ came to the conclusion that, on the basis of their studies on meningococcus toxin and antitoxin "the symptoms of meningococcus meningitis in laboratory animals are due

in large part to the action on the central nervous system of a soluble toxin elaborated by the meningococcus and that these symptoms can be modified or entirely prevented by the neutralization of this toxin with a specific antitoxin."

Hoynes¹⁸ reported a series of 142 cases treated by meningococcus antitoxin. The fatality in his cases was only 20% compared with a fatality of more than twice that figure for cases treated by him with serum. The author gave the antitoxin intravenously in 60 to 100 cc. doses diluted with 120 to 200 cc. saline or 10% dextrose solution. This dosage was repeated if no response was obtained in 24 hours. He has given as high as 200,000 units of antitoxin.

III. HUMAN SERUM

It has been shown that the addition of fresh human serum to the antimeningococcus serum increases the bactericidal power and opsonic activity of the antiserum. Bunim and Wies¹⁹ reported a case of meningococcus meningitis in which fresh human serum had been used in combination with the regular antimeningococcus serum. The antiserum therapy was followed by a clinical improvement but the cultures from the spinal fluid did not become sterile. After 28 consecutive positive cultures, fresh normal human serum was administered intraspinaly followed by additional antiserum, with immediate sterilization of the fluid. The authors came to the conclusion that when a case is resistant to an antiserum that agglutinates the recovered organism satisfactorily, the addition of fresh normal or convalescent human serum to the antiserum may be indicated. The exact proportions of the serum to the antiserum was not determined but it was suggested that 5 cc. of fresh human serum and 15 cc. of antimeningococcus serum is a satisfactory proportion. Fonde²⁰ reported 2 cases in which fresh human serum was used in combination with antiserum, with good results.

IV. FEVER THERAPY

Bennett, Person, and Simmons²¹ and Platou, MacElmeel, Stoesser and Cooke²² in 1936 showed for the first time experimentally as well as clinically that sustained artificial fever at 41.5 degrees C (106.8 F.) for 8 hours destroys most strains of meningococci. Both groups of workers recommended hyperthermia in chronic or subacute cases that are resistant to serum therapy. They emphasize, however, that fever is contraindicated in the acute toxic phase of the disease.

V. SULFANILAMIDE THERAPY

Buttle, Gray, and Stephenson²³ in 1936 showed in their series of experiments on mice that the administration of sulfanilamide by mouth or intramuscularly protects the animals against fatal doses of meningococci. This work was confirmed by Proom.²⁴ Branham and Rosenthal²⁵ went further and showed that the protective value of sulfanilamide on mice against meningococci is equal to that of serum but that the best results were obtained when both were used in combination because an apparent synergistic action seemed to exist.

Schwentker²⁶ in 1937 reported 52 cases of meningococcal infections treated exclusively with sulfanilamide with 8 fatalities or a fatality rate of 15%. Of 278 consecutive patients treated with antimeningococcus serum in the months immediately preceding the instigation of sulfanilamide therapy, the mortality rate was 30% as compared with 15% for the drug. The drug was administered both intraspinally and subcutaneously in a concentration of 0.8%. To some patients it was given by mouth. Willien²⁷ treated 5 cases and one recurrence with oral sulfanilamide with no fatality. He concluded that the response to treatment was satisfactory even with oral therapy alone. Both the above workers showed that the spinal fluid became negative within 24 hours in the majority of instances. Recently Eldahl²⁸ treated 12 cases of meningococcal meningitis in children under 4 years of age with intrathecal and intramuscular injections of 0.8%

sulfanilamide solution with 3 fatalities (25%), whereas formerly the mortality in this age group averaged 70%. He concluded that "sulfanilamide treatment--- has but little effect if the remedy is administered exclusively by mouth or intramuscularly. But if it is given intrathecally along with the other administrations, then the treatment is very valuable. This is probably because the elimination of the sulfanilamide through the meninges may be very slow and very slight when they are inflamed. It is not likely that intrathecal injections alone are sufficient, because the meningococci can be found outside the spinal canal, and on these the sulfanilamide when given by mouth or intramuscularly, can have considerable effect." Allott²⁹ using Marshall's original method³⁰ determined the sulfanilamide content of the cerebrospinal fluid during treatment of 36 cases of meningococcus meningitis and found that in many cases the concentration takes several days to reach a maximum, the dosage being kept constant. He found considerable variation in the speed with which the effective level is reached and maintained on equivalent dosage. He surmised that this variation is due more to differences in the ratio of excretion rather than to a variation in meningeal permeability as the blood sulfanilamide level also showed similar variations.

The latest report is by Waghelstein³¹ who reported 72 cases treated with sulfanilamide alone with a mortality of 15%, 34 cases treated with sulfanilamide and serum with a mortality of 24%, or a total of 105 cases treated with sulfanilamide either alone or in combination with serum with a mortality of 18%. Of 368 cases treated with antiserum prior to sulfanilamide, the mortality averaged 27%. The number of lumbar punctures performed was markedly reduced so at present the author performs only two taps. He found that complications due to sulfanilamide were mild and few and the number of recurrences were reduced. The complications due to meningococcal infections, however, were not reduced in occurrence. He also found that the spinal fluid cultures were more consist-

ently sterile after 12 to 24 hours of treatment in those cases in which sulfanilamide was taken every four hours by mouth or by naso-gastric catheter rather than when given every 12 hours by hyperdermoclysis.

Marshall and his co-workers³⁰ showed that the sulfanilamide level in the spinal fluid is almost on the same level as that of the blood, showing that the drug readily passes through normal or pathologic meninges. The observations of Eldahl²⁸ and Allot²⁹ does not coincide with the results obtained with the drug by American workers. This may be due to the fact that technical difficulties were encountered by using Marshall's original method of sulfanilamide determination. In our experience Marshall's original method gave low sulfanilamide levels both in the blood and in the spinal fluid. By using Marshall and Litchfield's³² modified method much better results were obtained, the sulfanilamide level being on an average 10% lower, than that in the blood. The absorption was good whether the drug was administered orally, subcutaneously, or intramuscularly.

Our experience to date totals 13 cases treated with sulfanilamide alone and 7 cases treated with sulfanilamide in combination with massive doses of antitoxin intravenously. We have had no deaths in these 20 cases. We have found that intraspinal administration was not necessary. Waghelstein's³¹ recommendation of administration by stomach tube has been found to be usually successful in infants, but in older children and adults due to the frequency of vomiting which accompanies the disease it has been found to be successful. In the latter case, the drug was administered by hypodermoclysis in the form of 1% solution in Hartman's solution every 8 hours during the critical stage of the disease and in those patients who cannot tolerate the drug by mouth. In all other instances, the oral route of administration has been satisfactory. In adults we have given an initial dose of $\frac{1}{2}$ grain per pound of body weight followed by a maintenance dose of $\frac{3}{4}$ grain per pound of body weight daily in divided doses. In infants and children, who

generally tolerate the drug better, we have given an initial dose of 1 grain per pound of body weight followed by a maintenance dose of 1 grain per pound of body weight daily in divided doses.

Seven cases were treated with sulfanilamide in combination with massive doses of antitoxin intravenously--- 100,000 to 200,000 units. The results were more striking and immediate with prompt subsidence of toxic symptoms and fall of temperature with crisis.

The remarkable rapidity in which the spinal fluid was sterilized was noted. In no instance was a positive culture obtained after 24 hours of sulfanilamide therapy. This cannot be said of either antiserum or antitoxin.

Waghelstein reported that complications associated with meningococcic infections occurred just as frequently as in cases in which antiserum was used. In 368 cases treated with antiserum, arthritis developed in 10, endophthalmitis in 2, and deafness in 6. In 106 cases treated with sulfanilamide, arthritis developed in 5, endophthalmitis in 1, and deafness in 5. This as well as our observations, indicates that sulfanilamide does not combat toxemia directly and that the attack must be on the organism. As Ferry¹⁶ has pointed out, the toxins give the characteristic symptoms of the disease as well as the permanent defects. It is reasonable to conclude, therefore, that the ideal therapy would be a combination of large doses of antitoxin intravenously to combat the toxemia together with continued administration of large doses of sulfanilamide orally or subcutaneously to destroy the organisms.

VII. OUTLINE OF TREATMENT SUGGESTED

1. Spinal puncture for diagnosis. Enough fluid is withdrawn for laboratory study. The fluid is analyzed for cell count and differential, organisms by smear and culture, protein, sugar, and Wassermann.

2. If the fluid is cloudy, sulfanilamide is administered immediately subcutaneously in the form of 1% solution in normal saline or Hartman's solution in dosages previously suggested. The drug is then administered orally every 4 hours if tolerated by this route. If not, subcutaneous injections of the 1% solution are given every 8 hours. The dosage used has previously been mentioned.
3. Antimeningococcus antitoxin is given in massive doses intravenously as early as possible. In children 50,000 units are given and in adults 100,000 units. This may be repeated the next day if favorable response is not obtained in 24 hours. The serum is placed in 200 to 500 cc. of 10% dextrose solution in normal saline together with $\frac{1}{2}$ cc. of 1:1000 adrenalin solution and administered slowly at the rate of 30 to 60 drops per minute. Sensitivity of the patients to horse serum should be tested. The antitoxin is given after the causative organisms have been definitely identified. In allergic patients we do not recommend serum administration.
4. Spinal punctures are done only as indicated for drainage and to reduce intracranial pressure. Usually two or three taps are all that is necessary.
5. Since sulfanilamide therapy was started, cisternal drainage has not been found necessary.
6. The administration of general anesthesia for spinal punctures is conducive to bronchopneumonia which usually is fatal. The elimination of spinal taps to a minimum and elimination of intraspinal therapy is a great advantage.
7. Administration of parenteral fluids in comatose patients, and fluids and feedings by stomach tube in infants are highly desirable.
8. Special nursing care in turning the patients from side to side to prevent hypostatic pneumonia is emphasized. Restraints should be avoided if possible.
9. Morphine is avoided because of its respiratory depressing effect. Sedatives if given should be used to quiet the patient and not to the point of anesthesia.
10. Blood transfusions are indicated when the hemoglobin or white blood count is low.

VIII. MORTALITY AND PROGNOSIS

In spite of specific antisera, the mortality from meningococcus meningitis in the United States³³ has averaged 50%. In Minnesota during the years 1918 to 1937 the mortality per 100,000 population has averaged 1.305. The case fatality for Minnesota, Minneapolis, and the Minneapolis General Hospital for the respective years is revealed in Table 6.

Table 6. Case Fatality Per Cent from Meningococcus Meningitis in Minnesota, Minneapolis, and Minneapolis General Hospital

	<u>Cases</u>	<u>Deaths</u>	<u>Case Fatality per cent</u>
Minnesota 1922-1937	1215	543	45
Minneapolis 1922-1937	323	131	41
Minneapolis General Hospital 1922-1938	255	101	40

Antimeningococcus serum was used at the Minneapolis General Hospital from 1922 to 1935, antitoxin from 1935 to 1937, and sulfanilamide either alone or combined with antitoxin during 1938.

The case fatality rate for the respective periods in Minnesota, Minneapolis, and the Minneapolis General Hospital are summarized in Table 7.

Table 7. Case Fatality with Antiserum, Antitoxin, and Sulfanilamide

	<u>Cases</u>	<u>Deaths</u>	<u>Case Fatality per cent</u>
Minnesota:			
1922-1934	950	421	44
1935-1937	265	122	46
Minneapolis:			
1922-1934	230	82	36
1935-1937	93	49	53
Minneapolis General Hospital			
1922-1934	157	55	35
1935-1937	83	37	45
1938-1939	20	0	0

STREPTOCOCCUS MENINGITIS

Prior to the advent of sulfanilamide, many therapeutic measures were exploited for a possible cure of streptococcus meningitis. Some of these were based on sound physiological principles. Successful results in 61 proved cases of this disease reported up to 1935 and tabulated by Gray³⁴ are attributed in some instances to one or another procedure. Repeated spinal drainage, surgical drainage (Dandy³⁵), spinal-cisterna lavage with various solutions, intrathecal injections of antiseptics and sera, ethyl hydrocupreine hydrochloride (Kolmer³⁰),

intravenous injections of dyes, sera, and antiseptics, blood transfusions, etc. have all been tried with occasional recoveries. The multiplicity of methods employed, however, is perhaps an indication of the lack of specific effectiveness of any one or combination of procedures. The more critical authors agreed that early diagnosis, complete eradication of focal infections, and adequate drainage were most responsible in the success of any proposed treatment.

Since sulfanilamide was introduced in 1935³⁷ for the treatment of strep-

tococcal infections, there have been innumerable reports of rapid recoveries. Neal³⁸ in a recent article reported that in hemolytic streptococcus meningitis using sulfanilamide in 27 cases, the mortality was reduced from over 95% in previous years to approximately 20%. Eley³⁹ stated that during the ten year period prior to the use of sulfanilamide at the Infants' and Children's hospitals of Boston 92 hemolytic streptococcus meningitis were treated by the usual methods with only one recovery. Since the use of sulfanilamide, 6 cases were treated with 6 recoveries. Silverthorne and Brown⁴⁰ reported that from 1924 to 1936, 93 cases were treated at the Hospital for Sick Children in Toronto, Canada, with one recovery. During 1937, nine cases were treated with prontosil and sulfanilamide or both with continuous intravenous injections of glucose-saline, daily spinal punctures, and mastoidectomy when indicated, with 5 recoveries.

Smith and his co-workers⁴¹ reported a recovery from an anerobic beta hemolytic streptococci, meningitis of otitic origin treated with prontosil and sulfanilamide. Schwentker et al⁴² reported that whereas no recoveries occurred in 37 cases treated at the Johns Hopkins Hospital in the last 15 years, three recoveries out of 4 occurred since the use of sulfanilamide. Schwentker⁴³ later reported 19 recoveries in 23 cases. Applebaum⁴⁴ reported 26 cases of otitic or sinus origin with 21 recoveries, whereas for 28 years prior to 1936, 274 cases were treated with only 15 recoveries. Retan,⁴⁵ Martin, and Ellenberg,⁴⁶ Litvak and Klughertz,⁴⁷ Weinberg, and associates,⁴⁸ Vitenson and Konstam,⁴⁹ Woodman,⁵⁰ Godwin,⁵¹ Lewy,⁵² Anderson,⁵³ Smith and Coon,⁵⁴ Love,⁵⁵ Cline,⁵⁶ and others reported favorable results with recoveries using sulfanilamide or its derivatives. The lowering of the mortality from about 97% to less than 20% shows the effectiveness of sulfanilamide in the treatment of this highly fatal disease.

At the Minneapolis General Hospital from 1922 to 1938, we have had 137 cases of streptococcus meningitis with only two recoveries. These two were treated with repeated drainage, saline irrigations,

scarlet fever antitoxin, mastoidectomy, and repeated transfusions. Other methods of therapy, such as Kolmer's intra-carotid injections of optochin, sera, etc. were tried without success. Since 1937, we have treated 8 cases of streptococcus meningitis with sulfanilamide with 8 recoveries.

The outline of treatment followed is similar to that described for meningococcus meningitis, except that no sera are used. Spinal punctures were done only as indicated to decrease pressure and for drainage when the fluid was extremely cloudy. On an average daily spinal punctures were done for four or five consecutive days. Early diagnosis, prompt and complete eradication of foci of infection, and early treatment are highly important to get the best results. Repeated observations at autopsies have revealed a hidden mastoid focus in patients with a previous history of otitis media but with no x-ray or clinical evidences of mastoiditis. Early treatment will prevent the formation of a localized meningitis. It has been our experience that sulfanilamide will not invade localized accumulations of pus, and therefore the drug will be ineffective when such a condition arises. Frequent transfusions have helped to improve the patients' general condition.

PNEUMOCOCCUS MENINGITIS

The treatment of pneumococcus meningitis has always been unsatisfactory. With the discovery of sulfanilamide and experimental observations that the drug is effective against the pneumococci, tremendous impetus has been given to the treatment of this condition. Clinical observation, however, does not seem to indicate that this drug is as effective against the pneumococci as against the streptococci or the meningococci. Mortality reports prior to sulfanilamide have averaged 99%, so that any form of therapy seems worthwhile.

Neal and Applebaum⁵⁷ reported 100%

fatality prior to 1936. Finland and his associates⁵⁸ reported 96 cases from 1926 to 1936 all of which died. Shaffer, Enders and Wilson⁵⁹ reported 74 cases from the Boston Children's Hospital with one recovery. Toone and Heggenbotham⁶⁰ reviewed 31 recovered cases and found that the treatment varied but most patients received some chemical or immunological agent. Optochin recommended by Kolmer was the drug most frequently used. Fifteen of 31 cases received homologous anti-pneumococcus serum intravenously, intraspinally, or by both routes. Daily lumbar drainage, cisterna drainage, genital violet, Pregl's solution, mercurochrome, autogenous vaccines, urotropin orally, etc. have all been tried both here and elsewhere with very little success.

Branham and Rosenthal²⁵ and Osgood⁶¹ reported that in vitro experimentally sulfanilamide and serum are more effective against the pneumococci than either used alone. Since the use of sulfanilamide, there have been some reports of better results but these have not been as striking as with streptococcus or meningococcus meningitis. Applebaum⁴⁴ reported 4 cures and 2 possible cures in 32 patients treated with the drug. Finland and his associates⁵⁸ from the Boston City Hospital reported 6 recoveries in 10 cases using sulfanilamide in large doses in conjunction with specific complement and serum. Eley³⁹ treated 6 cases with the usual doses of sulfanilamide with no recoveries.

Robertson⁶² and Ward and Enders⁶³ stated that for the phagocytosis and destruction of pneumococci, it is necessary to have specific antibody, an adequate number of leucocytes, and complement in the spinal fluid.

Since the best result to date is that reported by Finland et al, it may be worthwhile to dwell upon his conclusions and to review his outline of treatment. These authors found that sulfanilamide inhibits the growth of pneumococci, may clear bacteremias of low grade, reduce the number of pneumococci in the spinal fluid, and occasionally may cure a case but the spinal fluid culture remains positive for organisms for many days.

When used in conjunction with serum, however, it completely cures many severe pneumococcal meningeal infections. Moreover, they have found that with rare exceptions, complement cannot be demonstrated in the spinal fluid, when complement is injected it disappears rapidly, no antibodies can be demonstrated in the spinal fluid, antibodies contained in specific sera given intravenously does not invade the spinal fluid, bacteremia is frequently present or develops during the course of the disease, large amounts of specific antibody introduced into the spinal canal may be harmful by the effect of the precipitate formed from the interaction of serum and antibody, by the agglutination of pneumococci, and by the deterrent effect of both of these factors on the action of the leucocytes present in the spinal fluid. He has, therefore, recommended the following outline of treatment:

1. Complete drainage of spinal fluid and use for culture and type identification.
2. Large doses of sulfanilamide orally, subcutaneously, or by stomach tube.
3. Give moderate amount of fluid to insure moderate production of cerebrospinal fluid for drainage.
4. Give homologous type specific horse or rabbit serum intravenously.
5. One to two hours after serum has been administered, 15 cc. of the patient's venous blood are withdrawn and the serum separated. Another lumbar puncture is done and this fresh serum is given intraspinally.
6. In infants and small children or where frequent venepunctures are not desirable, fresh human serum obtained from any suitable donor is collected and used together with 0.5 to 1 cc. of type specific serum for intraspinal injections. Thereafter, lumbar punc-

tures are done 3 or 4 times daily or as indicated.

7. Fresh human serum and specific serum administration intraspinally may be repeated several times depending on the findings in the spinal fluid.
8. Sulfanilamide is continued for 7 to 10 days. The dosage used has been three to 4 times the recommended dose for other infections.
9. Frequent transfusions of blood are of help.
10. Eradicate foci of infection when present.

Reports from the literature indicate that Type I is most frequent in primary infections and Type II in cases secondary to otitic or sinus origin. The most frequent types in our series have been Types 1, 2, 3, 4, 5, 6, 7, and 8.

At the Minneapolis General Hospital from 1922 to 1936, we have had 85 cases of pneumococcus meningitis treated by various methods with no recoveries. In 1937-1938, we have treated 4 cases with type specific serum intravenously together with the usual dose of sulfanilamide with no recoveries. In 1938, we have treated two cases with three times the recommended dosage of sulfanilamide with one recovery. The other case that died showed at autopsy that the meninges and the surface of the brain were free from pus except for a localized abscess in the frontal area of the brain, and an extensive bronchopneumonia. We are quite sure that this patient would have recovered had it not been for his pneumonia. In both of these cases the sulfanilamide content of the spinal fluid ranged consistently between 20 to 32 mg. per 100 cc. The case that died was Type 3, and the recovered case belonged to a higher type because no reaction occurred with homologous sera Types 1 to 24.

Eley³⁹ recently suggested that larger doses of sulfanilamide to produce a concentration of the drug in the spinal fluid of 25 to 35 mg. per cent may be more

effective.

Early in 1938, the English drug house, May and Baker, announced that 2-(p-aminobenzenesulfonamide-pyridine) had been found to protect mice against invasion by pneumococci to a greater extent than sulfanilamide. This drug is marketed in Great Britain under the name M & B 693 or "Dagenan."⁶⁴ Using this drug, Reid and Dyke,⁶⁵ Robertson,⁶⁶ and Cunningham⁶⁷ reported recoveries from pneumococcus meningitis. Various English authors⁶⁸ have shown the superiority of sulfanilamide-pyridine in pneumococcal infections in man, thus confirming the claim of May and Baker. The exact mode of action of the drug against the pneumococcus is not known. Fleming⁶⁹ stated that the drug "does not in vitro prevent the capsulation of pneumococci. A more likely mode of action is simple inhibition of growth (and possibly of toxin formation), and while the organism's growth is stopped and its vitality lowered, some agent in the body damages the capsule or perhaps some autolytic process occurs." Experiences with this drug in our hospital seem to indicate that it is most effective against the lower types of pneumococci, particularly Types I and 3 which are the most common causative agents for pneumococcus meningitis. Sulfanilamide-pyridine has not been used long enough to warrant any conclusions being drawn, but it offers a hopeful outlook for this highly fatal disease.

INFLUENZAL MENINGITIS

Incidence

Influenzal meningitis is essentially a disease of infancy and early childhood. Taking all ages into consideration, Neal⁷⁰ ranks it fourth among the purulent meningitis. However, among 184 children under 2 years of age admitted to the Children's Hospital of Boston with purulent meningitis from 1926 to 1931, Ward and Fothergill⁷¹ reported that it ranked second only to meningococcal meningitis in incidence.

Neal in her series reported 84% were under 5 years of age. Fothergill and Wright¹² found that 80% were between the ages of 2 months to 2 years, and that there were no cases in infants below 2 months. This they attributed to a passive immunity derived from the mother. In our hospital, influenzal meningitis has been very rare. This may be due to difficulty in identifying the organisms due to marked pleomorphism and also the fact that the bacillus of influenza does not grow well on ordinary peptone media.

Prognosis and Mortality

Mortality has varied from 98 to 100%. Prognosis is always poor whether specific serum is used or not. Recovery is more frequent in children over 2 years of age. Huntington and Wilkes-Weiss⁵ treated 39 cases without serum with 2 recoveries. They collected 500 cases from the literature and of 373 infants under 2 years, there were 9 recoveries (97.6% fatality) while 26 of 127 children over 2 years of age recovered (79.5% fatality). Neal in 111 cases gave a fatality rate of 96.4%. Rivers⁶ in 220 cases reported a fatality of 92%. Bloom¹³ in 1931 collected 302 cases with 92% mortality.

Treatment

Wollstein⁷⁴ first developed serum in experimental work protecting monkeys with such serum. Ward and Wright,⁷⁵ and Ward and Fothergill⁷¹ reported that complement was lacking in the spinal fluid of influenzal meningitis patients and recommended the addition of normal serum to anti-influenzal serum before injection. Pittman⁷⁶ in 1933 developed type specific antiserum and used it in 18 cases with one recovery. Ward and Fothergill stated that too much antiserum for the concentration of complement present nullified effective bacteriocidal action. They treated 5 patients with specific antiserum and complement. All died but they noted that the cerebrospinal fluid was sterilized for varying periods of time up to 14 days. Autopsy showed that the cause of death was localized abscesses shut off from the general subarachnoid

space and so protected from the action of the complement and specific antiserum.

Fothergill³ in 1937 reported 201 cases treated with antiserum and complement with 31 recoveries or a fatality of 84.6%. He believes that the organisms enter the body via the respiratory tract, then invade the blood stream, and finally localize in the meninges. He has outlined the following method of treatment:

1. Specific serum is given intravenously once daily for 2 days, 30 cc. for infants and 30 to 50 cc. for older children. This is done to overcome bacteremia.
2. Mixture of antiserum and complement (fresh human serum) is given intrathecally twice daily for as long as indicated. The proportions recommended were 15 cc. of antiserum and 8 cc. of complement.
3. The spinal fluid is completely drained.
4. Since many patients receiving this treatment show evidences of temporary improvement followed by rapid fatal relapse, treatment should be continued longer than one imagines would be necessary.
5. Since in cases that died following a relapse, the cause of death was due to localized abscesses, early treatment aimed toward prevention of the formation of these abscesses seems important.

Eley³⁹ reported in 1938 that at the Infants' and Children's Hospitals of Boston, 96 cases of influenzal meningitis were treated with specific serum with 6 recoveries. Six cases were treated with specific serum combined with sulfanilamide with no recoveries. One case was treated with sulfanilamide in amounts sufficient for a concentration in the spinal fluid of 25 mg. per

cent with recovery. He, therefore, suggested that a higher dosage may bring better results.

At the Minneapolis General Hospital from 1922 to 1938, we have had 17 cases of proven influenzal meningitis treated by various methods with no recoveries. From a review of the literature, it is reasonable to expect the best results would be obtained by a combination of specific antiserum together with large doses of sulfanilamide.

STAPHYLOCOCCIC MENINGITIS

Occasional recoveries from staphylococcus meningitis have been reported, but the mortality from this disease has been practically 100%. Since most of our cases have developed in the course of a generalized septicemia, we have had no recoveries in 15 cases treated from 1922 to 1938. Repeated blood transfusion, vaccines, sera, antiseptics, chemicals, etc. have all been tried with futile results. Fenton and Hodgkiss,⁷⁷ Maxwell,⁷⁸ and O'Brien and McCarthy⁷⁹ recently reported recoveries from staphylococcus septicemia following the use of sulfanilamide-pyridine.

SUMMARY AND CONCLUSIONS

1. An analysis of the cases and treatment of meningococcic, streptococcic, pneumococcic, staphylococcic, and influenzal meningitis at the Minneapolis General Hospital during the period 1922 to 1938 are given.
2. Meningococcic, streptococcic, and pneumococcic meningitis were encountered most commonly in the order given, while influenzal meningitis has been infrequently diagnosed, probably because of the difficulty in isolating and identifying the Pfeiffer Bacillus.
3. Approximately 50% of cases of secondary meningitis were of otitic origin.
4. All forms of meningitis are more common in the male.
5. The case fatality rate from meningococcus meningitis in Minnesota has ranged from 40 to 45%.
6. The use of meningococcus antitoxin did not cause a lowering of the fatality rate as compared to antiserum.
7. Sulfanilamide used alone in 13 cases of meningococcus meningitis has been highly successful with no fatalities. The rapidity in which the spinal fluid was sterilized has been noted. In no instance were organisms recovered on cultures after 24 hours of treatment with the drug.
8. Sulfanilamide does not combat toxemia. Once the exotoxin unites with tissue, drugs or sera will probably not neutralize it. This is evidenced by the fact that although the mortality has been lowered by the use of the drug, the incidence of complications and sequelae has not been affected.
9. Experimental and clinical evidence suggests that sulfanilamide acts synergistically with specific serum. In 7 cases of meningococcus meningitis receiving the combined therapy of sulfanilamide and antitoxin, toxemia rapidly subsided and spinal fluid cultures became sterile within 24 hours. It seems, therefore, that the ideal therapy would be early administration of massive doses of antitoxin intravenously combined with continued large doses of sulfanilamide.
10. Since the use of sulfanilamide, spinal punctures for meningococcus meningitis have been reduced to two or three, and cisterne puncture has not been necessary.
11. Narcotics should be avoided in all forms of meningitis because of the respiratory depressive effect.
12. Blood transfusion is a valuable

adjunct in the therapy of meningitis.

13. From 1922 to 1937, 137 cases of streptococcus meningitis have been treated by various methods with only two recoveries, a fatality of 98.5%. With sulfanilamide, we have had 8 recoveries in 8 cases.
14. During the same interval, 85 cases of pneumococcus meningitis were treated with 100% mortality. Since 1938, four cases were treated with type specific sera intravenously plus sulfanilamide in the usual dosage with no recoveries. Two cases were treated with massive doses sufficient to raise the spinal fluid sulfanilamide level to 25-35 mg. per cent, with one recovery.
15. Since sulfanilamide-pyridine has been found by English authors to be more effective against the pneumococcus than sulfanilamide, its trial in pneumococcus meningitis may be worthwhile.
16. Sulfanilamide is not effective in localized accumulations of pus. Therefore, early and complete eradication of foci in secondary meningitis is important.
17. Intravenous or intrathecal administration of type specific sera in pneumococcus meningitis has not been effective. Lack of complement and antibody in the spinal fluid has been demonstrated. Therefore, the addition of these substances into the spinal fluid as recommended by Finland and associates may be a valuable procedure.
18. Seventeen cases of influenzal meningitis have been treated by various methods with no recoveries. Usual doses of sulfanilamide have not been effective. Eley's recommendation of massive doses of sulfanilamide to raise the spinal fluid concentration to 25 mg. per cent of the drug is worthy of consideration.
19. The treatment of staphylococcus meningitis has not been satisfactory. Recent reports in the English litera-

ture seem to indicate that sulfanilamide-pyridine may be effective in the treatment of staphylococcus septicemia and meningitis.

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V. GOSSIP

Enroute to Kansas City to give "Health Problems of Middle and Late Life" at Jackson County Health Forum (for laity) at Municipal Auditorium.....Our young daughter dislikes steam coming from cars; prefers to walk on "other" side. Wonder how large a train looks to a child accustomed to "home" world. Porters tire of further waiting, bring in steps, stare into space. At last we start. Something has been forgotten so we stop and start again. Always a fresh thrill to me..... Other travelers read papers. One elderly gentleman does so with great vigor. He looks like the kind who never allows paper to be separated. Other passengers who forgot to buy a paper eye his. As he finishes he folds it with care, lays it on his lap and stares into space.....This is three trains in one, linked together for economy's sake. All passengers are warned to sit in their own car before a certain time as train will be dismembered to go to Chicago and St. Louis as well as Kansas City....Two elderly spinsters get very excited when they discover Chef's economy special plate is pork chops. One is pleased, the other dismayed. The latter explains in a loud voice that pork chops give her indigestion. All the passengers now wonder what she is going to do. The waiter wonders too, but finally comes up with a substitute, chicken a la king. Now I wonder why elderly ladies peer so intently at their food, proceed to fork it up and down and over and over, order more hot water for either tea or coffee, and then fill up on bread.....The Iowa wrestling team is returning home after a bad night at Minnesota. The coach swaps yarns with the brakeman, the athletes anxiously look up as passengers go up and down the aisles, as if to say "Do you realize who we are"? A fellow passenger prays for continued cold weather in Minnesota and North Dakota. He sells seed potatoes. The railroads will not ship potatoes if the temperature is lower than five below zero. Seed potatoes grown in the north are sold in south and west (even in Idaho) as their own potatoes are unfit for seed. In spite of uniformly cold northern winters, southerners and westerners always forget, wait for fall prices to drop

and get caught as planting time arrives during our cold weather.....And so to bed. At this time I am in the mood of the author of "Outward Bound," Wondering if death is like this. Leaving family, friends and the job behind, going steadily out into space, to awaken in a new place.....Morning in the washroom. The funny man of the night before is not so funny now. Must not forget anything. (P.S. I did - I left a necktie).....The reception committee swings into action at the Travelers' Aid desk. Health Director Edwin Henry Schorer and his charming wife, Forum President Mrs. Clarence A. Hirsch, two reporters and two cameramen make up the party. We breakfast at Harveys in the Union Station. The committee appears anxious; the reporters are bored; the cameramen shoot and run. At last the reporters get their hand-outs (advance copies of speech). They show temporary animation as they depart.and now for a day with a visiting fireman. Meeting dozens of people with only a few names caught by either side. ...visiting Kansas City's hospitals for the white, colored, and the tuberculousW.P.A. slowly re-landscaping the grounds. They look our way as the siren on the city hall car arouses them - an ambulance driver now pilots one - The Muehlebach Hotel, the town's finest. What's this - a suite in yellow, built-in radio, two baths, modernistic furnishings; a basket of fruit from the management. Luncheon with much southern drawling on all sides Handsome young collar ad males with highly colored brunette companions..... The warmer weather fills the landscape with startling "Gone with the Wind" hats. To headquarters of Jackson County Health Forum in Argyle Building. Energetic President Hirsch brings medical speakers for lay audiences (Alvarez, Myers and Diehl from Minnesota), others from South Bend, Chicago, Baltimore, St. Louis, Cleveland, and New Orleans. Raises money by begging and raffling automobiles. Begs, borrows and steals "publicity" from every possible source. Leaves one breathless as she tells of what she has done and what she intends to do. Not a physician's wife or a nurse, but a daughter of a hospital

board member who has organized all hospital auxiliary women to help her. Has "Fresh-air Taxicab" office with staff of one (herself) on full-time basis..... Minnesota Medical Technologist Margaret Jackson is doing laboratory tests for the medical service station of the Civil Aeronautics Authority in the Bryant Building. Commercial Airline pilots report for examinations every six months. Searching for physical defects including those of special senses is object of study. Even more important is search for signs of going stale or wanting to quit. Pilots are close-mouthed, prematurely old in appearances, live on glory.....What anoxia does to judgment and dexterity is another problem. Most interesting is demonstration of Link trainer, a gadget for working out problems of following beam into port... Now to invite orthopedist Frank Dickson to teach in course on Diseases and Injuries of Bones and Joints. His complete understanding of what is expected is most gratifying....To dinner at the Missouri-Kansas Neuropsychiatric Society Meeting, where host Pathologist Ralph Emerson

Duncan is most gracious. Finally arrive at Auditorium where for first time I see my name in lights. A crowd of nearly 1000 pleases all by their interest...After which to the brightest spot in town to gossip of this and that, including medical columnist Logan Clendenning's physical tirade against an air drill near his home, Brunswick Stew, European travel via a cattle boat, Marian Talley's St. Paul (?) baby, Kansas City politics, Beaux Arts Ball in which Missouri Muralist Benton took such an active part last year (as pictured in "Life"). The Ball will be held in two weeks....At a later hour to bed after feasting on "Poor Man's Eggs"...At 9:00 the next morning homeward bound on the Rocket, where these lines are written....The people of Kansas City know how to dispense real hospitality.....

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