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MOSQUITOES.

AN UNUSUAL BREEDING PLACE.

Acting Assist. Surg. W. J. Stewart, on duty at La Guaira, Venezuela, reports that there had been a much larger number of mosquitoes than usual in the offices of the American consulate and that a careful search of the usual breeding places, including rain gutters, failed to reveal where they were breeding. There was in use in the office a water cooler of the type in which water from a large inverted bottle passes through a porcelain compartment surrounded by an ice chamber. One day in drawing off from the ice chamber some of the water resulting from the melting ice, mosquito larvæ were found in the water and on complete drainage of the ice chamber a considerable number of larvæ were found. The water and larvæ were inadvertently thrown away before the type of mosquitoes which had been breeding in this ice-cold water was determined.

The cleaning of the ice chamber and careful daily attention to it were followed by the total disappearance of mosquitoes from the offices.

THE TRANSMISSIBILITY OF PELLAGRA.

EXPERIMENTAL ATTEMPTS AT TRANSMISSION TO THE HUMAN SUBJECT.[1]

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There is a very widely held belief, at least in the United States, that pellagra is a communicable disease. The evidence in support of this is almost wholly indirect and consists, in the main, of certain analogies to infectious diseases presented by some features of its epidemiology. When critically examined one finds that this evidence either completely falls or that it is susceptible of an entirely different interpretation.[2] The only direct evidence in favor of this view that

[1] Read at the meeting of the Southern Medical Association, Atlanta, Ga., Nov. 16, 1916.

[2] A discussion of the literature is reserved for a later communication. In the meantime the reader will find the following of interest: Goldberger, 1915, Vedder, 1916, and Voegtlin, 1914.

calls for serious consideration is the report by Harris (1913), of New Orleans, of a successful inoculation of a monkey with a filtrate from pellagrous lesions.

The very extensive and comprehensive monkey inoculations by Lavinder and Francis (1914), like those of a number of other workers, including the later (unpublished) work[1] of Harris himself, have failed to confirm this report.

In order to throw further and, if possible, conclusive light on this subject the writer planned to test the question of the infectivity of the disease by experiment on an animal species known to be susceptible, namely, man himself.

This was made possible by the cooperation of a number of my colleagues and associates who, after being informed of the problem, freely volunteered to submit themselves to experiment. It was originally planned to carry out this test during 1915 concurrently with a test of the rôle of diet in the production of pellagra (Goldberger and Wheeler, 1915), to which a group of convicts were at that time being subjected. The pressure of other work, however, made it necessary to defer this phase of the investigation until the spring of the present year.

GENERAL CONSIDERATIONS.

Some 20 individuals volunteered to submit themselves to experimentation. It was not practicable, however, to utilize more than 16 of them. These included 1 woman.

They varied in age from 26 to 42 years. Four were 26 to 29, 9 from 30 to 39, and 3 from 40 to 42 years. Thirteen were physicians. They resided in various localities: Eight at Washington, D. C.; 1 at Columbia, S. C.; 2 at Spartanburg, S. C.; 1 at Milledgeville, Ga.; and 4 at New Orleans, La.

No restraint of any sort was imposed. They were advised to continue their customary habits of life and diet, and were permitted to travel freely in attending to their personal or official business.

No attempt was made to avoid "natural infection." Indeed, it should be noted that five of the volunteers by reason of their official duties came into frequent and intimate contact with pellagra in its natural environment. Three, including the woman, have come into known contact with cases of the disease, while four others have lived for considerable periods in a locality (New Orleans) where casual contact with the disease was at least a possibility.

In the appended list of the volunteers will be found the age, location of residence, and an indication of the experiment or experiments in which each participated.

[1] Communicated at a meeting of Louisiana health officers, New Orleans, July, 1915.

The materials used were blood, nasopharyngeal secretions, epidermal scales from pellagrous skin lesions, urine, and feces. The blood was administered by intramuscular or subcutaneous injection, the secretions by application to the mucosa of the nose and nasopharynx, scales, and excreta by mouth.

In order to reduce gastric acidity and thus minimize the possibly germicidal effect of the gastric juice, the ingestion of scales and excreta was preceded by a dose of from 10 to 20 grains of sodium bicarbonate. The ingesta were always taken on an otherwise empty stomach.

The materials whose infectivity was tested were obtained from 17 cases of pellagra of various types and of different grades of severity, including three fatal cases. A list is appended in which the pertinent data relating to each case are given.

The patients were seen and the experiments performed at different places. One, a fatal case, was seen at the Washington Asylum Hospital, Washington, D. C.; 1 at the Charity Hospital, New Orleans, La.; 3 at the State Hospital for Insane at Columbia, S. C.; and 12, including 2 fatal cases, at Spartanburg, S. C. The volunteers participating did not in all instances reside at the place where the experiment was performed, but assembled there at a specified time. This applies particularly to the experiments at Spartanburg, S. C.

As will appear from the details next to be presented, the infectivity of the blood was tested twice, of nasopharyngeal secretions twice, of scales three times, and by reason of the alleged controlling influence of methods of sewage disposal in the propagation of the disease the infectivity of both urine and feces was tested six times. Two or more of these tests were made on seven different occasions. In presenting the details of the experiments it seems best to consider the individual experiment under the group of which it formed a part on one of these seven occasions. The groups are considered in their chronological sequence. A tabular summary is appended.

DETAILS.

Experiment Group No. 1.

On April 25, 1916, blood and nasopharyngeal secretions were obtained from a patient (case No. 1) with a moderately acute first attack of the disease at the United States Pellagra Hospital, Spartanburg, S. C., and administered to two volunteers, G–J and W–GA.

(*a*) *Blood.*—The blood was drawn from a vein at one of the elbows, defibrinated, and 5 c. c. were injected without delay into the left deltoid of W–GA and 6 c. c. into that of G–J.

(*b*) *Secretions.*—Secretions were obtained by wiping out the nose and nasopharynx of the patient with a cotton swab and transferred

by at once rubbing this over the mucosa of the nose and nasopharynx of the volunteer. A separate swab was used for each.

Effects.—Both men felt some soreness and stiffness for a day or two in the muscle into which the blood was injected; otherwise nothing was observed.

Experiment Group No. 2.

On April 28, epidermal scales and urine were obtained from each of two patients and feces from a third at the State Hospital for Insane at Columbia, S. C.

Of the two patients furnishing both scales and urine, one (case No. 3) was a severe first attack and the other (case No. 4) a mild second attack. The patient furnishing the feces (case No. 2) was suffering from a severe attack and was having four soft bowel movements a day.

(*a*) *Scales.*—The scales were obtained by scraping the affected areas of the skin and, combined, weighed, it is estimated, about 0.1 to 0.2 gms.

(*b*) *Urine.*—The urine was a fresh catheter specimen in each case.

(*c*) *Feces.*—The feces specimen was obtained with the aid of a simple water enema and was liquid.

The scales with about 4 c. c. of each specimen of urine and with about the same quantity of the liquid feces were worked up into a pilular mass with wheat flour and in this form swallowed by volunteer G–J, 30 minutes after taking 20 grains of sodium bicarbonate and about 1 to 1½ hours after collecting. After swallowing this mass another dose of 20 grains of sodium bicarbonate was taken. The alkali was intended to reduce gastric acidity and thus perhaps favor infection.

Effects.—For several days after the ingestion of the foregoing materials this volunteer experienced some light epigastric fullness and eructations of gas after a meal. On the third day a diarrhea with frequent, painless, watery, and rather gaseous evacuations developed. The diarrhea lasted about a week. It was still present on May 7, on which date, as will presently appear, this volunteer participated in another experiment which included the ingestion of scales, urine, and feces.

Experiment Group No. 3.

On May 7 blood, nasopharyngeal secretions, scales, urine, and feces were obtained from some patients at the United States Pellagra Hospital, Spartanburg, S. C., and used for the inoculation of each of a group of five volunteers, G–J., S–E., T–WF., W–DG., and W–GA. A sixth volunteer, G–MHF., received blood only.

(*a*) *Blood.*—The blood was drawn from the general circulation of each of three patients, defibrinated and then pooled. Of this, 7 c. c. were injected subcutaneously into each of the six volunteers mentioned. The time elapsing between drawing and injecting the blood was under two hours.

To the pooled blood, one of the patients (case No. 5), with a mild ninth recurrent attack, contributed 10 c. c.; one (case No. 6), with a moderately acute second attack, 15.5 c. c.; and one (case No. 7), with a severe acute second attack, 20 c. c. The patients furnished, therefore, 1.5 c. c., 2.5 c. c., and 3 c. c., respectively, of defibrinated blood for the inoculation of each volunteer.

(*b*) *Secretions.*—Secretions were obtained from four patients and, after mixing, used for the inoculation of the five men above mentioned. One of the patients (case No. 1) was the same as the one that furnished the secretions for the first experiment (experiment group No. 1, (*b*)). The three others are cases No. 5, No. 6, and No. 7, already briefly characterized in describing the preceding blood inoculation.

The nose and nasopharynx of each of the four patients were carefully wiped out with a separate set of five cotton swabs. The secretions thus obtained were mixed by rinsing and soaking the swabs in some normal salt solution.

The inoculation was made by rubbing over the mucosa of each side of the nose and nasopharynx each of a set of three swabs soaked in the mixture just described. In this way a fresh set of six swabs was used for each volunteer. The time elapsing between collecting and inoculating was less than two hours.

(*c*) *Scales.*—Scales were freshly scraped from affected areas of skin of two patients, cases No. 1 and No. 7, previously characterized. Case No. 1 furnished 0.1 gm. and No. 7, 0.22 gm.

These were mixed and then divided approximately equally among the five volunteers each of whom swallowed his portion in the form of a "powder" about seven hours after they were collected and shortly after taking the dose of urine and feces next to be described.

(*d*) *Urine; feces.*—A specimen of urine and one of feces was obtained from each of the same three patients (cases No. 5, No. 6, and No. 7) as furnished the blood. In order to make sure of having the feces when wanted a simple water enema was used to get the specimens, none of which was diarrheal.

Ten cubic centimeters of urine and 5 grams of solid feces from each of the three corresponding specimens were worked up into a pilular mass with flour. About 15 minutes after taking 20 grains of sodium bicarbonate each of the five volunteers ingested an approximately equal portion of the mass. Each took therefore the equiva-

lent of about 2 c. c. of urine and 1 gram of feces from each of the three patients.

The urine and fecal specimens were between 3 and 9 hours old when ingested.

Effects.—About 10 days after the inoculation, one of the volunteers, T–WF, noted a slightly enlarged and somewhat tender lymph gland above the Poupart's ligament of the side of the abdomen that was the site of the blood injection. This gradually subsided. None of the other volunteers experienced any inconvenience, although, as will be recalled, one of them (G–J), on the date of this experiment, had not yet completely recovered from a rather marked attack of diarrhea following a previous ingestion experiment.

Experiment Group No. 4.

On June 7, 1916, urine and feces were obtained from a patient (female) at the Washington Asylum Hospital, Washington, D. C. The patient (case No. 8) had a typhoidal first attack, from which she died 10 days later (June 17, 1916).

The urine was a catheter specimen, drawn at 8.45 a. m., June 7.

The fecal matter consisted of two specimens; one, fairly liquid, was passed at about 9 p. m., June 6; the second, of soft puttylike consistency, was passed about 7 a. m., June 7.

Ten cubic centimeters of the urine, 1 gram of the first and 5 grams of the second fecal specimen were worked up into a pilular mass with cracker crumbs and a little flour. Gelatine capsules were filled, approximately equally divided, and at 12.30 p. m. ingested by five volunteers, C–RH, D–WF, McC–GW, G–J, and S–AM. Fifteen minutes before this, each volunteer took 10 grains of sodium bicarbonate.

Effects.—Some hours after ingesting the above one of the volunteers, S–AM, developed abdominal discomfort accompanied by abnormal, gaseous evacuations. The movements increased in frequency, developing into a marked diarrhea, which lasted about two weeks. He has been well since.

Another, McC–GW, experienced a little temporary gastric discomfort immediately after taking the material; nothing of note since.

None of the others of this group experienced any appreciable effects.

Experiment Group No. 5.

On June 8, 1916, another experiment was made with urine and feces from the patient (case No. 8) furnishing these materials for the preceding experiment, No. 7.

On this occasion the fecal matter consisted of three specimens. One of these, now 39 hours old, was passed at 7 a. m. June 7, and had

served in experiment No. 4; it had been kept at room temperature. The second was passed at 11.30 p. m. June 7, and the third at 7.15 a. m. June 8. Both of these latter specimens were liquid.

A urine specimen was drawn by catheter at 8.45 a. m. June 8.

Three grams of the first, 3 c. c. of the second, and 3 c. c. of the third fecal specimen, with 6 c. c. of urine, were prepared as in the preceding experiment, and at 12 o'clock equally divided among the three volunteers G–J, L–JP, and S–EA. Each received, therefore, the equivalent of 1 gram of each of the three fecal specimens and of 2 c. c. of the urine. About 20 minutes before taking this material each volunteer had taken 10 grains of sodium bicarbonate.

Effects.—Although two of these volunteers (L–JP and S–EA) had temporary attacks of looseness of the bowels immediately preceding the experiment, neither they nor the third who had participated in each of the preceding ingestion experiments experienced any inconvenience following the ingestion of this experimental material.

Experiment Group No. 6.

On June 13, 1916, urine and feces were obtained from a patient at the Charity Hospital, New Orleans, La. This patient (case No. 9) had a mild first attack.

The urine was obtained by catheter at 8 a. m. The stool, a liquid one, was passed at about 7.15 a. m., after a dose of magnesium sulphate.

Measured quantities of this material were prepared as in experiments No. 4 and No. 5 at 1.20 p. m. and ingested by five volunteers, A–CW, G–J, L–GB, M–MB, and W–CL, each one getting the equivalent of 2 c. c. of feces and 2 c. c. of urine. Twenty-five minutes before taking this material each volunteer took 20 grains of sodium bicarbonate.

Effects.—None of this group of volunteers experienced any appreciable effects.

Experiment Group No. 7.

On June 25, 1916, material was obtained at Spartanburg, S. C., for a final experiment.

(*a*) *Scales.*—Epidermal scales were scraped from pellagrous skin lesions of two patients (cases No. 14 and No. 17) at the United States Pellagra Hospital. They were not over four hours old when ingested.

(*b*) *Urine.*—Urine was obtained from three patients (cases No. 10, No. 11, and No. 12) at the county farm and from three (cases No. 14, No. 15, and No. 17) at the Pellagra Hospital.

(*c*) *Feces.*—Feces were obtained from four patients (cases No. 10, No. 11, No. 12, and No. 13) at the county farm and from three (cases No. 14, No. 15, and No. 16) at the Pellagra Hospital. Two of the fecal specimens were from patients (cases Nos. 12 and 13) with diarrhea.

The seven patients who furnished the material for this experiment were suffering from attacks of varying grades of severity (see list of pellagra cases), including two fatal cases (No. 12 and No. 13).

Measured quantities of the materials mentioned were worked up with cracker crumbs and a little flour into a pilular mass. Fifteen minutes after taking a dose of 20 grains of sodium bicarbonate this was ingested by each of the three volunteers, G–J, S–E, and W–GA, each taking the equivalent of about 4 milligrams of scales, 6 c. c. of urine (1 c. c. from each patient), and 8 grams of feces (2 grams from case No. 13 and 1 gram from each of the other six patients). The feces and urine were not over six hours old when ingested.

Effects.—Volunteer G–J, who participated in all of the preceding experiments and who as was noted had an attack of indigestion and diarrhea for about one week following the first ingestion experiment, experienced some mild dyspeptic symptoms for a number of days immediately after this.

Within two or three hours after the experiment volunteer S–E began to feel nauseated. The following morning he had three watery evacuations and 12 hours later a diarrhea began that lasted about a week. Nausea persisted for about the same period.

Volunteer W–GA had some slight ill-defined dyspeptic symptoms for about 24 hours following the experiment.

Aside from these immediate, temporary disturbances none of the volunteers has experienced any appreciable effects.

RESULTS AND CONCLUSIONS.

The first experiment was made on April 25 and the last on June 25, so that the volunteers have now (Nov. 16, 1916) been under observation for from four and one-half to six and one-half months, approximately. Observation has been maintained by association with a majority of the volunteers, by visits of inspection to the others, supplemented by reports from the volunteers themselves, or in the case of the laymen from medical officers with whom they are associated.

In four or five instances, as above noted, there were more or less marked immediate, but temporary, gastrointestinal reactions following, and, probably, due to the ingestion of the large doses of excreta. When one considers the relatively enormous quantities of filth taken the reactions experienced were surprisingly slight.

One of the volunteers, S–EA, had an attack of renal colic of eight to nine days' duration, from August 14 to August 22, 1916. Aside from this he, as well as the other volunteers, has enjoyed his usual health. None has developed any evidence justifying even a suspicion of pellagra.

It is not my present purpose to enter into a discussion of the etiology of pellagra. I may be permitted, however, to recall by way of contrast the result of the feeding experiment carried out last year (Goldberger and Wheeler, 1915). In that experiment, of 11 convicts subsisting on a one-sided diet, not less than 6 developed definite evidence of pellagra, while of over 30 controls not one showed any evidence that would justify even a suspicion of the disease.

It would appear, then, that while the opinion that pellagra is a communicable disease gains no support from the work here reported, the conclusion, elsewhere drawn (Goldberger, 1916), that it is a disease essentially of dietary origin, brought about by a faulty, probably "deficient," diet is materially strengthened.

SUMMARY.

Sixteen volunteers were subjected to experiment. With one exception all were men and varied in age from 26 to 42 years. No restraints were imposed on their customary habits or activities.

Seventeen cases of pellagra of various types and of different grades of severity furnished some one or more of the experimental materials.

The materials were blood, nasopharyngeal secretions, epidermal scales from pellagrous lesions, urine, and feces. Blood was furnished by 4 of the cases, nasopharyngeal secretions by 4, epidermal scales by 5, and urine or feces by 16, of whom 10 furnished both urine and feces, 3 urine without feces, and 3 feces without urine.

Blood was administered by intramuscular or subcutaneous injection; secretions by application to the mucosa of the nose and nasopharynx; scales and excreta by mouth.

Both urine and feces were ingested by 15 of the volunteers, 5 of whom also took blood, secretions, and scales.

The experiments were performed at four widely separated localities (Washington, D. C.; Columbia, S. C.; Spartanburg, S. C.; and New Orleans, La.), at which different groups of the volunteers were assembled.

Observation has been maintained by association with a majority of the volunteers and by visits of inspection, supplemented by reports from the volunteers themselves, 13 of whom are physicians, and by reports from other medical officers of the service with whom they are associated. During a period of between five and seven months none has developed evidence justifying a diagnosis of pellagra.

Tabular summary of experiments.

Date.	Locality.	Material. Kind.	Source (case).	Amount.	Manner of administration.	Volunteer subject.	Remarks.	Result.
1916.							*Time interval.*	
Apr. 25	Spartanburg, S. C.	Defibrinated blood	No. 1	5 c. c.	Intramuscular injection.	W-GA	The blood was injected intramuscularly within a few minutes after defibrination.	No pellagra.
				6 c. c.		G-J		
		Nasophar. secretions.	do	(?)	Applied to mucosa of nose and nasopharynx.	W-GA	Secretions obtained on cotton swab and at once rubbed over mucosa of subject. Fresh swab used for each subject.	Do.
						G-J		
Apr. 28	Columbia, S. C.	Scales	No. 3 and No. 4	0.1 to 0.2 gm.	Swallowed	G-J	Scales taken as "powder." Feces and urine made up into pilular mass with wheat flour and ingested. The quantities are minimal estimates. Interval 1 to 1½ hours.	Do.
		Urine		8 c. c.				
		Feces	No. 2	4 c. c.				
May 7	Spartanburg, S. C.	Defibrinated blood	No. 5, No. 6, and No. 7.	7 c. c.	Subcutaneous injection.	G-J	Case No. 5 furnished 10 c. c., No. 6 furnished 15.5 c. c., and No. 7 furnished 20 c. c. of defibrinated blood. Of the pooled blood 7 c. c. were subcutaneously injected into each subject. The time between drawing and injecting the blood was under two hours.	Do.
						G-MHF		
						S-E		
						T-WF		
						W-DG		
						W-GA		
		Nasophar. secretions.	No. 1, No. 5, No. 6, and No. 7.	(?)	Rubbed into mucosa of nose and nasopharynx.	G-J	Secretions freshly obtained by swabbing out the nose and nasopharynx in each case with a set of 5 cotton swabs and soaking these in saline solution. These fresh swabs wet with this secretion were rubbed over nasal and nasopharyngeal mucosa of each volunteer. Interval less than 2 hours.	Do.
						S-E		
						T-WF		
						W-DG		
						W-GA		
		Scales	No. 1 and No. 7	0.06 gm.	Swallowed	G-J	Case No. 1 furnished 0.1 gm. and No. 7, 0.22 gm. of freshly scraped scales. These were mixed and divided into five approximately equal parts and swallowed about 7 hours after they were collected.	Do.
						S-E		
						T-WF		
						W-DG		
						W-GA		
		Urine	No. 5, No. 6, and No. 7	6 c. c.	do	G-J	Urine and feces rubbed up into a pilular mass with wheat flour. Each volunteer swallowed a portion representing 3 gms. of feces (1 gm. from each case) and 6 c. c. of urine (2 c. c. from each case). Urine and feces 3 to 9 hours old when swallowed.	Do.
						S-E		
						T-WF		
						W-DG		
						W-GA		
		Feces		3 gms.				

June 7	Washington, D. C.	Urine Feces	No. 8	2 c. c. 1.2 gms.	do	C-RH D-WF McC-GW G-J S-AM	Urine and feces worked up into a pilular mass with cracker crumbs and a little flour. The urine was not over 4 hours old when ingested; each volunteer received 2 c. c. The feces consisted of two specimens, one 15 hours and the other about 5 hours old. Of the former each volunteer took 0.2 gm., of the latter 1 gm.	Do.
June 8	do	Urine Feces	No. 8	2 c. c. 3 gms.	do	G-J L-JP S-EA	Urine and feces prepared with cracker crumbs and a little flour. Urine was 3 hours old. The feces included 3 specimens; one 39 hours old, the second 12 hours, and the third about 5 hours old. Each volunteer took 2 c. c. of urine and 1 gm. of each fecal specimen.	Do.
June 13	New Orleans, La.	Urine Feces	No. 9	2 c. c. 2 c. c.	do	A-CW G-J L-JB M-MB W-CL	Urine and feces prepared with cracker crumbs and flour. Urine was about 5½ hours old. Feces were liquid, following saline purge. Each volunteer took 2 c. c. of urine with 2 c. c. of feces.	Do.
June 25	Spartanburg, S. C.	Scales Urine Feces	No. 14 and No. 17 Nos. 10, 11, 12, 14, 15, 17 Nos. 10, 11, 12, 13, 14, 15, 16	0.004 gm. 6 c. c. 8 gms.	do	G-J S-E W-GA	Scales, urine, and feces were worked up into a pilular mass with cracker crumbs. The scales were not over 4 hours old and each volunteer took about 0.004 gm. The urine and feces were not over 6 hours old. Of the urine each volunteer took about 1 c. c. from each case; of the feces 1 gm. from each of six cases and 2 gms. from the seventh (case No. 13).	Do.

These experiments furnish no support for the view that pellagra is a communicable disease; they materially strengthen the conclusion that it is a disease essentially of dietary origin, brought about by a faulty, probably "deficient," diet.

ACKNOWLEDGMENTS.

My sincere thanks are due Dr. C. F. Williams, superintendent, Dr. W. C. Sandy, medical director, and Drs. D. W. Register and J. F. Munnerlyn, assistant physicians, of the South Carolina State Hospital for the Insane, for access to and for material from cases of pellagra. My thanks are due also to Drs. W. M. Barton and Reiss for material from a case at the Washington Asylum Hospital, Washington, D. C.; to Drs. I. I. Lemmon and C. Dean for material from a case at the Charity Hospital, New Orleans; to Dr. O. W. Leonard, of Spartanburg, S. C., for material from cases at the Spartanburg County Farm; and to Dr. R. M. Grimm for material and for assistance in carrying out some of the experiments at the United States Pellagra Hospital.

I have, finally, to make grateful acknowledgment of my indebtedness to those of my colleagues and associates of the service whose willing participation in a trying ordeal made this work possible.

Volunteers.

A–CV.—Medical officer, 26 years. Stationed at New Orleans, La. Participated in experiment No. 6.

C–RH.—Medical officer, 37 years. Stationed at Washington, D. C. Participated in experiment No. 4.

D–WF.—Medical officer, 32 years. Stationed at Washington, D. C. Participated in experiment No. 4.

G. J.—Medical officer, 42 years. Stationed at Washington, D. C. Major part of the time spent in field work in Southern States. Participated in all seven experiments.

G–MHF.—Housewife, 35 years. Resides at Washington, D. C. The only woman among the volunteers. Participated in experiment No. 3 at Spartanburg, S. C.

L–JB.—Medical officer, 28 years. Stationed at New Orleans. Participated in experiment No. 6.

L–JP.—Medical officer, 35 years. Stationed at Washington, D. C. Participated in experiment No. 5.

McC–GW.—Medical officer, 40 years. Stationed at Washington, D. C. Participated in experiment No. 4.

M–MB.—Technical assistant, 33 years. Stationed at New Orleans, La. Participated in experiment No. 6.

S–AM.—Medical officer, 39 years. Stationed at Washington, D. C. Participated in experiment No. 4.

S–E.—Statistician, 35 years. Stationed at Spartanburg, S. C. Participated in experiments No. 3 and No. 7.

S–EA.—Medical officers, 39 years. Stationed at Washington, D. C. Had an attack of renal colic August 14–22, 1916. Participated in experiment No. 5.

T–WF.—Medical officer, 28 years. Stationed at Columbia and Spartanburg, S. C. Participated in experiment No. 3.

W–CL.—Medical officer, 28 years. Stationed at New Orleans, La., up to September 12; at San Francisco after that date. Participated in experiment No. 6.

W–DG.—Assistant epidemiologist, 42 years. Stationed at Milledgeville, Ga. Participated in experiment No. 3.

W–GA.—Medical officer, 31 years. Stationed at Spartanburg, S. C. Participated in experiments No. 1, No. 3, and No. 7.

Pellagra Cases.

No. 1.

W–S.—White female admitted to United States Pellagra Hospital, Spartanburg, S. C., April 14, 1916. Hospital No. 191.

Salient clinical features.—Weakness, moderate skin lesions which first appeared April 7, 1916, moderate diarrhea.

Severity.—Rated by Dr. R. M. Grimm, the medical officer in charge, as a moderately acute first attack.

Experimental material.—Furnished blood and nasopharyngeal secretions on April 25 and epidermal scales and nasopharyngeal secretions on May 7.

No. 2.

M–FN.—White male, Ward 4, Columbia State Hospital, Columbia, S. C. Service of Dr. J. T. Munnerlyn. Admitted February, 1916.

Salient clinical features.—History of illness of two years. Insane. Presents marked seborrhea of nose and lips. Dermatitis on both elbows, with encircling "areola" on left. Has about four soft movements a day.

Severity.—Rated by Dr. Munnerlyn as a "severe" case.

Experimental material.—Furnished feces on April 28, 1916.

No. 3.

L–JL.—White female, Ward A12, Columbia State Hospital, Columbia, S. C. Service of Dr. D. W. Register. Admitted February, 1916.

Salient clinical features.—Mental manifestations, eruption, red tongue.

Severity.—Rated by Dr. Register as a "severe" first attack.

Experimental material.—Furnished epidermal scales and urine April 28, 1916.

No. 4.

M–MC.—White female, Ward A12, Columbia State Hospital, Columbia, S. C. Service of Dr. D. W. Register.

Salient clinical features.—Mental manifestations, extensive eruption. History of an attack in 1914.

Severity.—Rated by Dr. Register as a "mild" second attack.

Experimental material.—Furnished epidermal scales and urine on April 28, 1916.

No. 5.

E–EA.—White male, admitted to United States Pellagra Hospital, Spartanburg, S. C., May 5, 1916. Hospital No. 24, 24a, 24b.

Salient clinical features.—History of first attack in 1908; present is ninth attack and is said to have begun about April 15, 1916. Presents mild skin and minor nervous manifestations, marked weakness, constipated.

Severity.—Rated by Dr. Grimm as a mild, acute ninth recurrence.

Experimental material.—Furnished nasopharyngeal secretion, urine, feces, and blood on May 7, 1916.

No. 6.

O–I.—White female, admitted to United States Pellagra Hospital, May 6, 1916. Hospital No. 195.

Salient clinical features.—Weakness, moderately severe skin manifestations, moderate "nervousness," vertigo, mild salivation. History of first attack April, 1915.

Severity.—Rated by Dr. Grimm as a moderately acute second attack.

Experimental material.—Furnished nasopharyngeal secretions, urine, feces, and blood on May 7, 1916.

No. 7.

S-H.—White male, 8 years old. Admitted to United States Pellagra Hospital April 26, 1916. Hospital No. 193.

Salient clinical features.—Severe extensive skin manifestations, some of moist type. Mentally dull and depressed. History of a first attack in spring of 1915.

Severity.—Rated by Dr. Grimm as a severe acute second attack.

Experimental material.—Furnished nasopharyngeal secretions, blood, urine, and feces on May 7, 1916.

No. 8.

S-M.—White female, 48 years old. Admitted to Washington Asylum Hospital, Washington, D. C., April 27, 1916. Service of Dr. W. M. Barton; resident physician, Dr. Reiss.

Salient clinical features.—Mild skin manifestations, beefy tongue, diarrhea, involuntary evacuations, disoriented, typhoidal.

Severity.—A typhoid-pellagra, fatal; died June 17, 1916.

Experimental material.—Furnished two specimens of feces for experiment on June 7, 1916. One, fairly liquid, was passed at 9 p. m., June 6; the second, more nearly solid, at 7 a. m. June 7. Also a specimen of urine drawn at 8.45 a. m. June 7.

For the experiment of June 8, besides the second of the preceding fecal specimens, which was preserved at air temperature, this patient furnished two additional stools, both fluid, one passed at 11.30 p. m. June 7 and the other at 7.15 p. m. June 8. Also a specimen of urine drawn at 8.45 a. m. June 8, 1916.

No. 9.

B-M.—Colored male, 74 years. Admitted to Charity Hospital, New Orleans, La., June 11, 1916, ward No. 31, bed 405. Service of Dr. I. I. Lemmon; resident physician, Dr. C. Dean.

Salient clinical features.—Minor nervous manifestations, mild dermatitis, history of loose bowels.

Severity.—A mild first attack.

Experimental material.—Furnished feces and urine. Stool, liquid, after saline purge, passed about 7.15 a. m.; urine drawn at 8 a. m., June 13, 1916.

No. 10.

K-L.—White male, 11 years. Admitted to Spartanburg County Farm June 16, 1916. Service of Dr. O. W. Leonard.

Salient clinical features.—Extensive marked skin manifestations; mild gastrointestinal symptoms.

Severity.—A well-marked first attack of moderate grade.

Experimental material.—Furnished urine and feces June 25, 1916.

No. 11.

K-OB.—White male, 43 years. Admitted to Spartanburg County Farm June 16, 1916. Service of Dr. O. W. Leonard.

Salient clinical features.—Extensive severe skin manifestations; mild buccal and gastric symptoms; constipated.

Severity.—A well-marked first atttack of medium grade.

Experimental material.—Furnished urine and feces June 25, 1916.

No. 12.

K-O.—White female, 9 years. Admitted to Spartanburg County Farm June 16, 1916. Service of Dr. O. W. Leonard.

Salient clinical features.—Extensive severe skin manifestations; marked diarrhea.

Severity.—A fatal first attack. Died August 25, 1916.

Experimental material.—Furnished urine and feces June 25, 1916.

No. 13.

S-JE.—White male, 37 years. Admitted to Spartanburg County Farm June 10, 1916. Service of Dr. O. W. Leonard.

Salient clinical features.—Has a history of pellagra extending over six to seven years; mental manifestations winter 1915-16.

Presents well-marked eruption; marked buccal and severe intestinal symptoms (watery diarrhea).

Severity.—A chronic pellagra, fatal. Died August 1, 1916.

Experimental material.—Furnished feces June 25, 1916.

No. 14.

J–M.—White female, 33 years. Out patient No. 43, United States Pellagra Hospital, Spartanburg, S. C. Came under observation June 19, 1916.

Salient clinical features.—Weak, tongue slightly red, constipated; moderately extensive, active eruption. History of attack in 1912 and 1915.

Severity.—Rated by Dr. Grimm as a moderately acute third recurrent attack.

Experimental material.—Furnished epidermal scales, urine, and feces June 25, 1916.

No. 15.

H–V.—White female, 21 years. Admitted to United States Pellagra Hospital, Spartanburg, S. C., June 24, 1916. Hospital No. 212.

Salient clinical features.—Presents moderately extensive, acute skin manifestations; mild mental symptoms (apathetic, confused). History of a first attack in June, 1915.

Severity.—Dr. Grimm rates this as a moderately acute second attack.

Experimental material.—Furnished urine and feces June 25, 1916.

No. 16.

S–S.—White female, 30 years. Admitted to United States Pellagra Hospital, Spartanburg, S. C., June 24, 1916.

Salient clinical features.—History of an attack, 1915, and of a recurrence in March, 1916, followed by improvement in April, but with retrogression during May and June. On admission felt weak, nervous, without nausea, but with burning and pain in stomach and with burning of feet. No other gastrointestinal manifestations. No eruption nor residuals of one.

Severity.—Mild second attack in posteruptive stage (or in interval) with mild suggestive symptoms.

Experimental material.—Furnished urine and feces June 25, 1916.

No. 17.

Q–LV.—White female, 25 years. Admitted to United States Pellagra Hospital, Spartanburg, S. C., June 24, 1916. Hospital No. 216.

Salient clinical features.—Presents definite skin eruption and mild suggestive symptoms (nervousness, weakness).

Gives history of an attack in 1913 and of one in 1915.

Severity.—Rated by Dr. Grimm as a mild third recurrent attack.

Experimental material.—Furnished epidermal scales and urine June 25, 1916.

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