

Original Communication.

RICE AND BERI-BERI.¹

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ONE of the chief causes of confusion in the study of beri-beri is its name, the meaning of which is unknown, and which has been applied to many and widely different diseases. Some years ago Pikelharing and Winkler wrote: "When one sees that some have regarded it as relating to difficulties of movement only, whilst on the other hand some have regarded it as an affection of the respiratory organs, and others again referred the seat of the disease to the heart or circulatory system generally, the marvel is that such a heterogeneous group of symptoms should ever have come to be recognized as constituting one disease."

In 1861 Mericourt and Fonssagrives arrived at the conclusion that there were two distinct diseases included in the term beri-beri.

The position now is in many respects the same as it was when Pikelharing and Winkler published the results of their investigations. The origin and meaning of the name beri-beri are unknown, and much of the confusion concerning the disease is due to this fact.

The two most prominent manifestations of beri-beri are paralysis and dropsy, and the name beri-beri is frequently used for two entirely different diseases: (a) epidemic palsy; (b) epidemic dropsy; the latter sometimes including kala-azar, ankylostomiasis, and post-dysenteric œdema. As the causes of these various diseases are different, it is not surprising that there is some confusion with regard to the etiology of beri-beri. If the disease took its name from one or other of its prominent symptoms much of the confusion would have been avoided. Epidemic peripheral neuritis and epidemic œdema are two distinct diseases. Captain Delany, as the result of his enquiry into the beri-beri of Assam, has reported that the disease which occurs there—*a.g.*, Sylhet, Mymen, Singh, &c.—is an epidemic œdema and not a peripheral neuritis. Axel Holst and Frolich have come to the conclusion that ship beri-beri is not the same disease as the beri-beri of the Far East.

Another factor which adds to the confusion is that many workers have based their conclusions on statistics compiled by native subordinates which are notoriously unreliable. Small wonder, then, that investigators have arrived at different conclusions when they have been working at two or more distinct diseases whose chief or only relationship lies in the fact that they have all been christened beri-beri. It should be understood that the disease investigated at the Kuala Lumpur Lunatic Asylum is the beri-beri described by Manson and Daniels in Clifford Allbutt's "System of Medicine," and defined by them as a "specific form of peripheral neuritis."

In the first place it would appear advisable to give

a short description of the more salient features of the disease and the methods employed in the examination of patients at the Kuala Lumpur Lunatic Asylum.

(1) *The gait* of the patient, if he be strong enough to walk at all, is of the usual "steppage" type common to all forms of polyneuritis where there is foot-drop. In a healthy man, as the "unemployed" foot is swung forward in walking the toes are extended in order that they may clear the ground. The beri-beric is, by reason of his paresis, unable to extend his toes. Consequently, in order to avoid scraping them along the ground he has to raise his feet higher, and he walks as though he were continually stepping over objects obstructing his path. He brings his foot down to the ground not heel first as a healthy man does, but the ball of his foot and his toes reach the ground first.

The gait of the tabetic is quite different; inco-ordination is apparent, and the heel is brought down first and with a bang as if the patient intended to "make his mark" upon the floor. The extensor muscles are affected earlier and to a greater extent than the flexors. Many a beri-beri patient can stand and even walk so long as he keeps his legs straight; but as soon as he attempts to put any weight on them while they are flexed they collapse under him. This method of walking and the loss of tone in the muscles leads to hyperextension at the knee. (See fig. 2.)

(2) *The Jongkok Test* (see fig. 3), so-called from the Malay word "jongkok," signifying to squat down. This is a crucial test for beri-beri. The patient places both hands on the top of his head, and slowly squats down on his heels and then rises up again. If the patient be suffering from beri-beri the extensors are early affected, and it soon becomes impossible for him to perform this exercise.

(3) *Foot-drop Test*.—Put the patient in a sitting position, the leg at right angles to the thigh, and the foot flat upon the floor. Place the hand on the thigh a little above the knee, and tell the patient to extend the foot and toes as shown in figure. If there is much weakness of the extensors he will be unable to do so.

(4) *Wrist-drop Test*.—This is performed as in figure. The forearm is bent at right angles to the arm. The elbow and wrist are kept upon the table by the pressure of the examiner's hand, and the patient is instructed to extend his hand. Weakness in the upper extremity usually appears later than in the legs. In the hand the first evidence of paresis is often manifested by an inability to extend the last joint of the thumb.

(5) *Knee Reflexes*.—These are best tested as in figure by sitting the patient on a table with the thigh well supported, reinforcement being employed if necessary.

A pleximeter or small hammer is more satisfactory as a striker than the fingers of the examiner. The loss of knee-jerks is among the earliest signs of beri-beri. The reflex is often increased for a short time before it gradually diminishes, and is then lost entirely. It is probably safe to say that the knee-jerks are absent in every case of beri-beri.

(6) *Tendo Achillis jerk* can be examined as in fig. 10.

(7) *The other reflexes* are not of much value as positive evidence of beri-beri.

¹ Being a further report on observations conducted at the Kuala Lumpur Lunatic Asylum.

The scapular reflex usually persists throughout the disease. Sometimes it is exaggerated. There is often increased myotatic irritability of the extensor of the forearm even when marked wrist-drop is present, and a series of taps on the back of the forearm will produce movements in the fingers as though the patient were playing the piano.

The Superficial Reflexes.—The cremasteric reflex, in which the first, second, and third lumbar nerves are concerned, is usually present even in advanced cases when the knee-jerk (third and fourth lumbar) has long ago disappeared. The plantar and abdominal reflexes are not lost as a rule.

(8) *The Electrical Reactions.*—Changes in the electrical reactions characteristic of nerve degeneration are among the very earliest signs of beri-beri, and have been thoroughly investigated by Pikelharing and Winkler. The means for testing these reactions were not available at the Kuala Lumpur Lunatic Asylum.

(9) *Involvement of the pneumogastric nerve* in a special and marked degree is the cause of some of the most striking signs of beri-beri. In those cases in which—

(a) The heart becomes very irritable; (b) the voice is very hoarse; (c) there is obstinate vomiting; the prognosis is bad. When the last symptom is present the patient rarely recovers.

The Heart.—The condition of the heart in beri-beri furnishes a valuable clue to diagnosis. Though the organ may be beating steadily at 70 or 80 whilst the patient remains quiet, it becomes accelerated to nearly double that rate after he has walked a few yards. Hæmic and functional murmurs are common. The cardiac dulness is increased, partly from dilatation and partly from fluid in the pericardium; but this is often obscured by the expansion of the lung tissue due to the deep inspirations of the patient. There is frequently an alternation in the rhythm of the cardiac pulsations, the diastolic interval is shortened, so that the first and second sounds mark off equal intervals, and the heart sounds become foetal in character.

(10) *Œdema.*—This is best sought for over the front of the tibiæ, the sacrum, and the upper part of the sternum. While there may be but slight œdema of the legs, the face may be puffy and so rounded as to become circular in outline. Œdema, to a greater or less extent, is rarely absent from a case of beri-beri throughout the entire course of the disease.

(11) *Muscular Hyperæsthesia.*—This is a very variable symptom. In some cases merely grasping the patient's calf with the hand will cause him excruciating pain. In those cases in which this is a prominent symptom the disease is usually severe. The converse, however, does not obtain; in other cases, though severe, this symptom may be absent.

(12) *Muscular wasting* is always present in the later stages, but is not very valuable from a diagnostic point of view, in the first place because it is general, and in the second because it is frequently masked by œdema.

(13) *Numbness and Paræsthesia.*—A certain amount of paræsthesia is almost invariable; but little reliance can be placed on subjective symptoms in uneducated Asiatics, and it is impossible in Chinese lunatics to map out areas of anæsthesia, &c. Numbness is early

complained of in the legs below the knee; quite early, too, there may be some numbness of the tips of the fingers. A convenient way to examine for this is to make the patient pick up a needle which is lying on a smooth table.

(14) *Dyspnoea.*—In the majority of severe, or moderately severe, cases there is some degree of dyspnoea at nights. In more severe cases this amounts to an actual fight for breath.

(15) *Uneasiness at the Pit of the Stomach.*—Everyone who has seen beri-beri amongst the Chinese of the Federated Malay Straits knows how common it is for a beri-beri patient to pat himself on to the stomach and say "angin" (wind). On examination, the stomach is frequently found to be dilated.

(16) The pupils react normally to light, accommodation, and cutaneous stimulation.

(17) There is no loss of co-ordination or muscular sense. If the patient can stand with his eyes open he can usually stand with them closed. The Rhomberg symptom of tabes is not present in beri-beri. Throughout the experiment at the Kuala Lumpur Asylum no cases were finally diagnosed as beri-beri until the knee-jerks had disappeared; the characteristic gait was present, and the patient was unable to "jongkok."

The following report has been made to the Government of the Federated Malay Straits, which has kindly granted me permission to publish the same:—

The population of the Malay Peninsula consists of a heterogeneous collection of the peoples of many nations.

Braddon has drawn attention to the fact that while the incidence of beri-beri amongst the individuals of one race may be terrible, both in numbers and mortality, the people of another nationality may escape entirely, or almost entirely, although living in the same country and associating freely with the individuals of that race which suffers from the disease. Braddon has also pointed out that the cause of the liability of the Chinese and of town Malays to beri-beri, and the comparative immunity of Indians and country Malays, is to be sought for in some fundamental difference between the habits of life of the one group and the habits of the other. This difference Braddon finds in the kind of rice eaten. He calls attention to the fact that the staple of diet of those communities which suffer from beri-beri is white rice prepared in the mills. On the other hand, those people who enjoy comparative immunity even whilst living amongst a population liable to the disease, do not, for the most part, eat this white rice; but, on the other hand, they consume either rice which is freshly husked in their homes, in the case of the Malay peasants, or they eat a yellow rice prepared in a special manner, and which he calls "cured" rice. In contradistinction to this, Braddon terms the ordinary white rice "uncured," and this "uncured" rice is, he says, the cause of beri-beri.

KUALA LUMPUR LUNATIC ASYLUM, 1906.

During the year 1905 a large number of lunatics in the Kuala Lumpur Asylum suffered from beri-beri. Ninety-four of the 219 lunatics treated in the asylum were affected, and twenty-seven died from the disease.

With the purpose of testing Dr. Braddon's theory

observations were carried on in the following year with regard to the diet of the patients. Half of the patients were placed on a diet of "cured" rice, whilst the other half remained on the diet of "uncured" rice, which kind all the lunatics in the asylum had been eating previous to the commencement of the observation.

At the end of 1906 a report on this experiment was submitted to Government, the substance of which report was as follows:—

The lunatics were housed in two exactly similar buildings on opposite sides of a quadrangle surrounded by a high wall. On December 5, 1905, all the lunatics at that time in the hospital were drawn up in the dining shed and numbered off from the left. The odd numbers were subsequently domiciled in the ward on the east side of the courtyard, and no alteration was made in their diet; they were still supplied with the same "uncured" rice as in 1905. The even numbers were quartered in the ward on the west of the quadrangle and received the same rations as the occupants of the other ward, with the exception that they were supplied with "cured" rice instead of the "uncured" variety.

Out of 124 inmates fed on "uncured" rice thirty-four suffered from beri-beri, two of whom were suffering from the disease on admission, and eighteen died; whereas among 123 patients fed on "cured" rice there were only two cases of beri-beri, both of whom were suffering from the disease on admission, and no deaths. The two batches of patients were kept in separate wards and fed at different times. Separate cooking and feeding utensils were used, but otherwise the patients were allowed to associate together. At the half-year the two batches were changed over to each other's apartments.

The "uncured" rice supplied to the asylum was of excellent quality and much better than that to which persons of the class from which the patients are drawn are accustomed outside the asylum. No mouldy or stale rice was given. The rice was cooked in the usual Eastern manner. The following is the procedure: It is first washed with cold water in galvanized iron buckets. It is then thrown into a shallow iron pan, or kwali, half full of hot water, which is placed over a wood fire. In about twenty minutes the rice has swelled and has taken up all the water; a little earlier in the case of the uncured rice, and later in the cured variety. It is then stirred round twice with a large spoon, or chabok, and the burning wood is taken out from under the kwali, only glowing charcoal being left. When the rice has become soft, which occurs about twenty minutes later, the rice is taken out with a large spoon, care being taken not to disturb the sheet of burnt rice or krak which is caked over the surface of the kwali. The two varieties of rice were both cooked in the same manner by the same cook (a Chinese).

At the end of 1906 there remained thirty-five lunatics in the "cured" rice ward and thirty in the "uncured." The first patient admitted in 1907 was admitted to "uncured" rice, the second to "cured," the third to "uncured," and so on to the end of the year. A few female patients are brought to the asylum and their names are entered in the same lists with those of the male patients, and they are dieted in the

same way. There is only one small ward for women, and, as a rule, they remained in the asylum but a short time, and are, as soon as possible, transferred to the Perak Asylum, where there is better accommodation available for them. None of the women developed beri-beri, and they have not been included in the reports.

CLASSIFICATION OF RICE.

As the observations dealt with the effect of different kinds of rice on the health of the patients, it seems well in the first place to give some account of the different classes of rice commonly eaten in the Malay Peninsula, and also to give some explanation of the words "cured" and "uncured," as applied to rice, and of the sense in which these terms are used in this report.

The actual named varieties of rice consumed are as innumerable as the peas and beans of the horticultural catalogues, and, for the most part, can be differentiated only by the expert. There is, however, a classification of rices which is based on the different methods of preparation which the rice undergoes subsequent to harvesting, and before being cooked by the consumers. It should be clearly understood that this classification is absolutely independent of the botanical varieties of the rice, and has to do only with its preparation before retailing. Peas might be classified in a similar manner as "green," "dried," and "pickled," quite apart from whether they were "marrowfat" or some other garden variety.

Rice is thus divided into three classes, viz.:—

CLASS 1. *The Home-pounded Rice*, such as eaten by Malays in country districts. The unhusked grain is stored in large bins, and as it is required for food it is taken and pounded and winnowed by the women of the household to remove the husk.

CLASS 2. *White Rice*.—This is the rice which forms the staple article of food for the Chinese miner, for the town Malay, and for all Asiatic inhabitants of the Peninsula except the Malays of rice-growing districts and immigrants from India. Under the heading of white rice are included the rices sold in the shops as Siamese and Rangoon. These names refer to certain characteristics of shape and size in the grain, and it would be as unsafe to infer that they had come from Siam or Rangoon as it would be to infer that the Bromley Beauty Potato had been grown in Bromley. Much so-called Siamese rice is grown in Province Wellesley, near Penang. The grain or paddy from which this white rice is made is taken to the mills, and there it is husked between revolving millstones. Subsequently it is polished by friction between a revolving stone and fine wire gauze, or by other methods which remove the whole of the outer layers of the grain and leave it white, clean, and pleasing to the eye. This class of rice Braddon terms "uncured."

CLASS 3. *Indian Rice*.—This class includes the various kinds of rice eaten by Indians in this country. As in the case of Siam and Rangoon rice, it does not necessarily come from the country which its name would indicate. The term Indian rice is employed for rice which has undergone a special form of preparation before being retailed for consumption.

Much of the Indian rice now consumed in the Peninsula is made from the same paddy as that which is sold as Siam rice, and some of it is grown in Province Wellesley. Indeed, it is possible that, of a certain crop from one paddy field, half the rice, after being milled, might be sold as Siam rice, and half, after being specially prepared, might be put on the market as Indian rice. Indian rice is the "cured" rice of Braddon. The mode of preparation is as follows:—

The unhusked grain or paddy is soaked in water for twelve to twenty-four hours, or even longer. It is then heated in vessels containing water over a slow fire until the husks burst. The third stage in the preparation consists of spreading out the grain and drying it in the sun; when this has been completed, it should be possible to separate the husk from the seed by light rubbing between the palms of the hands. The rice is then husked by pounding, or is taken to the mills, where the same process is effected by the millstone, but it is not polished by the rapidly revolving stones against the fine wire gauze after the manner of the white rice in Class 2.

In the resulting grain especially, as considered from a dietetic as opposed to a cosmetic point of view, there is a great difference between the rice of the second class (the white rice) and the rice of the first and third classes. In the preparation of the white rice the polishing processes which it undergoes remove the outer layer of the grain, the aleurone layer, rich in gluten, and of great dietetic value. In the home-pounded rice of Class 1 and the Indian rice of Class 3, this aleurone layer is not removed by any process of polishing, and such rices may be compared with the "wholemeal" flour of the English market, while the white rice of Class 2 resembles more the ordinary white flour used for making white bread.

THE TERMS "CURED" AND "UNCURED."

In reporting on beri-beri at the Kuala Lumpur Lunatic Asylum during 1906, I adopted Braddon's terminology, and described the rices as "cured" and "uncured," intending to convey by the term "cured" that the rice had undergone a certain process of preparation as described in Class 2, but not meaning to imply that it had been "cured" in the sense of preventing deterioration or fermentation. Objection has been taken to these terms "cured" and "uncured," on the ground that they prejudice the enquiry.

The names Siam and Rangoon rice, &c., are open to the objection that they are merely local terms, and, as already explained, Siam rice may be either "cured" or "uncured," and does not necessarily come from Siam. As pointed out above, one difference between the white rices of Class 2 and the rices of Class 1 and Class 3 is, that the white rice has its outer gluten layer removed by polishing. It is also a matter of experience that while communities whose food consists in the main of the white rice of Class 2 are subject to beri-beri, those people whose staple diet is the unpolished rice of Class 1 or Class 3, if they suffer from beri-beri at all, do not do so to the same extent as do the eaters of white polished rice. It therefore would seem best in an enquiry with regard to rice as a factor in the etiology of beri-beri to classify the rices as (a) polished and (b) unpolished.

In connection, however, with the particular observation at the Kuala Lumpur Lunatic Asylum, it has been thought advisable to retain the classification of "cured" and "uncured," as these terms were adopted at the beginning of the observations and employed in the preliminary report. It must, however, be understood that the name "cured" merely means rice that has undergone the preparation detailed under Class 3, and it should be remembered that the term is here used entirely without prejudice, and that it is not intended to convey that rice thus treated enjoys any special immunity to attacks by ferments or other deleterious agents.

KUALA LUMPUR ASYLUM, 1907.

During the year 1907 the observation was continued on the same lines as in 1906. The patients on "cured" rice were kept in the East Ward, and the patients who were taking the "uncured" variety were domiciled in the Western Ward. The two groups of patients, as before, received their food in the dining-hall at different tables and at different hours. The patients on "uncured" rice took their meals at 10.30 a.m. and 4.30 p.m. The patients on "cured" rice fed at 11 a.m. and 5 p.m. The "cured" rice was cooked in a new kwali, or cooking-pot, which had never been used for cooking any other kind of rice. The "uncured" rice was cooked in a kwali about two years old. The plates used by the one set of lunatics were kept separate from the plates used by the other party. The diet supplied to each group of patients was exactly the same in all respects, except as regards the kind of rice supplied.

The patients on cured rice receiving 28 oz. of the best Indian rice known as Muttusambah, and the patients on "uncured" rice being supplied with the same quantity of the best white rice obtainable, which is known locally as No. 1 Siam. The following is the diet scale:—

Fresh meat	4 oz. four times a week.
Fresh fish	5½ oz. twice a week.
Salt fish	5½ oz. once a week.
Vegetables	8 oz. daily.
Cocconut oil	¾ oz. daily.
Rice	28 oz. daily.

All lunatics drank water from the public supply, which is of excellent quality.

During the year 1907, 136 patients were treated in the "uncured" rice ward; of these patients, twenty-eight suffered from beri-beri, four of whom were suffering from the disease on their admission, while in twenty-four the disease developed whilst they were in the asylum.

During the same year 131 patients received a diet containing "cured" rice; four of them were admitted actually suffering from beri-beri, but none of these 131 patients developed the disease in the asylum.

The net result of the observations for the years 1906 and 1907 was as follows: 219 of the patients admitted to the asylum were put on a diet containing "cured" rice. None of these patients developed beri-beri. On the other hand, 126 patients were dieted on "uncured" rice, and sixty-five cases of beri-beri occurred in this group. The above figures

with regard to patients treated in the asylum include many cases who were admitted for observation as to their mental condition, and who only remained in the building for a few days or weeks.

Sixty-three patients in the "cured" rice party remained in the asylum for a shorter period than twenty-eight days. Seventy-one patients belonging to the "uncured" rice group are in the same category.

No patients admitted to the asylum were discharged within twenty-eight days of admission suffering from beri-beri. It would, therefore, be better to exclude these patients. The corrected result to the end of 1907 is, then: "Cured" rice patients (219-65); 154 cases of beri-beri developed in asylum, *nil*; "uncured" rice patients (226-73) 153; cases of beri-beri developed in asylum, 65. Duration of observations two years and twenty-seven days.

Time in Asylum before developing Beri-beri.—In 1907 as in 1906 a large proportion of the cases of beri-beri occurred amongst patients who had been in the asylum for a longer period than three months.

Cases of beri-beri.	1906.	1907.	Total.
Admitted with the disease	4	8	12
Developed during first month of residence in the Asylum	6	3	9
Developed during second month	7	4	11
Developed during third month	8	6	14
Developed after third month.. .. .	20	11	31

Seasonal Incidence.—The cases of beri-beri occurred as follows during 1907: January, 7 cases; 3 admitted with beri-beri. February, 5 cases; 1 admitted with beri-beri. March, 3 cases. April, 1 case. May, 4 cases; 2 admitted with beri-beri. June, 1 case. July, 1 case. August, 1 case. September, no cases. October, 4 cases; 2 admitted with beri-beri. November, 4 cases. December, 1 case.

Doubtful Cases of Beri-beri.—A large proportion of the patients admitted to the asylum consists of misdemeanants, sent there from the magistrate's court for observation as to their mental condition. Hence no fewer than eighty-six out of a total of 267 patients spent less than twenty-eight days in the asylum.

118 remained in the asylum over 100 days.
41 " " " under 100 and over 50 days.
22 " " " 50 and over 28 days.
86 " " " 28 days.

During 1907, 136 patients were treated in the "uncured" rice ward; of these, fifty-one remained in the asylum under twenty-eight days, none of them suffering from beri-beri, except one, who was admitted with the disease, and died soon after his arrival.

Of the eighty-five remaining, twenty-four developed beri-beri, four were admitted with the disease, and in twelve others cedema appeared, and the knee-jerks (present on admission) were lost. These twelve cases were not included in the list of beri-beri patients, as there was no definite paresis in any of them, nor were any pathological changes found in the rhythm of their cardiac pulsations. They may be termed "doubtful cases" of beri-beri.

Of the "cured" rice patients, ninety-six remained in the asylum more than twenty-eight days. Four of them were suffering from beri-beri on their admission to the asylum, but no cases of beri-beri developed amongst this group of patients, nor were there any doubtful cases.

Knee-jerks of Patients on Admission.—The condition of the knee-jerks in the case of each lunatic was noted at the time of his admission, and was found to differ from the average in about 28 per cent. of the cases, as is shown in the subjoined table:—

KNEE-JERKS OF PATIENTS WHOSE DIET WAS "UNCURED" RICE.

Average	100
Increased	5
Absent	17
Diminished	14

KNEE-JERKS OF PATIENTS WHOSE DIET WAS "CURED" RICE.

Average	98
Increased	7
Absent	39*
Diminished	8

* Including sixteen transferred from Siam rice, suffering from beri-beri.

Alteration in Knee-jerks after Admission.—Marked alterations took place in the reflexes of some of the patients after admission to the asylum. Still more striking was the difference between the type of alteration which occurred in the knee-jerks of that group of lunatics on a diet of "uncured" rice, and the knee-jerks of those on "cured" rice. Three of the patients on the "cured" rice diet lost their reflexes (in each case during an attack of dysentery). Of the "uncured" rice patients no less than thirty-four lost their knee-jerks whilst in the asylum.

Seventeen patients admitted and placed on the "uncured" rice diet had absent knee-jerks. In none of these cases did their knee-jerks return. Very different was the case of the "cured" rice patients. Here thirty-nine patients were admitted without knee-jerks (including sixteen transferred from a diet of "uncured" rice suffering from beri-beri). Of these thirty-nine patients, fifteen recovered their reflexes.

Result of Feeding Persons actually suffering from Beri-beri on a Diet which does not consist chiefly of "Uncured" Rice.—During 1907, thirty-two patients in the asylum suffered from beri-beri. Twenty of these were transferred to a diet in which the "uncured" was replaced by "cured" rice, with the result that thirteen recovered, four were discharged from the asylum (because they were no longer insane) improved, but not entirely cured of their beri-beri, three died of dysentery within fourteen days of elimination of "uncured" rice from their diets. Of the remaining twelve, one was given a milk diet, and was discharged in an improved condition; one died on the day of his admission; ten remained on a diet of "uncured" rice. Of these ten, six died, and four (being no longer insane) were discharged suffering from beri-beri. None of these ten patients recovered in the asylum. A similar result was observed in 1906, when ten patients suffering from beri-beri were dieted on "cured" rice with no deaths, and of twenty-six who remained on the "uncured," eighteen died.

The net result for the two years is therefore: Thirty-six patients actually suffering from beri-beri fed on "uncured" rice—twenty-four died (66.66 per cent.). Thirty patients actually suffering from beri-beri fed on "cured" rice—three died (10 per cent.).

The following is a list of the beri-beri patients treated in the Asylum during 1906 and 1907, showing results of diet:—

LIST OF PATIENTS ACTUALLY SUFFERING FROM BERI-BERI IN THE LUNATIC ASYLUM DURING 1906.

Transferred to "Cured" Rice.		Transferred to "Uncured" Rice.	
Name.	Result.	Name.	Result.
(1) Ah Lok ..	Cured	(6) Poh Hoo ..	Cured
(2) Chow Hon ..	"	(7) Wgh Wee ..	"
(3) Lew Sew ..	"	(8) Lim Hee ..	"
(4) Tai Ah Yong ..	"	(9) Gam Pah ..	"
(5) Kassim ..	"	(10) Wong Foo ..	"

Remaining on "Uncured" Rice.	
Name.	Result.
(1) Thay See ..	Transferred, District Hospital. Absconded.
(2) Tau Kong ..	Transferred, District Hospital. Relapsed, died.
(3) Lim Kan Kee ..	Transferred, District Hospital. Died in relapse.
(4) Swit Bin Batim ..	Transferred, District Hospital. Died in relapse.
(5) Ten Hoi ..	Transferred, District Hospital. Died in relapse.
(6) Wgh Hoh ..	Transferred, District Hospital. Died of mania.
(7) Leong Weng Sin ..	Discharged, being no longer insane. Suffering from beri-beri.
(8) Tan Tin Sin ..	Discharged, being no longer insane. Suffering from beri-beri.
(9) Leong Kam Ming ..	Transferred, District Hospital. Discharged as no longer insane. Suffering from beri-beri.
(10) Foo Lim ..	Transferred, District Hospital. Relapsed. Discharged as no longer insane.
(11) Lye Phin ..	Died during first attack.
(12) Balang ..	"
(13) Lim Yoon ..	"
(14) See Tan Fan ..	"
(15) Yong Seng ..	"
(16) Lim Kow San ..	"
(17) Chin Seng ..	"
(18) Long Chin ..	"
(19) Chan Fat ..	"
(20) Chan Quai ..	"
(21) Chow San ..	"
(22) Bong Yet ..	"
(23) Lim Pow ..	"
(24) Khoo Kam ..	"
(25) Low Ah Jak ..	"
(26) Quah Kiam ..	"

LIST OF PATIENTS ACTUALLY SUFFERING FROM BERI-BERI IN THE LUNATIC ASYLUM DURING 1907.

Transferred to "Cured" Rice.	
Name.	Result.
(1) Sutra ..	Cured.
(2) Lee Quee ..	Cured.
(3) Tham Moon ..	Discharged, much improved.
(4) Koh Ah Tak ..	Cured.
(5) Gan Ching ..	Cured.
(6) Tan King ..	Discharged, much improved.
(7) Goh Pan ..	Cured.
(8) Koh Hong ..	"
(9) Guan Fah ..	"
(10) Lim How ..	"
(11) Hoh Hang Hoh ..	"
(12) Poh Cheng ..	"
(13) Chin Sam ..	Died from dysentery one week after stoppage of "uncured" rice.
(14) Lim Hong ..	Cured.
(15) Thye Yin ..	Died of dysentery eleven days after stoppage of "uncured" rice.
(16) Drami ..	Discharged much improved.
(17) Chong Kim ..	Cured.
(18) Yong Hong ..	"
(19) Lee Shin ..	Discharged eighteen days after transference to "cured" rice, slightly improved.
(20) Leong See ..	Died thirteen days after admission from dysentery.

Remaining on "Uncured" Rice.	
Name.	Result.
(1) Low Yin ..	Died of dysentery.
(2) Wong Chin ..	Died of pneumonia.
(3) Lok Kim ..	Discharged, suffering from beri-beri.
(4) Leung Gin ..	Died of syncope.
(5) Low Ken ..	"
(6) Leng Gin ..	"
(7) Vong Chan ..	Discharged with beri-beri.
(8) Lee On ..	Died of dysentery.
(9) Yap Quee ..	Discharged with beri-beri.
(10) Hong Kong ..	Discharged, suffering from beri-beri.

One patient, Tan Thim, died on the day of admission. One patient, Malayappen, was put on a milk diet and discharged after three months. Much improved.

The general health of the two batches of lunatics was much the same. The following table shows the number and causes of the deaths in each party:—

Cause of Death.	Number of Deaths	
	on "Cured" Rice.	on "Uncured" Rice.
Beri-beri ..	3	24
Mania ..	8	7
Other diseases ..	12	12
Dysentery ..	29	20
Total ..	52	63

It is a well-recognized fact that lunatics in an asylum are, as a community, highly susceptible to the attacks of disease, and as individuals their resisting and recuperative powers are exceptionally feeble. This fact may account for the high case mortality amongst the lunatics who actually suffered from beri-beri, and renders still more remarkable the large proportion of recoveries amongst those attacked, who were subsequently transferred to a diet of "cured" rice.

Process of Return of Knee-jerks.—Knee-jerks returned in seven of the beri-beri patients, who were transferred to "cured" rice. In those cases in which they returned they commenced to do so within about sixteen weeks after the "uncured" rice had been withdrawn from their diets, and were at first much below the average. In those cases which have been under observation for a sufficient time, within about twenty-four weeks the knee-jerks approached the normal, and then gradually became increased until they were markedly exaggerated, subsequently declining again to normal. In twelve cases the knee-jerks remained absent. Seven of these cases were discharged from the asylum within six weeks—i.e., before sufficient time had elapsed for the reflexes to return. In five there was no sign of return after sixteen weeks, and it is probable that in most of these five cases the knee-jerks have been lost permanently. The manner in which the knee jerks return—first diminished, then gradually increasing until the reflex is exaggerated, and then declining to average—recalls the condition of the knee-jerk at the commencement of an attack of beri-beri, but in this latter case the order of the changes is reversed—normal, exaggerated, gradually declining to disappearance.

Note on Beri-beri at the General Hospital.—The lunatic asylum is attached to the General Hospital, and it is instructive to notice the race incidence of beri-beri as demonstrated by admissions to the latter institution during the last three years. Within this period 10,000 patients were admitted to the wards of the General Hospital. Of these, 6,878 were Indians—"cured" rice eaters. The remaining 3,124 consisted

of Chinese, Japanese, and Malays -- eaters of "uncured" white rice.

During the three years under consideration, 232 cases of beri-beri were admitted. Five of these cases occurred amongst the 6,878 Indians who, speaking generally, do not eat "uncured" rice, and 227 cases of the disease amongst the 3,124 "uncured" rice eaters. It is a most striking fact that all the five Indian patients who suffered from beri-beri were eaters of white "uncured" rice. Less than 4 per cent. of the Indian patients who are admitted to the General Hospital are eaters of this rice. In connection with this, Dr. Dowden, of Perak, has kindly forwarded an account of a Tamil Indian admitted to hospital suffering from beri-beri; he, too, was found, on enquiry, to be an eater of "uncured" white rice.

Theories of Causation of Beri-beri.—It would be out of place to discuss the mass of evidence for and against the various theories of the causation of beri-beri; but it is necessary to consider in connection with these theories the evidence of the particular experiment under report. The three most prominent theories are:—

- (1) The theory of place-infection.
- (2) The theory of contagion, the dirt disease theory, and the theory of conveyance of infection by parasites such as bugs and lice.
- (3) The dietetic theory, including nitrogen starvation and the poisonous rice theories.

In connection with Place-infection, it is interesting to note that the Kuala Lumpur Lunatic Asylum, with which this report is concerned, was formerly the "Old Gaol" of Travers' experiment, and of which Braddon says: "It was an old prison, reputed to be, and to have always been, incapable of originating beri-beri." This building was first used as a lunatic asylum in 1898. Since it has been used for this purpose there have been cases of beri-beri every year, the largest number in any one year being 94, in 1905, so that it was last year called, with some reason, "a hot-bed of beri-beri."

If the disease is a "place-infection," the lunatic asylum should have been thoroughly impregnated by December, 1905, when the observation was commenced. Since that time, however, no cases of beri-beri have developed amongst the patients from whose diet "uncured" rice has been eliminated, while it has continued among the patients whose food remained unaltered.

In June, 1906, *i.e.*, six months after the commencement of the observations, there had been many cases of beri-beri in the East Ward, which was occupied by patients on "uncured" rice. In the West Ward the patients had no "uncured" rice and no beri-beri.

On June 20, 1906, the patients were transposed, the patients from the West Ward being transferred to the East, and those from the East Ward to the West Ward. The domicile of each group of patients was changed, but their food remained the same. The patients transferred to the East Ward, which, according to the theory under discussion, should have been infected, did not develop beri-beri.

By the end of 1907 this ward, "a hot-bed of beri-beri," had been occupied for eighteen months by patients on a "cured" rice diet. During the whole of

that time not a single case of beri-beri had occurred amongst them. On the other hand, the "uncured" rice group of patients took their beri-beri with them when they were transferred to the Western Ward, where no cases had occurred for the preceding six months. From the date (June 20, 1906) of its occupation by patients on "uncured" rice down to the end of 1907, this Western Ward was never free from beri-beri. At the end of 1907, the gang of patients occupying this ward was put on a diet of "cured" rice, and although they still remain in this ward where beri-beri was previously rife, no case of the disease has occurred amongst them since the change was made in their diet four months ago.

The Contagion Theory, including conveyance by parasites, &c.—During 1906, 1907, and the first three months of 1908, ten lunatics were admitted to the asylum actually suffering from beri-beri. Six of these patients were admitted to the "cured" rice gang. During the same period twenty-six patients suffering from beri-beri were transferred from the "uncured" rice group to the "cured" rice ward. Thus thirty-two patients suffering from marked beri-beri were admitted to the "cured" rice gang. Yet none of the latter developed the disease.

It may be argued that the disease is communicable during its early stages only. The lunatics of each gang mixed freely in the hospital compound with lunatics belonging to the other gang, and the gangs were separated at night and meal-times only. Fifty-eight lunatics who developed beri-beri in the asylum, and were admitted without the disease, both before and during the earliest stages of the disease, associated freely with the "cured" rice group of lunatics. None of the latter developed beri-beri. No special immunity was enjoyed by the lunatics employed on extra mural work. As in 1906, those patients who were sane enough and strong enough physically to be employed in working outside the asylum, in the grounds of the General Hospital, and in the gardens of the staff, enjoyed no special immunity to beri-beri, but suffered equally with those patients not so employed.

The Dietetic Theory.—The evidence of the experiment is strongly in favour of beri-beri being due to a defect in diet; and, in this case, at any rate, to a defect in the "uncured" rice, since except for the difference in the kind of rice the diets of the two groups of patients were exactly the same. During the course of the experiment 219 patients were treated on a diet of "cured" rice and none of them developed beri-beri. On the other hand, 65 cases occurred amongst the 226 patients on "uncured" rice.

At the end of 1907 the diets of the two groups of patients were changed, the patients on "uncured" rice being put on "cured" and *vice versa*.

Subsequent to this change no cases of beri-beri occurred in either group for twelve weeks, when a case developed in a lunatic named Chew Sing Hoh, who belonged to the group of patients who were transferred to a diet of "uncured" rice on January 1, 1908, having previously been on a diet of "cured" rice. The result of feeding patients actually suffering from beri-beri on a diet of "cured" rice is also of interest when considered in connection with the dietetic

theory. Thirty of these patients were transferred to a diet of "cured" rice and three of them died. Thirty-six remained on "uncured" rice and twenty-four of them died. The experiment throws no light on the question as to whether "uncured" rice acts as a direct or merely predisposing cause of beri-beri; whether it contains a specific poison or is deleterious only because it is deficient in some dietetic element essential to the human economy.

"Uncured" rice does not always produce beri-beri. Alcohol does not produce alcoholic poisoning in every workhouse where it is allowed. Arsenic does not cause poisoning whenever it is administered. Patent sterilized foods do not produce scurvy in every infant fed upon them.

In some institutions where "uncured" rice is supplied to the inmates very few cases of beri-beri occur. This is probably due to variations in the sample of rice, and it is possible that, other things being equal, the amount of beri-beri occurring is dependent upon the amount of polishing which the rice-grain has undergone. The more thorough the removal of the outer layers the greater the incidence of beri-beri among its consumers.

It also appears that to cause beri-beri the diet must be of a one-sided nature consisting chiefly of rice. When the diet is very varied there is but little beri-beri.

Such rice as is eaten by Europeans in the Federated Malay States is of the "uncured" variety, but the quantity consumed is quite insufficient to cause beri-beri.

The well-to-do among the eaters of white polished rice suffer from beri-beri occasionally, but not to the same extent as mining coolies in out-of-the-way districts where transport is difficult and the rations consist in the main of dried fish and rice. Braddon explains the comparative immunity of these well-to-do people by saying that they eat less rice because they eat more of other foodstuffs. This is a possible explanation, but on the other hand, it may be due to the fact that their food is more varied than that of the mining coolie. It must be understood that the upper classes of those who eat polished rice enjoy but a relative immunity.

During the puerperium and during long debilitating illness beri-beri is not uncommon in the families of the wealthier Chinese. The special incidence of beri-beri among women during the puerperium may be due to lessened resistance to the cause of the disease; on the other hand, it may be due to an altered diet.

"Uncured" rice does not always cause beri-beri. As the result of enquiries made amongst Chinese women, some of whom have suffered from beri-beri after their confinements, it is found that during the puerperium they take neither curry stuffs nor vegetables. Their diet, as far as rice is concerned, remains the same as in health, and in quantity it is unrestricted. The more of it they can eat the better pleased are their relations and friends. As regards meat, they are always given pork and sometimes chicken, stewed almost to rags. The fat is removed from the pork before cooking. Ginger and herbs are added before eating. Pieces of dried fish cooked by being laid on glowing charcoal are sometimes given. The diet of

a healthy person is much "richer" in quality and much more varied. The chief differences are the inclusion of curry stuffs and vegetables in the diet of healthy persons, and the method of cooking, in which frying in lard is more common than stewing. The pork, fresh vegetables, and salt fish are all prepared in this manner (frying in lard). In addition to rice the diet also includes curry stuffs, boiled salted vegetables (imported from China), and fresh fish cooked in coconut-oil. It appears probable, therefore, that in these cases of puerperal beri-beri the cause is to be found in the one-sided diet—the excessive amount of polished rice which is consumed. These considerations point to the conclusion that "uncured" rice, when it bears an undue proportion to the proteids and fats of the diet, tends to produce beri-beri. "Uncured" rice is less nutritious than "cured" rice, for the outer layer has been removed from the former by polishing. It is indeed possible that both rices may contain an equal quantity of a poison capable of producing beri-beri, but that this poison has a deleterious effect only upon those persons whose food, consisting of "uncured" rice, is deficient in dietetic value.

CONCLUSIONS.

The cause of beri-beri is to be sought for in the diet. It may be taken as proved that the elimination of white "uncured" rice from their diets prevented the occurrence of beri-beri in the "cured" rice group of patients at the Kuala Lumpur Lunatic Asylum.

The result of the experiment tends to show that white polished rice, although of the best quality, is a cause of beri-beri, acting either by some poison which it contains or by a starvation due to some defect in the nutritive value of such rice. The experiment proves that if in a coolie's ordinary diet white polished rice be replaced by the "cured" rice which is used in the Kuala Lumpur Asylum, beri-beri will not occur. It is reasonable to infer that the adoption of such a measure in all the prisons and asylums of those countries where beri-beri occurs would entirely prevent the occurrence of the disease in such institutions. It is probable that as people learn the dietetic nature of the disease and the danger of a diet which consists in the main of white polished "uncured" rice, beri-beri will become as rare as scurvy.

DESCRIPTIVE MATTER TO ILLUSTRATIONS.

- FIG. 1.—Beri-beri Gait (a convalescent Chinaman).
 FIG. 2.—Tabetic Gait (in a Chinese Woman).
 FIG. 3.—Jongkok Test.
 FIG. 4.—Foot-drop Test.
 FIG. 5.—Wrist-drop Test.
 FIG. 6.—Wrist-drop in an early case of Beri-beri.
 FIG. 7.—Slight weakness of extensors of thumb in a mild case of Beri-beri, three days after symptoms first noticed.
 FIG. 8.—An early case of Beri-beri, with rather more marked finger-drop than the above.
 FIG. 9.—Knee-jerk.
 FIG. 10.—Tendo Achillis Jerk.
 FIG. 11.—The West Ward.
 FIG. 12.—The East Ward (the big tree is the same shown in each photograph).
 FIG. 13.—Bengal Rice (Pooloonga Arisi, Muttu Sambah). This rice is grown and cured in India, and was supplied to the "cured" rice group in the Asylum, none of whom developed Beri-beri. Cost, about 44 cents a gallon.
 Note the "branny" powder on this rice and remains of the outer covering. All this is cleaned off by polishing in the case of Siam rice.



FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

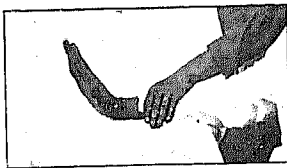


FIG. 5.

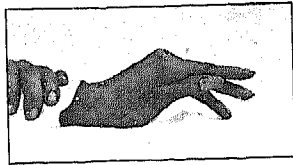


FIG. 6.



FIG. 9.



FIG. 10.

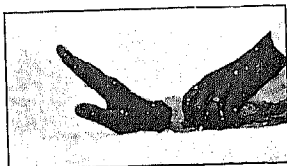


FIG. 7.

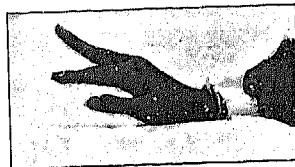


FIG. 8.

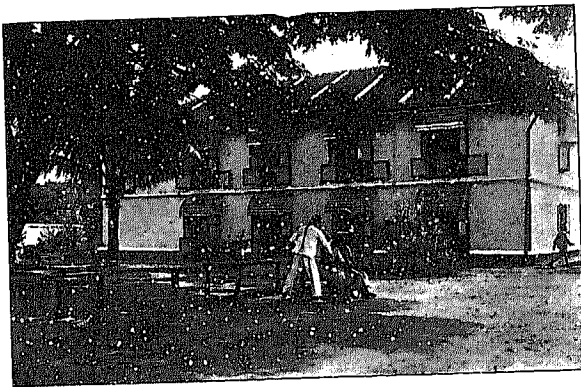


FIG. 11.

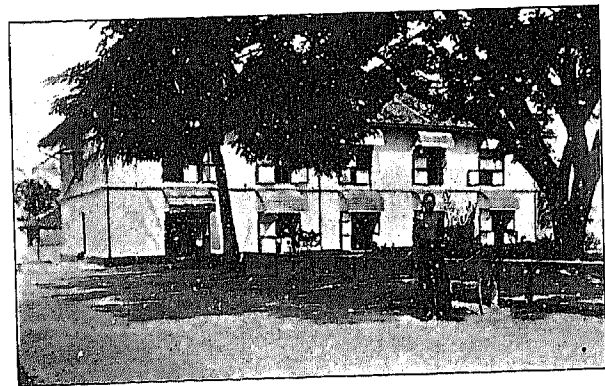


FIG. 12.



FIG. 13.

FIG. 14.

FIG. 15.

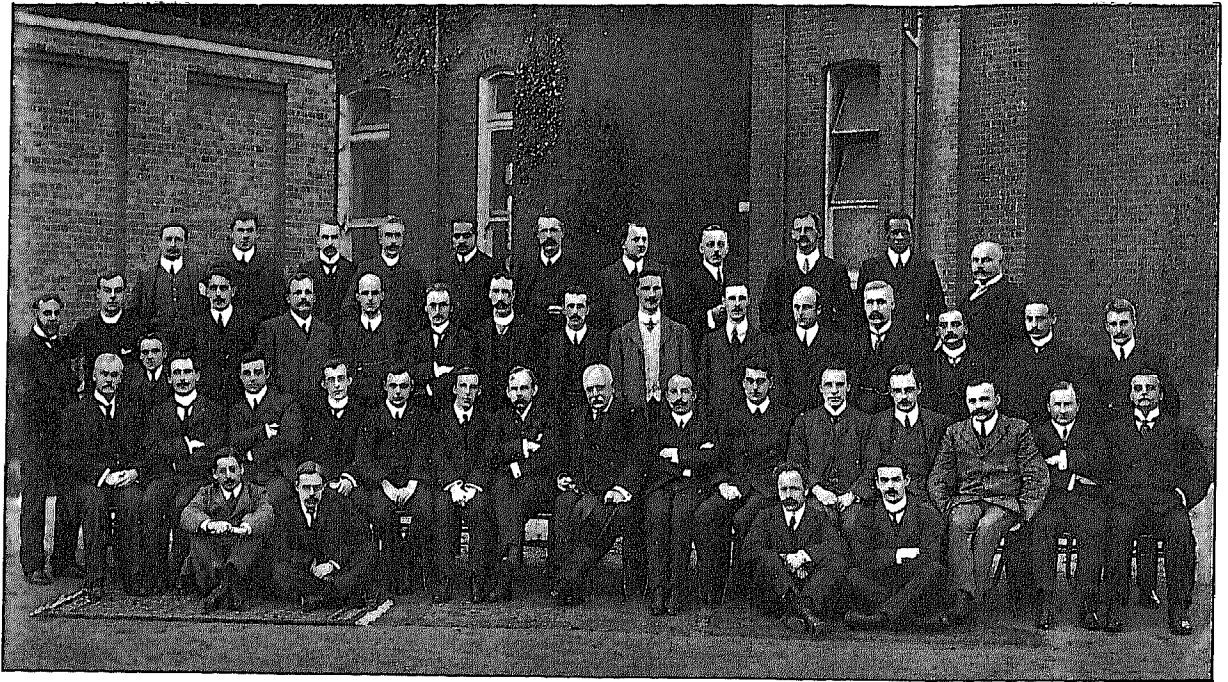
FIG. 16.

FIG. 17.

FIG. 18.

Figures illustrating article on "Rice and Beri-beri," by William Fletcher, M.B. Cantab.
(For descriptive matter see end of article.)

LONDON SCHOOL OF TROPICAL MEDICINE.



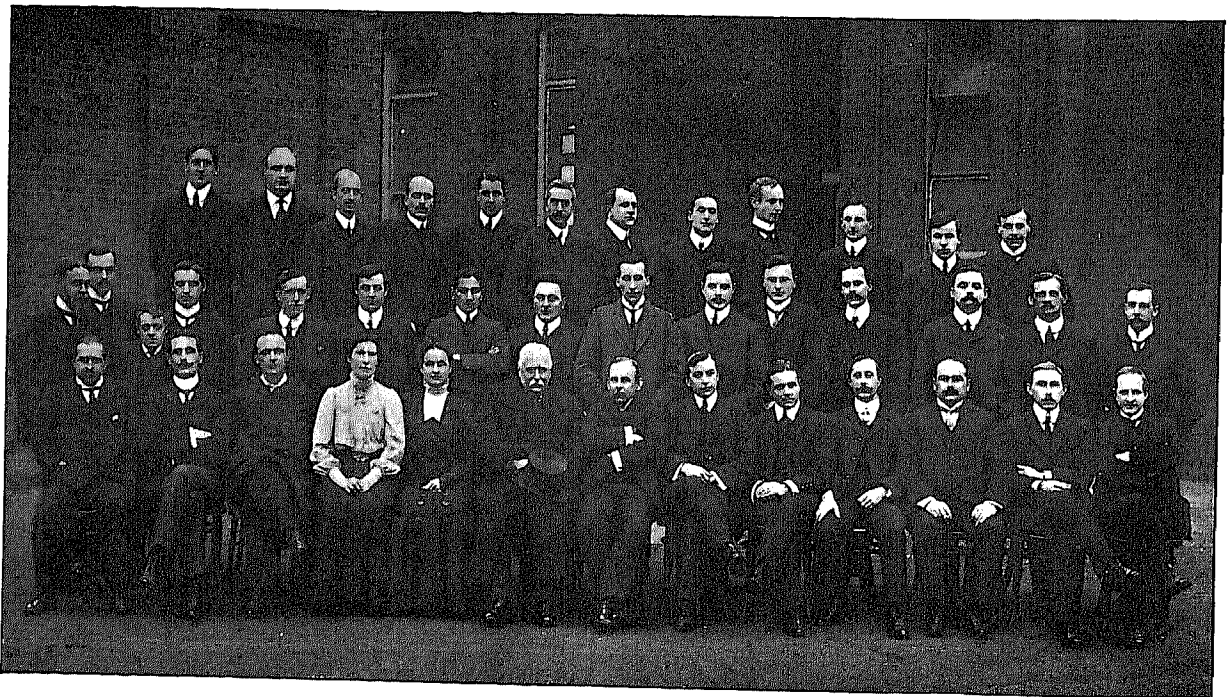
Sitting on Ground—W. C. Hossack, A. G. Payne, S. G. L. MacLaine, J. G. Copland.

Front Row—E. C. T. Sutcliffe, H. B. G. Newham (Demonstrator), O. M. Wenyon (Protozoologist), H. B. Kent, J. Macgregor-Smith, R. T. Leiper (Helminthologist), Col. A. Alcock (Arthropodist), Sir Patrick Manson, J. M. O'Brien, W. H. Thresher, T. H. Sulfern, H. C. Brown (Capt. I.M.S.), F. G. Sharpe, A. Copland, S. C. G. Fox.

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Back Row—L. T. R. Hutchinson (Capt. I.M.S.), O. Luhn, O. Marriot, T. S. Dunn, S. R. Shirgaokar, C. D. Sutherland, G. B. Warren (Laboratory Assistant), C. H. Watson (Capt. I.M.S.), J. H. McDonald (Major I.M.S.), J. A. Browne, D. E. Anderson.

28th Session. October-December, 1908.



Front Row—H. E. Arbuckle, H. B. G. Newham (Demonstrator), Mr. K. W. Goadby (Lecturer), Miss Watney, Miss Dow, Sir Patrick Manson, K. O. M. G. (Lecturer), Col. A. Alcock, I.M.S. (Arthropodist), J. W. Archibald, J. C. Spillane, G. M. Gray, A. W. Grant, I. Davenport Jones (Capt. I.M.S.), T. Hood Rankin.

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29th Session. January-April, 1909.

FIG. 14.—No. 1 Siam, as supplied to the "uncured" rice group of patients in the Asylum, amongst whom sixty-five cases of Beri-beri occurred. Cost, about 36 cents a gallon. This is a very highly polished rice.

FIG. 15.—Rangoon Rice (Bras Pegw). A polished rice; but not polished to the same extent as No. 1 Siam. Cost, about 20 cents a gallon.

FIG. 16.—Padi or unhusked Rice. 15 cents a gallon.

FIG. 17.—Home-pounded freshly husked Rice. Prepared from Padi, bought in the market at 15 cents a gallon.

I have never seen an eater of this rice with Beri-beri.

FIG. 18.—"Cured" grain Rice. This rice is "cured" in Penang. It forms the staple diet of almost all the Indian coolies, and is supplied to the labourer on rubber estates.

The eaters of this rice do not suffer from Beri-beri. In the bottom corner is some "uncured" Siam rice.

"C. R. Soc. Biol.," t. lxiv., p. 878.

A CASE OF BALANTIDIAL DYSENTERY IN A MONKEY.

Noc, F. The author observed a fatal case of dysenteric disease in a female *Macacus cynomolgus* at the Pasteur Institute of Saigon. In the animal's stools were found large numbers of a ciliated infusorian corresponding to *Balantidium coli*, though rather smaller.

Post mortem, the large intestine was found covered with superficial ulcerations. The parasites occupied the margins of the ulcers, and sometimes the sound portions of the bowel between the tubular glands, but were not very numerous there. They were especially numerous in the epithelial debris detached from the mucous membrane.

"Annales de l'Institut Pasteur," November 25, 1908.

A CONTRIBUTION TO THE STUDY OF TRYPANOSOMA CONGOLENSE.

Laveran describes the parasite in many animals, and the course of the disease in each animal. Most of the animals die, the goat showing the lightest infection and a speedily-acquired immunity. *Post mortem*: The spleen is found enlarged in some animals to an enormous extent, and the increase in size in certain instances appeared to be so sudden that rupture of the capsule with hæmorrhage occurred. The *Trypanosoma dimorphon* has a higher degree of pathogenicity than *T. congolense*, and immunity is unattainable with the former strain. Infection is by way of flies, and prophylaxis consists in screening the patients so as to prevent flies becoming infected and so distributing the disease, combined with the extermination of the breeding-place of these flies.

"Journ. Amer. Med. Association," January 23, 1909.

SOME FACTORS IN THE HISTORY OF HÆMOGLOBINURIC FEVER.

Deaderick, W. H., gives a categorical account of the history of hæmoglobinuria and of the confusion of the disease with bilious intermittent fever and yellow fever. The introduction of quinine as a treatment for malaria is by some considered synchronous with the appearance of blackwater fever; this contention would, however, appear to be negatived by the fact that in districts where malaria has been, and is being, treated with quinine, blackwater fever is less frequent, as well as by the positive evidence that the disease existed amongst peoples where the use of quinine was unknown. The immigration of Europeans was influential in the history of hæmoglobinuric fever in several ways: (1) By the increase of susceptible population; (2) by the importation of quinine; and (3) by the advent of physicians competent to diagnose and to describe the disease.

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THE JOURNAL OF

Tropical Medicine and Hygiene

MAY 1, 1909.

CLOTHING IN TROPICAL COUNTRIES.

No one has yet given us a formula whereby a European intending to proceed to the Tropics may set to work to procure appropriate clothing. Such being the case, it may be said that no such formula is possible, otherwise it must surely have been forthcoming. One would have thought that by this time, with all our knowledge of textile fabrics, and of the absorbing or resisting power of clothing of different hues to sunlight, a medical man, on being asked by an intending traveller what to wear, could have supplied him with a "prescription" for apparel as readily as one for malaria prophylaxis. It is not so, however, and a medical man in Europe, when asked to recommend what to get as equipment for the Tropics, falls back upon the knowledge he has obtained from advertisements, and advises accordingly. Is it possible to be exact on the point? Can we approach the subject from a scientific basis, or must it remain empirical merely? In the first place, it is necessary to get rid of some of the traditions which have gathered around the subject. When the journey is decided upon the question of outfit arises, and many a parent has had good reason to dread mention of the subject. A young man or a young woman, more especially a bride, is frequently besieged with advice as to the clothing required. Old friends retired from the Tropics may