Thesis
on the geographical distribution, etiology, and treatment of Beri-Beri.

By
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The higher subjects passed along with the ordinary
Preliminary subject on
French
Natural Philosophy
Metaphysics

Unfortunately I did not appear for Greek
Exams then, I shall present myself for Clinical
Exams in due course.
Historical account and geographical distribution. — As far back as 2697 B.C., Beri-Beri was described in the "Hiehching," the oldest Chinese medical treatise extant, under the name of "Hiih-Koi," or "Malarial leg." The earliest description of it by Japanese physicians dates from 1562. Western knowledge of the disease, however, is but of a comparatively recent date; for it was not until 1866, when Dr. De Silva Lemos of Bahia, Brazil, published his observations in the Medical Gazette of that place, on the disease which he called "morbus inominatus," that medical men in various parts of the world began to be on the lookout for this inominable malady.

For a long time its territorial limitation was believed to be the Indian coast of the Bay of Bengal, 18 to 20° N. latitude,
and the island of Ceylon. It is now known that the area of its endemic distribution is co-extensive with the Tropical and Subtropical belts; and under certain "artificial" conditions, it has been met with even in Temperate Climates. It is the scourge of many of the mines and plantations of the Malay and Eastern Archipelagoes. It is apt to break out among the coolie gangs engaged in extensive engineering works in the tropics, such as the Panama Canal or the Congo Railway. It haunts the Dutch army in Sumatra; and used to be common enough, until better hygienic conditions prevailed, in the British armies in India, and the Japanese Navy. Later Beri-Beri has been met with on the Eastern seaboard of Australia, in Fiji Islands, in Lake Nyassa, in the Upper Congo, in Havana, in Caledonia, in the
Sandwich Islands; all of which places, not before known to be liable to the disease.

Beri-Beri is prone to break out in asylums, in jails, in schools, in ships, etc. Where overcrowding and insanitary conditions serve to produce the disease by supplying the necessary (artificial) conditions for its development. Examples bearing on this point will be given when discussing the etiology of Beri-Beri.

The disease is now almost unknown in China (as an endemic disease); whereas in early times it was frequent, and where also it was first described by Chinese writers.

In Japan — the home of Beri-Beri — on the other hand, it would appear to be increasing, particularly in her large, lowlying, damp, overcrowded towns.
Etiology.

I propose here to give a critical digest, partly based on experience, of the various views and theories that have been advanced as regards the etiology of Beri-Beri; and, in order to do so with clearness, will divide them into fallacies, predisposing, exciting causes.

A. Fallacies.

1. Diet. Dr. Takaki, late Director General of the Tokyo Naval Hospital, or insufficient diet, attributed Beri-Beri to the absence of nitrogen in the food of the Navy. The following is a quotation from his Report which was published by the Japanese Central Sanitary Bureau, Navy Department in 1890. It runs thus: "The extinction of Makke (Beri-Beri) must be attributed to the improvement in the scale of diet. He refers to the improved proportion of the carbon and nitrogen in the
dietary, which, instead of being as low as 10 to 15 e., he found invariably in all the cases he inquired into 13 to 14 e., thus altering the composition of the blood.

But it will soon be shown that instead of being an exciting cause of the disease, the deficiency of nitrogenous food is probably not even a predisposing one.

In the first place, Dr. Takaki himself admits that in the same Report already referred to, that along with the improved dietary, the hygienic conditions of the navy were also improved. "With the progress of society," he continues, "persons in the navy came to take care of their health.... That such improvement of individual health has its effects upon the general improvement."

And all my investigations lead me to think that in the improved hygiene of the navy was its salvation from..."
its old enemy. By overhauling the
ships and preventing overcrowding,
the germ of Berti-Berti was removed
and the conditions favourable to
its development and propagation
were nullified. In my opinion
fresh air, exposure, and sunshine
are inimical to the germ of Berti-
Berti, as they undoubtedly are to
the Plague Bacillus—a truce
of which I have seen three epidemics
in the South of China, and in which
all above measures were sometime
successful. But removal of the epidemic was
essential.

Again, Dr. Sumimura, of Japan
fame, says that the question of
diet, according to his own wide
experience, is of subtleful importance.
"Indeed, those who are in a condition
able to afford good and abundant food
are most liable to Berti-Berti."

Further, the outbreak of Berti-Berti
in the Fiji Islands in 1894, may here
be cited as against the food theory.
All the patients were Japanese coolies
of whom about 300 were imported for the purpose of working on sugar plantations. They arrived in the colony on April 27th, 1894; and it was understood that they were all medically examined in Japan, and passed as free from the disease. On May 30th the first hospital case was admitted, and by the middle of November there were more than 220 cases. The disease was entirely confined to these immigrants, and spreading either to the Indian labourers who worked on the same plantation with them or the Fijian inhabitants of the villages. The Japanese cooks, however, were lodged by themselves separately; but "they were fed on the same food as theirellow labourers."

It is plain, therefore, that whatever may have been the exciting cause, it certainly was not the food; or why should the disease be confined to the Japs alone?

Again, Sir Powell, then Principal
Again, there are the facts connected with the Epidemic of B. Beri, in the jail of Singapore. The jail was divided into a male and female side, the buildings being contiguous and in the main, the inmates of both sides of the jail being fed alike and from the same stores; notwithstanding, it was of the inmates of the male side of the jail who were attacked first with the disease. Had the food been the medium of the infection (or poisoning) the male and females would have been victimized alike. (Lancet, Aug. 1897, p. 415.)

civil Medical Officer, Straits Settlements, one of the homes of B. Beri, in his Report, Government, dated 14th June, 1886, on the outbreak of B. Beri in the prison at Singapore, says, "I fail to assure that the dietary for the cannot be credited with having been a factor in the causation of the disease. It is a prison diet, but it is one which is liberal, sufficiently nutritional, and varied." The diet consisted of rice, fresh beef, fresh pork, fresh fish, salt fish, vegetables, oil or lard, curry stuff, salt.

The history of the outbreak at the Richmond Asylum, Dublin, tends to prove that B. Beri is not a food disease. Dr. Conolly, Norman, Superintendent of the Asylum, says, "Both rice and smoked fish had been accused... But the food of the paupers in the Asylum did not differ essentially from that of the people around them, and on close investigation neither feeds...
"nor rice could be held guilty. Moreover it is highly improbable that the same food supply was used in the asylum during the epidemics of 1894, 1896, and 1897. Indeed, we are told by D. C. Norman that toward the close of 1894, fresh fish was substituted for imported rice (probably coming from Newfoundland, where Beri-Beri is said to be endemic); and the fresh marine fish has been continued since; notwithstanding B. Beri after being absent for a year broke out again in 1896, and returned again in 1897.

The rice used was that commonly sold in the city of Dublin; and it was practically confirmed as a medical error. As regards the diet of the asylum, it was good and sufficient, and even a little ahead of that given in many Irish asylums.

Beri-Beri, then, is not a food disease. In China, where the mass of the population, rich and
poor alike, live chiefly on rice. The disease is now but very little known. Europeans too, living in China, and who daily partake of rice, though in a small measure, are hardly ever known to contract the disease. And the same may be said of Europeans living in Japan, for according to D. Simonson's high authority, "foreigners, of native of Europe and America, in Japan enjoy nearly absolute exemption from Bori Bori. Out of a total population of about 2,000 foreigners in Yokohama, a district of especial prevalence of the disease, not a single well-authenticated case has been met with."

Under this heading of "Diet as a cause of B. Bori) I intend briefly refer to the "Survey Theory." It was morehead and W. L. Chilton (Colonial Surgeon, Singapore) among others who held this theory, because in some B. Bori cases the gums were found bloody, but that was probably more coincidental,
are for all the facts against such a supposition. The Singapore jail diet, the Table already quoted, and by which Dr. Powell, the medical officer, disproved the diet theory; the Dublin Asylum diet, also already referred to, the great authority of Dr. Simmons of Japan, which has already been shown to be against such a theory; all these facts go to show that scurvy could not be a cause of the disease. Indeed, in many instances, the disease was contracted after the sailors had arrived in port (Yokohama) and after a free supply of fresh provisions had been obtained.3 Surgeon C. S. Vines, in a Communication to the B. M. Journal, Oct. 1844, p. 845, speaks of an outbreak of Bére among the Indian and African sailors on board the vessels in the London Docks towards the close of 1843. "Their diet being almost entirely vegetable."
Theory that B. Beri is a form of scurvy would seem to be weakened, if not wholly disproved by these facts.

6. Anaemia. Several works on Indian diseases ascribe B. Beri to an anaemia. Sir Joseph Fayrer views it as a result of whatever tends to depress the vital energies & improve the blood & cleanse the nervous centres. And Maclean states that the causes which tend to directly or indirectly bring about anaemia, are among the chief factors in the causation of the disease. 5

The anaemia theory is absolutely erroneous, and has been amply disproved in Japan, in the Straits Settlements, in Burma, and in many other places. And Manson asserts that hematometric observations have shown that anaemia, if it should happen to be present in a case of B. Beri, is in no relation, except an accidental one, to the disease. 6
Bellying and Starke are equally opposed to the disease being caused by
anaemia. They hold that B.Beri has no dependence on anaemia.

In China, where the mass of the people are underfed, andwhere
rice is the staple food, and where also anaemia and malarial cachexia
form some of the commoner diseases we meet with, Beri-Beri,
as I have previously stated, is hardly known. In Japan, the
habitat of the disease, "the well-housed and well-fed generally suffer
most." The same authority, Dr. Simmons, states that "in the
incipient stage of the disease, paleness of the mucous membrane
and other symptoms of anaemia are greatly the exception." Iron,
Quinine, and tonics prove of little value. Anaemia generally appears
late in the disease; and thus B.B. is rather the cause than the result
of anaemia. At how Imrich
close the point under consideration by the following remarkable quotation from the same authority: "That not only those who are well provided for, but those also having the general appearance of health and vigour, as shown by firm and well developed muscular system, are among those in Japan who usually suffer from this disease; 

... those on the other hand, of naturally weak constitution, or who are suffering from chronic diseases, rarely become its victims in any form." 9.

C. Kidney Theory. - Blauing ascribes Beri to disease of the kidney, but there is no evidence to prove that it is due to this cause; indeed, the weight of evidence goes against such a theory, for in a considerable number of cases where the urine was examined there was no albumen present. 10. The post-mortem examination also showed the absence of nephritis. 11.
Malarial Theory. — Like every tropical pathological mystery, Malaria has been assigned by some writers as a cause, but without sufficient evidence. There are no doubt certain resemblances between the circumstances which appear to give rise to Beri-Beri and Malarial affections generally, but a close scrutiny of the two diseases and the utter uselessness of Quinine in Beri-Beri forbid this conclusion. It only resembles Malaria in being a disease of locality, and also in being fostered by damp, by high temperature, by its most often attacking those who sleep on or near the ground. But it is unlike Malaria in being pretty common in large cities, and also in the absence from the blood of Beriberics.
of the Malarial parasite. It is
Manson has many times
examined the blood of B. Boer
patients, but without with
negative results.\textsuperscript{12} The
bacteriological investigations
in connection with the Richmond
Asylum Epidemic, Dublin,
were equally unsuccessful.\textsuperscript{13}

Again, in the South of China,
where we daily meet with
Malaria in all its forms, and
also with its varied beneficent
effects, B. Boer is hardly known
as an endemic disease. Indeed,
the cases of B. B. we meet with
in the South, at any rate,
have either been cases of returned
Chinese immigrants at the Straits
settlements, and other such places,
where the disease is endemic, or cases
due to infection (afterwards)
through such immigrant coolies. The one
contracting the disease, made for
their native land, as is the
universal Chinese custom—the dread of dying away from home being very repugnant to their nature.

3. Ankylostomiasis— As a cause of B. Beri, or as identical with it, hardly deserves mentioning. But it sometimes happens that the two diseases (which are now known to be widely distributed in most tropical and subtropical climates) are found in one and the same person, and hence the confusion. Where, however, ankylostomiasis is moderate alone is present, the absence of paralytic symptoms and anaesthesia suffice to distinguish it from B. Beri.

B. Predisposing Causes.

a. Overcrowding and unhealthy conditions. Overcrowding seems to be the most important predisposing cause of B. Beri, but it probably occurs not from overcrowding itself but in overcrowding, as will presently be shown. It occurs in jails, ships, asylums, mining camps, plantation lines, and other concentrations of
humanity. H. Anderson of Tokio gives a striking instance of the "Ship Berisberi." Out of 300 seamen about 70 were attacked with B. Beri, of which No. 20 died in a short time. On inquiry, the food, clothing, exercise of the Sailors were found satisfactory, but nearly the whole crew slept during the night in a space allowing but 32 cubic ft. for man, while, owing to the sheltered anchorages of the ship (for it was lying in the Naval Dockyard) the water was almost stagnant. After the sleeping quarters were altered by the Admiralty, the Epidemic almost entirely ceased. 13.

The best example of it is the Dublin Lunatic Asylum. The officially recognised accommodation of the Asylum being 1000, it had crowded into it 1492—roughly speaking the number of inmates exceeded the due accommodation in the ratio of 3 to 2. As the
Insane probably require more rooms
than any other folk, this represents
a very deplorable state of things. Other
unhygienic conditions also prevailed,
as for instance the lamentable state of
sewage of the buildings. 13–
With reference to the diet, there is
nothing to suggest a dietetic cause.
This point was fully referred to under
the "Diet Theory".
Like "ship" and "jail", B. Beri is developed and rendered
violent in overcrowding. In the case of the ships, forecastles, in the
other the sleeping and other
quarters, form "incubators" of the
disease - the exciting cause of
which will be considered by us.
And if it be asked how do I account
for the occurrence of B. Beri among
the "better housed and well to do" Japanese?
(to whom reference was made under
the "Diet Theory", and of whom D.
Simmons of Yokohama speaks as
being equally subject to the disease.)
I answer that however rich and well-housed the Japanese, like their former rulers the Chinese, and Teachers, their sleeping quarters are ill-ventilated and over-crowded. Should the germ of B.B. gain access to such apartments, it quickly work havoc among the inmates. In China a whole family often finds enough room enough in one small bedroom, and in not a few cases in one single bed. But over-crowding per se is not enough for the production of the disease. Given the germ, however, and the favourable condition alluded to, B.Ber is must show itself, and hence is the almost complete absence of the disease in China.

In the case of the Dublin erythema, already referred to, the nurses suffered from the disease, because they were not only exposed to the infection, or rather poisoning in performing their duty, but, their sleeping
quarters were unhygienic and overcrowded. Dr. Corolly Norman, the Medical Superintendent, tells us that the staff were nearly as much crowded as the patients, and that all the office (kitchen, laundry, etc.) were faulty in construction and quite insufficient in size so that workers there were crowded and huddled together in a very insanitary way. 14.

b. Climatic conditions. Cold and wet summers, in which changes are sudden, are held by those who have had most experience and seen much of the disease in its strongholds to be favourable to the development of Beri-Beri. Dr. Summons of Yokohama gives it as his experience that “with a sudden fall of temperature after a few hot days, accompanied by rain, he was able to predict an increase in the number of cases in the outdoor service.” 15.
When B. Bovi occurs in Winter or in temperate climates, it is because similar favourable conditions are artificially produced — an "incubator" for fostering the disease provided. Manson gives a striking illustration of such artificially produced climate. Some years ago he visited the forecastle of a ship from which a number of B. B. Cases were admitted in the Seamen's Host at the Albert Docks. He found that, being rather cold weather, the lascars had a fire blazing in their confined quarters, every door, scuttle, winding, and ventilator of which they had carefully closed. The place was suffocatingly hot, damp, and redolent with filth and humanity. There was a crowd of them huddled together in the forecastle.

Such an atmosphere is a precise imitation of the tropical conditions under which the form of B. Bovi develops and becomes lethal.
c. Localit. - All the evidence, so far as I can make out, is in favour of B. Beri being a "Place-Disease." This statement is proved by the prevalence of the disease among those who come from beyond its limits to reside within them; and also by the rapidity and almost certainty with which sufferers find relief, or recover entirely, on being removed beyond the area of its production; and the equal rapidity and certainty with which all the symptoms of the disease re-appear if a patient returns too soon, or at all, to the same or similarly infected localities.

Soldiers and Students and Sailors, who come as transient residents to such affected localities as Yokohama, sooner or later get the disease. Instances of this are to be found in the China.
Imperial Maritime Customs Medical Reports, 19th Issue, p. 45, et al. Here follow striking examples of recurrence of the disease whenever the patient returned to the affected place. This is the case of a botanist at the Yokohama Beri Beri Hospital who suffered from a severe attack of the disease, but who soon recovered on having been sent to the mountains some 30 miles distant. After his recovery he returned to his station at the hospital, when the disease again appeared itself, and he had again a return to the mountains.

d. Occupation. — This acts as a predisposing cause only in so far as it has been observed that B.Beri has a predilection for those who lead a sedentary life and are much indoors, as prisoners, inmates of asylums, students, (Eastern),
Sailors—especially those on board men-of-war and coasting junks. This is especially observed in the latter when, coming from a distance, they are obliged, while the vessel is receiving or discharging cargo, to remain sometime in a port where the disease is prevailing.

E. Age and sex.—According to Statistics of the Tokio Beri-Beri Hospital, the disease occurs chiefly between the ages of 20 and 30. It affects both sexes, although in Japan comparatively few females suffer from the disease except during pregnancy and a short time after confinement. This is, perhaps, because the congeonations of humanity in Japan are chiefly male, such as sailors, prisoners, students, etc. On the other hand the Statistics of the Richmond Asylum, Dublin, show that
of the two sexes the female sufferers were even in larger proportion, for out of a total of 527 cases (during the three epidemics of 1894, 1896, and 1897) no less than 322 were females, and only 205 males.

C. Exciting Causes. — Besides what I termed "Fallacies" or "Precautions" theories relating to the causation of B. Beri, I have hitherto considered only Predisposing causes, being convinced, after reviewing the whole evidence, that there is only one exciting cause of this disease, viz., a specific germ which is capable of generating or producing aToxin outside the body which poisons the blood through being swallowed or, perhaps also, inhaled, those who reside in the area in which it is developed.

I am also convinced that that germ is generated in certain endemic localities (as has already been pointed out under the heading of the "Geographical Distribution of B. Beri"); that it is capable of being conveyed from place to place, as will
be shown presently, but not communicable from man to man, i.e., it is not contagious; that unlike the material form, it is non-parasitic; that its virulence depends on the repeated poison (Toxin) dose received by the victim, and that removal of patient from the poison environments results in elimination of the poison and speedy recovery.

Bekelis and Winkler claim that in the blood of Beriberic, bacilli and micrococci are often found; that pure culture of such micrococci cause, when injected into rabbits and dogs, nerve-degeneration of a like nature to that found in B.B. patients. 21. D'Espey of Montevideo, similarly asserts that in cultivations of the blood of animals suffering from the disease, he has found a micrococci which, after culture and injection into the blood of healthy animals, seems to reproduce the disease.

But such statements as the above...
stand in need of confirmation. Indeed, recent investigations by competent workers tend to negative such results. Dr. Manson, one of the greatest authorities on the malarial parasite, considers that "there are various sources of fallacy about Pelharing and Winstler's experiments, and that their conclusions have not been accepted as yet by many sound authorities." I have many times looked for bacteria and microscopic parasites in the blood of berbers, without success." Equally unsuccessful were the results of examination of the blood of P.B. patients during the Richmond Asylum, Dublin, Epidemics. "Our results were on the whole negative," says Dr. Norman, speaking of the eminent investigators who made the examinations, "we believed at first that we had succeeded in isolating a corpus resembling that described by Pelharing, but there are reasons to believe we were mistaken in this particular."
Dr. F.W. Mott, pathologist at London County Asylum, and D. Bowditch called
for "no definite organism" in cases they had examined, and which were
under the care of Dr. Manson, of Seamen's Hospital. 25

Of course such widespread
disease, which frequently occurs in
epidemic form, can only be caused
by a germ; but such a germ
has not been positively and satis-
factorily proved to exist within the
body of patients suffering from
Beri-Beri. On the other hand,
the presence of a Toxin in the
human body, which, Toxin has
been produced or secreted by forms
existing outside the body in the
patient's surroundings, and has
obtained access into man by the
alimentary, or perhaps, also the
respiratory tract, seems to be
deduced or inferred from the
clinical symptoms and also
from other facts. It is a well
A known fact is that when patients suffering from the disease are removed from the endemic area, they rapidly begin to recover, and may be out of danger in a few days; while those who continue to remain in the poisoned surroundings tend to become worse, by absorbing repeated doses of the poison, and very likely die. This would not be the case if the germ itself, and not its toxin, were the poisoning or infecting agent – were actually parasitic in the human body and the immediate cause of the disease. In such diseases, as well as those that do not die out, more rapidly, and such germ diseases usually run a course of a more or less definite duration, and certain not so readily cured by mere removal from the environment where the disease was contracted.
As to the communicability of contagious
ruses of Beri-beri, there is abundant
evidence to show that it is only
communicable from man to
man; on the other hand all facts
that do show that those who come
from beyond the endemic area, to
reside within it, or live in a place
where the disease is known (have
once broken out) jails, street-wa-
ship-fleets, &c.) will in all
probability suffer from the disease.
Manson states that nurses & medical
men in hospitals, where, perhaps, there
may be hundreds of B.B. patients,
do not catch the disease; nor
in hospitals located outside the
endemic districts does it spread.
To other patients, of course if
hospitals are themselves infective,
are themselves B.B. centres, B.B.
may in that case attack patient
admitted for other diseases.
In these circumstances nurses and
medical attendants may also suffer.
A striking instance of the non-communicability of non-infectious cases of B. Bert, is the evidence in the Fiji Islands, already referred to, and which occurred in 1894. All the patients were Japanese coolies, of whom about 300 were imported into Fiji for the purpose of working on Sugar Plantations. They were lodged by themselves, quite separately from the other labourers who were Indians. B. Bert appeared among them in a month after their arrival in Fiji, and in 5 months time no less than 265 of the total 300 Japanese coolies were struck down with the disease. Yet "the disease was entirely confined to the Japanese immigrants, not spreading either to the Indian labourers who worked on the same plantation with them or to the Fijian inhabitants of the village." This clearly shows that only those who lived under the same conditions and were exposed to the poison.
B. Bari (however brought to the lodging encampment) suffered from the disease; and that the other labourers who worked along with them, but did not live in the same quarters with them, did not suffer with and infected by the disease.

The Richmond Asylum, Dublin, epidemic is also a case in point. The disease was confined to the asylum where it arose. Of the staff (although none suffered during the first epidemic in 1894) a number contracted the disease. But then we are told by the medical officers of the institution that the staff were nearly as much crowded as the patients, and that all the officers were fault in construction and quite insufficient in size, so that workers there were crowded and huddled together in a very unsanitary way. But while a large number of the insane inmates died, none of the striken members of the staff did.
that, I presume, was due to having removed the sufferers among the staff from the poisonous prionising surroundings; which was, I fancy, impossible 1572 in the case of the insane inmates.

Then there are also the facts respecting the well known epidemic in the jail of Singapore. This jail was divided into a male and female side, the buildings being continuous; nevertheless, it was only the inmates of the male side who were attacked with B. Beri. 30.

But although B. Beri is not contagious or infectious, like Typhus for example, it is capable of being conveyed from place to place, although it sometimes appears as if it arose de novo — i.e., without transmission from a previous case, or indeed through any traceable means. But is it always and invariably possible to trace the cause of an outbreak of Typhoid or of Typhus? And yet
yet those must be very few indeed who can believe that either of these diseases can arise in any other way than by transmission from a previous case in China, for instance (and to it I particularly because I know it so well, having practiced in it for eleven years) would have been exterminated were this by both Typhoid and Dysentery were the recognised predisposing causes of these diseases were quite sufficient for an outbreak of the disease, for all such predisposing conditions are in operation, and yet how comparatively little known these diseases are in China. And so in the case of Beri-Beri no amount of surrounding need cirumstantial condition, etc., can possibly determine an outbreak of Beri-Beri, but given the necessary conditions, even in Temperate climates, and give the B.B. Serum, which many have been but accidentally introduced from without and the result would be an outbreak of Beri-Beri. Nor could it be said
That as the form of B. Bori has not been satisfactorily proved or demonstrated, it might be that its predisposing causes also act as exciting causes; for, ceteris paribus, the same argument would apply to Typhus Fever, for instance, the micro-organism of which has not yet, as well known, been definitely demonstrated. And so in the case of yellow fever—according to the latest investigations of the great bacteriologist J. Sternberg of the United States Army—and yet both these diseases are equally infectious; although, in the case of yellow fever the infection is a more infective and not as in the case of Typhus—but rather as in the case of B. Bori.

The following are instances showing that B. Bori germs could be carried from place to place, and that outbreaks of the disease are due to the presence of such germs.

In 1888 an outbreak of B. Bori occurred in Cocos-Keeling Islands, where the disease had never been known.
before. The outbreak coincided with the arrival of a batch of coolies from Java, one dying directly on arrival, and, in spite of all efforts, the disease quickly spread. There appeared no assignable cause for the prevalence of B. Beri except the importation from Java — one of the hands of the Siamese.

Another instance is that of the New York S.S. Anconia. On this vessel B. Beri broke out, and as it had visited Australia (which is regarded as a B. B. country) and also had two Chinese on board — the cook and the steward — the cause of the outbreak must have been infectious. (So to speak) through one or other or both of them. Source of the germs of B. B. were then probably thus introduced into the ship.

Many more examples bearing on this point could be mentioned, but suffice it to refer to P. M. J. p. 747 4-943, Sept., 1897, where mention is made of a number of B. Beri outbreaks
on ships, and where fever-infection of the ship is shown to be the cause of the outbreak, Paul Jowitt conclude with the following striking example, which is of a quite recent date. On June 16th, 1898, the German barque Steinbek arrived at Bermuda from Probolinggo, Java, with a cargo of raw sugar, all the crew except one man and a boy down with B.B. Pern. The captain stated that his ship is the Lodestar of London, and that after the voyage from Rangoon to Falmouth (where all her crew were down with B.B. At three men having died at sea) she was sold to her present owners. She was overhauled, and took in provisions and fresh crew at Amsterdam. She then sailed to Java. The stores taken on board were sufficient to last the whole voyage out and back.
None of the crew had been ill with B.B. before; one man had been in a ship with the crew ill, but was not attacked himself. 

Now while it was very probable that that one man was the medium through which the germ of the disease was brought into the ship, it was also quite possible that the germs of B.B. were already there in a dormant state, for the same vessel, although under a different name, had experienced an outbreak of B.B. on board ship a year or two previously. But in any case, the outbreak of B.B. on the Steinsbek was evidently due to the presence of the germs of the disease, which had been at sometime or other conveyed there.

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Treatment.

A. Hygiene. — Of the hygiene treatment, the most important, as has already been demonstrated.
under the etiology of Béri Béri, is removal as soon as possible from the infected or poison-generating area (prison, camp, asylum, ship, etc.) to an unaffected locality. The rooms to be occupied by patients must be dry, well-ventilated, sunny (if possible), and raised above the ground. In the case of crew on board ship, the sick and healthy alike ought to quit the forecastle and remain on deck under canvas. Great care should be exercised in moving sick cases, for sudden heart failure is liable to occur, and such must be kept carefully at rest in bed.

From the frequently limited area of prevalence of B. B., the place to which patients should be removed need not necessarily be very distant from the poisoned area. A few miles would often suffice. Mountains, if within reasonable reach, ought also be chosen, for the influence of high temperature and inferiority of air on the
disease is deleterious. With regard to diet, rice (in countries such as China and Japan, where it forms the staple food of the people) is to be avoided. This is not because of a tacit belief in the old rice theory, which I have already shown to be untenable, but because rice, in the enormous quantity it is taken by those who chiefly live on it, is bulky and less digestible.

In place of it the coarser cereal such as barley, wheat, oatmeal, beans, ought to be given. And in addition to this vegetables, milk, eggs, and a certain amount of animal food, should form a part in the dietary. Fluids should be very sparingly allowed in the tropical form of the disease, for obvious reasons.

B. Medicinal.— In the wet form of B. Beri treatment should be directed first and foremost towards strengthening
the heart's action, and for relief of the overloaded pulmonary system and removal of the excess of fluid in the areolar tissue and serous cavities. To this end hydroaquate cathartics and Cardiac tonics are indicated. Sulphate of magnesia has by consensus of opinion proved a most efficacious cathartic, and it has the additional advantage of being very cheap and easily obtainable. In the milder forms, 1 oz. daily will suffice; while in severe cases, 2-3 oz. per diem will be found necessary, for then no less than half a dozen copious watery stools would be required. After a decided improvement has been made by this, active depletion, smaller doses at longer intervals often keep the patient comfortable. For this purpose 3 or 4 every day for a week or so will probably suffice.
In some of the severer forms, and where the drug is not well borne in consequence of gastric irritability, Eau thermale has been employed by some with great benefit. But while bearing in mind that depletion is of paramount importance to the waterlogged patient, and indeed on it depends its chance of recovery, care must be taken that he is not depressed dangerously by their action.

As death usually occurs through heart failure, combined with pulmonary oedema, the treatment by cathartics, if effectual, must be begun early. While cathartics are the chief means by which the fluids are withdrawn from the waterlogged system, diuretics also form a valuable adjunct. A mixture of yokes half gives a mixture of nitrate and nitrate of potash, 3f and 3f respectively, per diem.
If in spite of free purgation, signs of cardiac distension and failure persist and increase (as shown by pulsation of vessels in the neck, dyspnoea with cyanosis, increased area of cardiac dulness as the right and reduplicated second sound), bleeding the patient to the extent of 8-10 lb. from the arm or external jugular has been recommended by Dr. Anderson of Japan and by Manson. Often as the bleeding plus rapid acceleration of the alarming condition sets in... The bleeding should be repeated if the alarming symptoms recur, as they are pretty sure to do. After two or three such paroxysms the patient may either recover, or sink into complete exhaustion and die.

With regard to pleural and pericardial effusions, Manson advocates tapping in certain urgent cases, but so far as my investigation, so this measure has neither been
adopted nor suggested by physicians of great experience with the disease in its Japanese home.

Respecting Cardiac tonics. In mild cases, Digitalis or Strophanthine, in moderate doses, is certainly valuable, and, if in the later stage Strophanthine be combined with faithful syrup, it acts as a capital heart tonic. But in cases of acute cardiac distress, as shownly the symptoms of dilatation of the right side of the heart, more rapid means of sustaining the heart and tiding the patient over a serious attack is urgent. In such cases Nitroglycerine in full doses (Mannen gives 1/35 of 1/100e. Solution, and give this dose every 1/4 - 1/2 hour until threatening symptoms pass away), and nitrite of amyl inhalations pending the action of Nitroglycerine. But where such measures fail, bleeding as previously shown, may succeed.
And it must ever be borne in mind that in this the wet form of B.B. in which I have been speaking, free purgation, as has already been stated, must go hand in hand with cardiac tones and the other measures mentioned.

Often, however, the severer forms of B.B. end fatally; as in such cases the oedema becomes extreme, and the whole body becomes engorged with fluid in a few hours time; and the patient dies from heart failure and suffocation, almost drowning.

In addition to the means already mentioned for the sustaining the heart's action, as well as the use of stimulants, Eletorinum, and that class of cathartics must come promptly into play if the patient is to gain anything by depletion.

In the dry or atrophiæ form of B.B., the depleting measures by cathartics and diuretics are not, of course, called for, and indeed seem to aggravate.
matters. But tonics are beneficial.

Respecting the muscular atrophy and paralysis, no treatment of these should be commenced before the hyperaesthesia of the muscles is gone — or almost gone. For the muscular hyperaesthesia, A. Stedden of Japan advise arsene as a remedy of much value; and Japanese physicians also use it extensively. When the time for treating the paralysis and muscular atrophy comes, paralysation, massage, and strychnine hypodermically into the muscle substance, in from 1/50 to 1/500. During convalescence iron and arsenic may be given with advantage.

c. Prophylaxis. — To avoid helminths, the patient must not return to the infected or poisoned locality. Examples illustrating this are many, and the striking one has already been given under "etiology".

In B.B. countries, lowlying, damp,
places, as also overcrowding are to be avoided. Ships forecastles are to be kept dry, well ventilated, thoroughly clean, and no overcrowding is to be permitted; and when a case of B.B. occurs, the healthy and sick should alike be removed to the deck and kept under running cold, and the forecastles are to be thoroughly cleansed and disinfected, and all rotten planking destroyed or thrown overboard.

In the case of steamers and vessels, the same prophylactic means must be followed as far as possible. In any case where this is impossible, the sick must be removed at once, while the other inmates are to be daily carefully examined for any early symptoms of the disease: examine for anaemia, muscle wasting, muscular hypertrophy, loss of knee jerk (in some cases exaggeration precedes the loss of knee jerk), oedema over shins.
presence of some of these symptoms, more especially the protrial anaesthesia and oedema, the muscular hyperaesthesia of the Cables, and weakness of legs, is a strong cause for suspicion; and such patients (or at least suspected cases) should at once be removed from the infected area.

In proof of the value of disinfection of the affected place, the following may be added.

Dr James Lawson, of Hongking, when Surgeon on the S.S. Chingtao, in 1894, he investigated an outbreak of Beri-Beri on board. He found that at least three voyages previously fresh crews were medically examined and found free from the disease before being signed on, had been shipped on the S.S. Chingtao. On approaching Sydney on each trip, cases of B.B. developed. On this particular trip, the ship had become very shorthanded from death and cases of B.B. amongst
The crew. "most careful disinfection with carbolic solution (1 in 5) was advised and carried out, certainly with good results, as at least on the succeeding two trips no cases developed." It almost similar experience occurred on the Canadian Pacific S. S. Hyrcania when he was Surgeon of the Ship. Disinfection with 1 in 2000 corrosive sublimic solution, with the result that no fresh cases developed.
References.


d. Chinese Imp. Customs' Medical Reports, 19th Issue, p. 45.


2. Same as d.


