"A Commentary on
Cholera outbreak in India,"

being a thesis
compiled for the degree of
Doctor of Medicine
in the University of Edinburgh
by
Joshua Chayton White,
M. B., C. M. Edin.
Surgeon Captain,
Indian Med. Service.
Moymer Black Corps
Khorawa
Rajputana, India
July 8th, 1893

Dear Sir:

I beg to forward you enclosed in a separate packet my thesis for graduation as M.D. in the University of Edinburgh at the next graduation ceremony.

I graduated M.R.C. on Aug 1st 1887, my age is 28 (born Oct 21st 1864) and I enlisted in the Indian Medical Service in 1889. My Commission bearing date Sept 30th 1889 (see army list). I have complied to the best of my knowledge with all the regulations and requirements as set forth.
in pages 16 and 19 "Programme of Classes and Regulations" Graduation in Medicine, and I submit appended the necessary certificates and a letter from the Clerk of the Dean of the faculty of Medicine received last October.

I have instructed my bankers to pay into the Register £16 5 0 total fees for the degrees, which will come to hand shortly after receipt of this letter.

The title of the thesis is "A Commentary on Chicken Outbreak in India." Kindly address any further communication to the above.

Yours faithfully,

To the Dean of the faculty.

Love, Capt. [Signature]

Prof. Chalmers Whitehouse.
26th Sept. 1892.

Dear Sir,

In reply to your letter of 29th August, I beg to state that you can take the degree of MD in absentia after being settled for a period of years in foreign parts, but must wait till August 1893. (See p. 18, for MR regulations and for size of thesis paper.) The fees for MD are £10 5s = £5 5s. for degree, £1 for matriculation, and £10 for Government Stamp-duty.

I am, dear sir, 
Yours truly,

J. Sinclair,
Clerk to Dean.

J. Chaytor-White, Esq., M.B.
To the
Dean of the Faculty of Medicine
Univ. of Edinburgh.

I hereby certify on my honour that my thesis entitled "A Commentary on Cholera outbreak in India was solely and entirely composed and written by myself for the purpose of graduation as Doctor of Medicine in the University of Edinburgh. I also certify that I was 28 (twenty-eight) years of age last birthday (Oct. 21st 1892), that I am an officer of H. M. Indian Medical Service, my Commission dating the 30th Sept 1889. That I have been over two years resident in India and that I am unable to attend my duties for graduation in August next. I request
M. B. C. M. Aug 21st 1889.

Joshua Chaytor White mo. ce.
Surgeon, Captain I. M. Med. Ser.

Khoravar.
Rajputana, India. tỷyaver Chel Corps.
Sany 5th 1893.
A commentary on Cholera outbreak in India.

The literature of cholera is so enormous in amount and so comprehensive in character that a paper treating of the disease in any phase of its course or particular may seem to many an almost superfluous procedure, and although I am aware of the impossibility to adequately treat more than one phase of the disease with the exhaustive detail it deserves, I trust this short commentary written with the advantage of books of reference or records in a small Indian establishment, will not be altogether void of interest to those whose experience of Asiatic cholera has perhaps, not been extensive.

What I shall endeavour to treat of in the following pages, will be to a certain extent partake of the description of a personal experience with the disease as it met with in India in epidemic form, with a few deductions therefrom the outcome of actual observation of cholera in a tropical climate and in the midst of insanitary surroundings.

I regret there be few facts at the outset that there is nothing very new or very
original, but I am more than hopeful that the time is not far distant when the lines of inquiry that are now being followed by continental and other observers will be productive of a result that will revolutionize our present empirical treatment of cholera, at least as an endeavour to overcome an imperfectly explained series of phenomena.

"Tempora mutantur et nos in illos mutamur," an axiom which many of the old school are loth to accept, but one which I hope we in India will not neglect in a climate that is not conducive to innovation and for too difficult of conversions to new and correct ideas.

I think that the recent outbreak of cholera on the European continent has in many ways been productive of public good, and the so-called scare has stirred up activity many sanitary authorities in the British Empire that would otherwise have allowed incipient and disease to spread by aids without indication. The European continent, as I remember it some ten years ago, was shockingly regardless of all
sanitary reforms and Germany was in no 
white better in this respect than Russia,
and compared with the British Isles the 
comparison was altogether an unfavor-
able one. I am speaking of a decade 
ago, and things on the Continent are 
unquestionably better now than then. 
It is however with some satisfaction 
I observe, that when choler visited 
the United Kingdom last year and 
attacked the country at various points 
with sufficient force of disease because 
an epidemic in any in sanitary country, 
that England escaped. The isolated Case, 
its importation ones, that occurred would 
probably have been sufficient to cause 
epidemic choler in a country less 
heedless of sanitary reforms — but 
England escaped choler last year, and 
we hope that should this unwelcome 
visitor to appear next spring our 
shores may be equally fortunate. 
It is I think a true saying that ideal 
analogue choler hardly 
finds a home, not that ideal anal-
tation exists in Britain, but in England 
at all events, things approach nearer 
as satisfactory standpoint than I
hard seen elsewhere, and after having visited many cities of the eastern and western hemispheres I can affirm without fear, that I have nowhere seen sanitation held as at home. In many of the larger cities of the Eastern United States, also in Australia and New Zealand, all countries enjoying good climatic habitation is well looked after and is indeed far better cared for than in our warmer Eastern possessions with their teeming populations of filthy natives, where epidemic disease is endemic and good sanitation imperatively needed. For we in India have as it were, the enemy of cholera always present and are constantly waging a war of sanitary reforms as the only true prophylaxis of epidemic disease. Russia, Russia and India invariably supplies it with cholera by one route or another from thence it is distributed over the whole European continent. The time is probably not far distant when this matter of dissemination of cholera will become an international question requiring earnest attention, and it behoves the Indian government and its sanitary
advisors considers this contingency
with all the severity the case demands.
The danger to other countries from
India is enormous. Take one route
done that cholera travels to make this
apparent. The pilgrim traffic from
India to Mecca via the Red Sea and
Jeddah is yearly over a hundred
thousand souls. It is an exceptional
year that there is no cholera in Jeddah and
the cholera brought there inevitably comes
from India by pilgrims, would be "hajis," from India via
these comes are in the endemic area. In
1886 came the fourth
epidemic in England.
Statistics proved
Eastern Bengal chew that the district
from Puri to Uppanah on the coast to
Parmauk on the north, as the apex of an
imaginary triangle, are never free from
cholera and there is no the area in which
cholera can be properly called endemic.
unquestionably the remedy India sought
to apply in the provinces.
Epidemiological returns from the civil
surgeons of districts supplying pilgrims.
Should be furnished throughout the year, and in connection with the civil authorities, these districts where disease should be rigorously excluded from the supply of pilgrims. The benefit of this could be felt by the pilgrims as well as by the community, as instances in 1890 when I understand, that of those carried from India to Dacca in that year over 50% never returned - most having died of cholera.

I do not know how it is that the Indian government so carelessly allow fairs to be held in years where cholera has early in the spring shown itself to be active, for there is no more certain means of disseminating the disease than by these "melaas". No doubt the government are both to interfere with the religious observances of a large class; but there probably the welfare of the world is concerned a wise discrimination in this matter would be of much good and, I take it, of little harm. The people attending these fairs are filthy natures collected in a place that of all others is preeminently fitted both in soil and surrounding for the growth of the cholera germ or parasite. This water that thousands upon
Thousands both in at Kharkov, full of human excrement and germs of disease, is year by year and of choice drunk by those that attend there fair, a most favorable locality for the investigation of many forms of sickness.

The recent epidemic in Russia has again shown, if indeed further proof were wanting, the uselessness of all quarantine regulations. Once again demonstrated the immense superiority and safety of good sanitation as opposed to it. [The futile attempts made at Baku last summer to establish quarantine were quite ineffectual to keep the disease from travelling along the trans-Caucasian railway to Astrakhan and Saratov, and it quickly spread along the trade routes to Russia in Europe.] It was with a feeling of some surprise that I read an article lately in the magazine "The Forum" by my friend and late teacher, Lewis A. Bayne of Bellevue Hospital, New York, wherein he advocated stringent quarantine and sanitary control as our only sure safeguard and sure way of avoiding cholera. I had thought that everyone with any experience had seen for himself and recognised the
impracticability and undesirability of attempting such a thing as stringent quarantine, itself in theory but useless in practice. Surgeon-General Cunningham in his book "Cholera—what can the State do to prevent it?" has shown the hardships of strict quarantine in India how it has altogether failed to effect its purpose. Since the outbreak of 1858, England has not attempted to enforce it and still there appears to be a lingering hope that quarantine may prevent the introduction of epidemic diseases and that sanitary cordons may be productive of good! Sanitary cordons of any value in India must be rigid and any rules demanding such are not beneficent, much suffering on the native, and are with all quit powerless to prevent intercourse. Indian police are not the depended upon to carry out an order which they cannot understand and which is distasteful. Their ideas as interfering with the liberty of the subject, I think that the less stringent measures that have been adopted [by the order of the Local Govt. Board dated July 17th, 1873] for quarantine, with which they must not be confounded, are of much advantage. These rules, I may briefly remark, deal especially with
The detention of such vessels that are reasonably suspected of being infected by cholera, no vessel being under suspicion unless a case of cholera or choleraic diarrhoea has occurred on board, and the detention is only to be as long as is necessary for the detection and isolation of the sick and the disinfection of the ship and cargo.

One of the places where it was agreed as imperative that a permanent quarantine station, was in the neighborhood of Suez, and the place chosen was for on the W. Coast of the Gulf of Suez, 60 miles below the entrance to the Canal. The reason for a station here is apparent without explanation, but the place decided upon was one of the most desolate. Barren of trees it has been my lot to see. The water was bad where the supply insufficient, the sanitation altogether neglected, and the burial of the dead most insufficiently provided for. This place has now been abandoned for "Mosse's Wells," a station on the east coast with a good water supply and a fair situation. As this is but one route by which cholera travels to the European continent, its advantage is doubtful, except in that all the Palestinian pilgrims
from the Mediterranean ports can be detainted there on their way back from Korea. Ships examined at these quarantine stations, are sent back to the quarantine station until "precaution" is obtained from the local officials.

The reactions hindered to trade in India that would result from strict adherence to quarantine can hardly be realized by those who have not been brought into direct relation with Chitra making its appearance in the midst of a large undertaking. During last summer I was employed by the Government of India on special duty in Kashmir in connection with the Gilgit Transport, which was a military operation of large proportions, organized with a view of provisioning the far distant frontier outpost of Gilgit for 3 years. As many high mountain passes in the Himalayas, one over 14,000 feet, had to be crossed the difficulties were considerable to the expense proportionate. The passes are as a rule free from snow for 4 months only in the year, the time for working was therefore limited. When I arrived, Kashmiris to take up the appointment in May, Chitra has just made its appearance
one or two cases having occurred in Srinagar, the capital of the Kashmir State, the presence of a large epidemic that eventually carried off over 11,000 souls. The men that had come from the Punjab and India to work in the transport, numbered 3,500 of the worst class of subjects, mostly coolies and mule drivers, filthy men with filthy habits, to certain Contract disease sooner or later. The base of operations was the village of Bandipur, situated on the Wular Lake, the largest collection of water in Kashmir, and the filth of the place when arrived was indescribable. I at once set to work to have the village cleaned up and to protect the water supplies, which were absolutely good. All possible sanitary improvements were made; rigid rules were drawn up and guards to enforce them were requisitioned, but no quarantine was imposed. Twenty thousand mounds (2,500 tons) of supplies entered the place and were carried on coolies and mules up to Gilgit and in all only 25 cases of cholera occurred. Had quarantine been enforced, no cases would have been registered as all the supplies would have been condemned.
or gone bad, and cholera might last longer, and be more serious than ever reported. As it was the undertaking, one of the greatest of the kind ever attempted, was in the face of many difficulties successfully achieved.

Now the cholera got to Kashmir in May last, and thence through Afghanistan to Persia, Russia in Asia & Russia in Europe, is still a matter for conjecture. Sir Harry of Kashmir in his report "Cholera Epidemic in Kashmir 1892," states that out of 214 transport cases brought it with them from the Punjab, 34 of these died at Semil in Kashmir on April 24, 1892. This may possibly be correct, but through employed on this work, I could find no record of any transport case having died on that date. The matter will probably never be satisfactorily cleared up.

The endeavour to trace introduction of cholera into cantonments or districts in India, is fraught with considerable difficulties and the unreliability of the evidence adduced is notorious, so that it is not advisable to place too much confidence on the details.

The government last year prohibited
The hot weather being held on the usual large scale on account of the risk of diascnematizing cholera, but I believe in March last, before the fair opened, cholera was present in the Punjab, a recurrence possibly of the cholera of the previous year which is believed that had its origin in the Kurdis war fair of 1871. [29 Sept. H. Hindley
D.M. S. of Peshawar writes (B. M. J. Sept. 10th 1872) with some reason, that the mild winter of 1891 never really affected the growth in Afghanistan from whence Cholera spreads to Persia, Russia, Arabia and Russia in Europe. From Baku on the Caspian, the disease appears there spread eastward to Tiflis, but its mode of extension beyond that city seems doubtful. The route to Europe therefore taken by the last epidemic differs slightly from that usually followed in that it took neither (1) the Red Sea Egyptian route,
(2) the Indian, Afghanistan, Bokhara, Khiva caravan route (3) Southern India, Persian Gulf, Syria, Caspian Bokha route.

I think our progress of civilization by allowing of increased facility of transport by sea, rail and road, has contributed more to the rapid dissemination of cholera than anything else. If sanitary reform had kept pace with Commerical enterprises
in India, I do not think the disease would have the
day it now has of asserting itself in this country
year after year. In India communicability is
inarguable of filthy habits, and why any.
being attacked by cholera in a large epidemic is
a matter for wonder, probably, irresistible.
and idiosyncrasy assert themselves in this disease,
as Sir W. Replies has lately declared, the greater
extent than is usually credited.

As was before referred to, Kashmir last year
suffered from a severe outbreak of cholera, the
last epidemic previous to this having visited
the state in 1888. From 1824 to 1880 epidemics
were calculated at the rate of one in 15 years,
but since the new high road into Kashmir has
been opened and greater facility of transport for
the Punjabs exported, cholera appears on an average
now every third year, the probability is, that
unless the sanitation is improved, this beautiful
country will have cholera annually as an annual
visitor. For a similar reason cholera now
annually visits the Punjabs whereas previously
interval of several years intervened between
one outbreak and another. It undoubtedly the
convenience of railways & quicker transport is
the direct cause of this. In the Russian outbreak
last year, cholera spread with remarkable rapidity
from Central Asia to the Caspian Sea & India.
the time in transit taking but a few weeks. This prevailing it had taken months.

The small station in the heart of Rajputana where I wrote this is an illustration of the converse of the above. This place was visited by cholera in July last. One hundred and twenty cases with but 41 deaths occurred in the village and bazaar. But only 7 cases with two deaths occurred in the regiment. I believe, on account of good sanitation, excellent water supply, and careful precautions taken by the medical officers in charge of the regiment at the time, the disease was checked before it had assumed any proportion. The station is nearly a hundred miles away from the railway, and the roads are bad, the place difficult of access and its trade small and unimportant. The inhabitants of the place are Khoors, an offshoot from the Hindu race and there are few or no contributors to the great fair.

The last outbreak here was 17 years ago and it was mild in character, and I can only ascribe the remarkable immunity of the place to its isolated position and absence of pilgrim traffic. The Khoors are a dirty people and their own houses and villages are insanitary to a degree. Similarly, I believe distance from India expensively limited vitality without suitable soil treatment sufficiently accounts for the
The remarkable immunity of Australia and the islands of the Southern seas from cholera suggests that the germ of cholera in all their relations has not been yet satisfactorily disposed of and there that maintain the germ theory will not cover the grounds of nor completely account for all cases of outbreaks, have still at all events a right of appeal. I think there is yet an unexplained something, a peculiarity of form or a degree of virulence, assumed at certain times and under certain conditions by the virius cholera asiaticæ, that has not yet been brought to light. Why a germ known to the present cannot under certain climatic or telluric conditions, produce a disease it is known to the progenitor of, is still unexplained. I do not believe that at the present moment the cholera germ is any more dead in Russia or Hamburg than it is in India, and yet at the time I write there is no cholera in those places, though I should say the possibility of a great outbreak in Spring is considerable.

That determines what are the actual conditions favorable to a change of cholera from an endemic base to epidemic form, is still as much a matter for conjecture as that really determines the formation and cessation of an epidemic.
I think that a more extended enquiry into the
relation of soil and climatic conditions would be of
value would possibly serve to elucidate facts that
would throw the relation between endemic and
epidemic diseases might to some extent account
for communicative immunity. Professor of
Birchfield has done more in this direction
than anyone. This "soil water," "material substance"
"preponderating germ" theories, where the germ
acting on a suitable soil generates a children
poison, are too well known require more
than mention. In this respect I would refer
to the admirable instructions drawn up and
set forth by a Sanitary Commission as far back
as 1867. They are in the Appendix to the Army
Med. Dept. Reports for that year in which clear
and definite lines for obtaining the fullest advices
from such an enquiry are to be found. Since
that year where an enquiry was set on foot
two special experts were sent to India to inquire
into its diseases, much has been done and
in spite of all we are still uncertain as to the
exact nature of those etiologic laws which govern its
origin and transmission.

The influence of climate in nurturing and
harboring the disease is well referring to.
Tropical countries are unquestionably favorable
to soil climate, inimical to the origin there.
of cholera. The influence of cold, not in killing but in keeping the disease dormant from autumn to the following spring, has been so frequently observed as to lead one to expect a rejuvenescence in spring after an autumnal outbreak.

Height, on account of temperature, soil and drainage, is as a rule unfavorable to the origin of cholera; but in India hill stations frequently suffer through importation from the plains as was the case last year in Dehra Dun (8000 ft) and also in Kashmir where an outbreak occurred in a camp 10,000 feet above sea level.

I doubt very much if aerial influence as understood by local and temporary climatic disturbances, has anything to do with determining an outbreak of cholera. In Kashmir the elements were said to be abnormally disturbed at the height of the epidemic and the hills had a blue appearance; but I was in Kashmir throughout and observed nothing unusual to attribute the cholera to fanciful imagination.

The exact effect of rainfall on epidemic cholera is doubtful. Personal experience on this point has yielded nothing but conflicting results so I am inclined to regard the effects of rainfall altogether. It is by many admitted that a copious rainfall of four inches in the 24 hours, such as occurs in the "rains," will as a rule
check an epidemic in progress, while a small rainfall does harm by disseminating hargoma, but I think rainfall has as effect on determining an outbreak or in checking one.

I used the 3rd attention on point that may seem trivial. This is, that in warm countries dust may be a vehicle of communication. I have frequently had occasion to notice the likelihood of dried particles of matter being carried long distances into tanks, drinking water and on to food, by the distant dust storms that blow in India. But I do not think there is sufficient tangible evidence to make one alter the opinion as to water and food being the chief vehicles of communication, and that the disease is distinctly not an air-infectious one, but one that is admitted into the system by way of the mouth only in food and drink.

An interesting epidemic as showing the part water plays in communicating cholera, was that which broke out in the 1st Battalion 1st Gurkhas at Shamsal, a Himalayan hill station, on July 12, 1890, which I was especially ordered. There are two battalions in this regiment, the first occupying the lower station (5,500 ft.) and the second the upper station (Bhagswa), this latter having an elevation.
of 8,000 feet above sea level or situated 8,000 feet above the first battalion at the bottom of the hill. Cholera had claimed itself in the tea gardens in the Kangra valley below Portland time previous riots appeared in epidemic form at Dharamkot, and guards had been placed on all the roads to examine persons entering the military station from outlying districts; but on July 7, a cholera (insidious) died in the upper station of Chailward. By Thursday a rainstorm occurred eight days after Cholera broke out in the lower station, and so desecrations were that 280 died in the regiment including 123 fighting men, while some thousands died in the immediate neighborhood. This outbreak was traced in this instance to the cholera old or was known that wool dust clothes in water that ran with a fall of 3000 feet directly into the stream used for drinking purposes by the men in the lower station. No other case occurred in the upper station, and on July 22 the monsoon broke, rain falling continuously for a fortnight, and so most cases of cholera occurring. No European was attacked in this epidemic and it is a fact of frequent observation in India that in some epidemics Europeans seem to have an entire immunity from cholera.
while in others the reverse is the case. This gives rise to the (a) question of immunity upon which Pettenkofer so strongly insisted; (b) possibility of the being special varieties or forms of vibrio which affect particularly one race of forms which another is immune. In Kashmir last year again Europeans almost entirely escaped and over 11,000 natives succumbed, while at Murree closely at a later outbreak 16 Europeans died, mostly officers. No nature was known these been attacked.

The pathology and chemistry of the vibrio cholerae asiaticus has been the subject of such extended inquiry of late that to treat of the matter in extenso would be beyond the province of this paper. Since its discovery by Koch in 1883, the comma bacillus may be truly said that had a checkered existence. The many times changed its form only to appear anew the henceforth known as vibrio and not a bacillus.

It is hardly necessary for me to refer to its well-known characteristics as recent occurrences have no doubt made them familiar to all. Its variability of form, degree of curvature, length, and thickness, have been a cause of much confusion and may account for some of the dozen distinct varieties that Cunningham and other observers exist. The most interesting experiments that have been conducted of late are perhaps those of Stagg and
Rabies. The former ingenious method of procuring a vaccine as a protection against cholera is perhaps still fresh in the memory of many. From an agar cultivation of the debris of a series of inoculations into the peritoneum of guinea pigs, a highly concentrated exudation of very virulent character is obtained which has been called a virus culture. This virus culture kills with great rapidity when given to guinea pigs by the mouth after the contents of the stomach have been neutralized or when injected into the peritoneum, but if it is injected under the skin it does not kill the guinea pig only producing an extensive edema, a slough forming and the wound eventually healing by granulation. If inoculation is now made with concentrated virus into the peritoneum or intestine, the animal is found to be immune and it does not die. The objection to this is the coughing that occurs, so to obviate this Seffkine, by a series of cultivations produced an attenuated virus that merely produces edema and a slough and which, when injected under the skin is found to confer immunity to the guinea pig from the cholera microbe no matter whether injected into peritoneum or elsewhere. Rabbits and pidgeons had the same immunity when similarly treated, and on inoculating himself Dr. Seffkine found
that practically the same phenomena of swelling
and oedema at the point of inoculation with
general malaise, occurred in himself as had been
observed in the rabbit. As was pointed out
at the time there is no certainty that laboratory
inoculation will give immunity against the
natural infection of cholera, however that may
come about, and this is one of the points we
are still uncertain about. Indeed if
Cunningham's suggestion on these being several
varieties of cholera vibrio is correct, is there any
certainty that immunity from one variety is
necessary immunity from all? From observation
I am inclined to admit the possibility of there
being more than one variety of vibrio concerned
in the production of cholera, and would suggest
the probability that, from the union of two or more,
a poison may arise causing cholera intoxication.
Kuepper's suggestion that cholera enters the system
while the vibrio is still in the spore stage, thus
evading the action of the gastric juice, is
Supported by Ferran (Compt. Rend. de l'Acad. de
Sciences XXV, 14, 107), who states that he has observed
in the intestines of a large comma Bacillus; two
small granulations analogous to spores which
on the protoplasma being digested were set
free and readily stained by analine dyes.
This very important statement, that their
is a short shift in the life history of the cholera vibrio is in a manner borne out by the well-known experiments of Sicher and Donvan on mice fed with filter paper coated with cholera dejecta, in which it was shown that paper coated in liquid 60 or 7 days old, proved considerably more fatal to the mice than that coated in liquid 1 or 2 days old, and that consequently the maximum amount of the dejecta was not attained until some time had elapsed after the mice were evacuated and separated from the body. He inferred is that active spore formation takes place in the intestine, since few vibrios are found on the first day and many in the third and fourth.

An occurrence that may be perhaps worth recording was observed in Srinagar, Kashmir last year after the outbreak of cholera. The epidemic as may be remembered was of great severity, 17,000 cases of the disease being registered. As the cholera was waning, chicken cholera broke out and the mortality was considerable. The few diseased ran a short, sharp course. The microbe of chicken cholera is supposed to be the vibrio brevichikovii B. Samoilova in his work describing this vibrio, remarks as slight similarity in appearance
to the vibrio of Koch but does not admit of their actual identity. They resemble one another in character and multi-locular form. How the disease is spread is not clear, as intramuscular or peritoneal injections of the growth into guinea pigs did not produce the disease to any extent. Experiment afforded proof that the probable means of infection was by the respiratory passages and so into the blood. The microbe's seat of greatest activity was the alimentary passages, in which it produces a disease identical with chicken cholera, but strangely enough the lungs were found free from disease. It was at the end of the cholera epidemic in Kastoria that the chicken disease occurred, and it is not possible the vibrio of Koch to that of Petrovnikov being so nearly identical was variable in form, that these two vibrios are but forms of one and the same microbe altered in some unknown way?

It certainly is peculiar that the chicken epidemic should last appeared after the cholera and admits of an explanation. I believe same correct in saying Koch failed to produce chicken cholera by injection of vibrio culture into frog's intraperitoneally. Lindsay, Barron Sanderson & Hoffkine declare dogs, mice against pigs, the susceptible, both pigs poison, and their
is reason for believing that bears and jackals can also become infected. Pettenkofer, on the other hand, affirms that all experiments in children conducted on the lower animals are valueless as proving nothing, even if infection were "natural" which it is not.

Our present empirical treatment of cholera is so discouraging that I shall not attempt to more now refer to it. Our chief anathema where we do not know how to heal, a confession I hesitate to make, is prophylaxis. As has been my endeavor throughout this paper, there is nothing at all comparable to good sanitation, which necessarily includes good sufficient water supply, efficient removal of excreta and all filth, good food, drainage and healthy surroundings without crowding. Acting on the fact that acid will kill vibrio cultures, I think it is a wise precaution to administer to troops & others as a prophylactic eight or ten drops of dilute acid in water at early morning when the stomach is empty. It is advisable generally to drink an empty stomach during cholera, and also the drinking of fluids between meals, since Matthew Ray & Alexander has shown solid food alone promotes the secretion of hydrochloric acid by the gastric cells.

I strongly advise a ration of tea ball troops
passing through an infected district. Because:
1. Water must be boiled before use.
2. The tannin of tea is a germicide.
3. Tea acts as a stimulant generally.

All drinking water should be boiled, food supplies should be carefully inspected, and dishes and plates washed in boiling water before use. The use of vinegar with food while cholera is prevalent is an admirable precaution. Some in favor of checking premonitory diarrhoea, the effectiveness of which is questioned by Johnston and Thes.

The ordinary precautions as to general health, sanitary observances, and the usual methods of treating the disease, I shall not mention as it is well understood and familiar. There is emphatically no specific in cholera and after many trials I cannot point to any definite drug of more value than another. Each case must be treated on its own merits. 75% will usually die at the beginning and about 25% at the close of an epidemic, and in India a mortality of 50% is satisfactory as showing only the epidemic to be of ordinary violence. Salol and the vagus treatment have not proved of much value, and neither have transfusion nor the intravenous injection of saline fluids been productive of encouraging results. Neither the bismuth enemata nor hypodermic injection
of pilocarpin with blisters over the kidney, has been found specific. The symptoms of suppression of urine is always the carefully considered. It is an index of the progressive or an almost pathognomonic sign of the disease, and is due chiefly to the paresis of the lining cells and blood vessels of the glomeruli.

Regarding the treatment of cholera by perchloride of mercury, there has occasion to address the following letter to the Principal Medical Officer H.M. Forces in India through the Chief Medical Officer in the State of Rajputana.

Sir,

with reference to circular letter No. 5976 dated Army Head Quarters, Medical Division, Simla 28th June 1891 from the P.M.O. H.M. Forces in India to all Administrative Medical Officers in India 80 year Enquiry hereon No. 2823, I have the honor to submit for your information and favor of transmission to Army Head Quarters the following modification of the treatment herein recommended.

2. The treatment of cholera by perchloride of mercury was first brought to my notice in 1888 when on a visit to China. In both China and Japan cholera is constantly treated with mercury but administered by subcutaneous injection and not by the mouth as suggested in the above-gated letter. There is usually injected 1/20 gr. of the
"paralysis with 5grs of arsenious chloride in 10 min.
"of distilled water, the salt increasing the difficulty;
"small drops of the mercury. I observed mercury only.
"enterously in children in two epidemics - in the
"outbreak in the 1st Garthas at Kharmsa in
"July 1870, and again in Kashmir last March.
"This drug dealt with the Lebzik Rampur. On this
"latter occasion I am inclined to believe the treatment
"was of value as out of 12 cases treated in the epidemic
"period at the beginning of the epidemic, there were
"only 3 deaths.

3. - Sane of opinion, that the action of the
"mercury on the blood in children is thus: -
"(a) It increases fluidity.
"(b) It lessens or possibly destroys the activity
"of the blood.

I am also of opinion that the administration of
"this or any other drug by the mouth in the algid stage:
"and later in any stage of the disease, is
"discouraged. In children the exhibition of drugs by
"the mouth is of less value than the hypodermic needle.
"On account of the Secretive apparatus of the organism
"being thrown out of balance is a portion, the gastric
"cells are in an almost inactivating state. Moreover
"solution by mucous membranes is retarded in
"children: - (1) Injurious schemes that camphor
"injected per rectum took 5 min. in children,
before it could be detected in the breath while in health it took 1 min. only.

(2) Hobart by experiment found that atropine injected in children to dilate the pupils when given by the mouth but not when hypodermically injected.

(3) He observed that morphine given by the mouth in Chorea tonicospasm did not contract the pupils appreciably at all.

Think the above experiments pretty conclusive to demonstrate that the hypodermic is really the only rational medication in Chorea — a disease whose prominent characteristics are paroxysms of convulsions.

4. In the fourth place it is preferable to inject the mercurial solution into a selected vein such as the median basilic or saphena —

(a) Danger unless deeply injected frequently comes sheer as the seat of puncture.

(b) Then directly injected into the blood rapidity of action is insured.

5. To sum up, I would recommend the medicinal treatment of Chorea excepting perhaps in the premonitory stage, the by the hypodermic method for the following reasons:

(1) In Chorea there is little or no absorption from the gastric mucous membrane.

(2) The embarrassmet of vomiting is avoided.

(3) Rapidity of action is obtained.
(4) Dedication per rectum is uncertain on account of passing & diminished absorption.

As regards the disposal of the dead in epidemic cholera, I am much in favor of cremation as supplying a ready means for killing the infective organisms within the body. If buried, the corpse should be wrapped in a sheet soaked in antiseptic solution and covered with ashes.

In large epidemics quicklime pits have been used, quicklime favoring rapid disintegration of the body.

In conclusion I can but iterate that there is still much to be done and much to elucidate in this mysterious disease, so horrible in its detail & relentless in its mercy, and if in this incomplete paper I have offered any suggestions of value, this commentary will not have been altogether void of interest.

S. Chaytor-White M.O. C. E.

Major Field Corps. Surg. Capt. I. M. S.

Kherwara, India - Bengal Service.

January 25th 1893