ON THE HISTORY, ETIOLOGY, AND PROPHYLAXIS OF INDIAN ENTERIC FEVER, with especial reference to the conditions of military life in that country.

A Thesis presented to the University of Edinburgh for the degree of Doctor of Science, in the Department of Public Health, by Charles Henry Bedford, M.B., &c., Surgeon-Captain, Bengal Army.
55, George Square, 
Edinburgh, 30th Jan., 1892.

I hereby certify, on my honour, that since receiving the degree of Bachelor of Science in Public Health in 1889, I have been actively engaged in the performance of the duties of a Medical Officer of Health in India, that for more than one year; that in all the instances stated, I have been in sole charge of, and alone responsible for, the sanitation of the Station Regiments now to be detailed. These appointments were held separately, at different periods, and are stated in chronological order.

(1) Charge of the barracks, lines, etc., of Her Majesty's 3rd Royal Irish Lancers, and also compiler of the medical statistics of all the troops—four full regiments and two batteries of Royal Artillery—in the station of Newry.

(2) For the longest period of my service in India, as sole Sanitary Officer of the Station Cantonments, population
(which included several large native villages)
of Lansdowne; as also in charge of
the 2nd Battalion of H. M. 3rd Regiment
of Gurkha Rifles, – barracks, lines, etc.

(2) Sole sanitary charge of the Barracks,
lines, Owen of H. M. 7th Regiment of
Bengal Cavalry, at Bareilly, – the
appointment I last held before
leaving India for home on sick-leave.

I also certify that it is impossible
for me to obtain a certificate to
the above effect, such being contrary
to the usage & Regulations of the Service.

I also declare the Thesis I have helped
for the Degree of Doctor of Science to
have been composed entirely by me,
for the purpose of graduating
as above.

Charles H. Bedford, M.B.,
Surgeon-Captain, Bengal Medical Service.
"Nothing is so difficult as to know when a fact is a fact."

(John Hunter)

"The great enemy of knowledge is not error but inertness."

(Buckle's "History of Civilization" vol. iii. p. 394)

"Enteric Fever is the most fatal of all the diseases to which the European soldier in India is liable."

(Report of the Sanitary Commissioner with the Government of India for 1887)
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Abbreviations:
E.F. = Enteric Fever; I.M.S. = Indian Medical Service; M.S. = British Army's Medical Staff.
The numbers refer to the Bibliography. * = 2 footnotes.
Chapter 1: — Introductory Remarks

The subject I have chosen for my Dissertation is both one of the most-appropriate, as well as one of the most vitally important; I could have chosen in my capacity as an officer of the Bengal Medical Service. The subject is one upon which the members of the Medical Profession in India hold widely divergent opinions on, which naturally lead to contradictory efforts to prevent the development, as well as to modify the therapeutics of the disease. An additional advantage it presents as a graduation Thesis is that it is, so far as I can learn, the only one ever presented to the University dealing with the subject of Indian Syphilitic Fever. My aim in this Thesis will be to show:

1) that E. T. is not a disease produced directly by climatic causes, but is one owning a truly specific cause, not differing etiologically from the corresponding disease in Europe. But, in India, the disease is so modified by its
"environment," so to speak; the condition of life in that country are so very dissimilar from those obtaining in Europe that the subject assumes an almost totally new appearance; and at the same time, it becomes evident that so many great modifications are introduced, clinically and etiologically, that we must expect views, based on these differences, to arise and to be promulgated, seeking to explain these diseases from purely climatic causes.

2. That the school which would have us believe that Enteric Fever's prevalence in India is exaggerated, and that Malarial Remittent Fevers, either with or without bowel complications, really cause the huge death-rate from "fevers," should teach us to approach every case of continued fever with perfectly unbiased minds, in a spirit of diligent inquiry, conscious of the fact that much work is yet required before the perplexing coil of "Indian fevers" can be looked on as completely unravelled.
I must make no further explanation as to the choice of this subject, as there will be ample proof given in the course of the Thesis as to the overwhelming importance of the subject in its bearing on the Europeanarrisoning & coloni- 
gation of India, & as to the great loss the Empire annually sustains from the invaliding & deaths from this disease alone. 

(B) The widely-different views of medical men of acknowledged standingability on the subject.

My aim has been to gather together all of importance that has been written on the subject, & to carefully extract the essence of this vast amount of literature has been no light labour; to weigh the evidence for & against the views expressed; & finally to state the opinions that have myself formed independently on the subject from the study of cases of brother-officers of my own in India, of the literature of the subject, from my inference gained as Sanitary Officer of a large station in India.
I have long felt the want of any work or pamphlet which would cover the ground I have done in this Thesis, for none such exists; and I can only trust that my present effort may assist, in however humble a way, in the further elucidation of what is confessed to be probably the most difficult subject in Indian Medicine of the present day.

The conditions of life are so very different in India that it has been felt that some sort of general account of them is absolutely necessary preliminary to the proper understanding and development of the subject in hand.
Chapter 2: - A Short Account of the Conditions of Indian Life & Service.
(a) Men;

1. In Cantonments

(B) Officers;

2. On Service in the Field

(C) Civilians;

(D) Ladies;

(E) Women;

(F) Children.

(a) Men; 1. In Cantonments.

All of these groups will be considered under four sub-heads: (i) Dwellings;

(ii) Duties, occupation of leisure time;

(iii) Diet, Water-supply, clothing;

(iv) Conservancy arrangements.

(i) Dwellings: In nearly every European cantonment in India, palatial barracks exist. These are built in separate blocks, generally “in echelon”; and contain one-half of a company or a half-troop, — about 40 or 50 men.

The superficial space allowed, per men, is 90 feet in the Plains, 960 ft. in the Hills; cubic space, 1800 ft. in the Plains, 600 c. ft. in the Hills; the height of the room is 20 ft. in the
Plains, & 10 ft. in the Hills; the room's width is 24 ft. in the Plains, & 22 ft. in the Hills.

There runs all round the block a veranda to keep the sun off the walls of the barrack-rooms, which is generally 10 ft. wide.

Many of these barracks are two-storied, but a vast number of one-storied barracks exist; this is the rule in the Hills.

The building materials are sun-dried brick over which is laid a thick coat of cement, or a facing of sun-dried brick which has been burnt (burnt-brick) — the burning consolidates the material, makes it much less hygroscopic.

The barrack is raised off the ground two feet or so, but open arches for the basement are hardly ever used, which is a matter for regret.

The roofing is either of well-burnt tiles (which should be invariably a double roof), or of thick thatching placed on tiles. These roofs are generally planted.
A short distance below the "wall-plate," from which spring the rafters, are a series of small windows. Doors are very few introduced to face each other: permit of the free pulsation of air, being much aided by the comparative narrowness of the barracks. In the space between two doors, two mens' beds are placed. The floors are generally flagged, or covered with huge slabs of slate; a few barracks have wooden floors.

A row of beds runs along each lateral wall, the gable-end walls open on to the verandah, attached to which are closets, night-urns. These latter are generally built detached from the barrack, have a covered way, with lattice-bullied walls, as a means of communication.

In the hot weather, from April to July, all the doors are closed by screens made.

Foot-note: * The seasons: June in India are, roughly: Hot weather, April—July; Rains, July—October; Cold season, October—end of March.
from the roots of the "Khös-Khös" grass, in glass jars kept wet by a staff of coolies, surrounded for the purpose. If the relative humidity of the air is low (i.e., if it is "dry").

especially if there is a breeze blowing on to the screen or "tatte," the temperature of the room can be kept fairly cool. The evaporation of the water & the abstraction by it of the heat in the warm air particles. Floor screens often serve to cool the air between 15° & 20° F. Sprinkling the floor also serves to cool the air by means of evaporation.

The cooling is, however, when the air has less than 70 per cent. of saturation.

The "thermatidate" is also used on the same principle as the "Khös-Khös tatte." By its means, air is sucked in by fans. "revolution, third" grass-root screens, & by another action, propelled into the room. The whole is worked by hand-power. Every man has, in addition, over his bed, a "shukba," a frame of canvas.
or wood, to which is attached a "fringe" of canvas, about 7 ft wide, which is oscillated by a native-coolie outside the room. This promotes evaporation from the body, and helps greatly, when the air is dry, to "keep the body cool," though the temperature of the human being rarely, if ever, rises above 98:6° F. (as was demonstrated by Dr. J. B. D'Arcy, R. Army, in thousands of cases rain-wet thermostatically by him) the cause being the perfect equilibrium in health between sweat-production and external temperature. When on the subject of风扇机, it may be as well to point out that they, in common with other artificial means of reducing the temperature, are by no means unmixed blessings. The风扇机 for the barracks—one of which hangs above every man's bed—are manned by young boys (who are a most connubial class in India, as a rule) for efficient cookies naturally so to officers'
civilians' establishments where more "punkah-wala" relatives are kept, where the wages are higher, or where they are not subjected to the treatment that is occasionally meted out to them, with no unfeigned hand, by "Kamor Atkins," under such circumstances as these.

If the night tine, the coolie becomes increasingly drowsy, & this culminates in the punkah's oscillations ceasing, whereupon the sleeping inmates of the barrack burst out into a profane persiflage which generally awakens them when a chorus of bitter invective is poured forth supplemented by something more material in quality. This produces a violent series of waves of the punkah, & a consequent chill to the weak bedewed bodies of the men. Such as fever, liver congestion, dysentery, pneumonia, & what affects us most at present is desiring E.T. - diarrhea, which too often converts the put into the "locus resistitancee minoris" for the E.T. scene, is thus produced.
About 30 - 50 yards from the barracks are a set of cooking-houses, &c., separated again from these, the latrines & urinals. These are generally built of dried mud, & their "internal economy will be described later.

A barracks-block is also set aside for a "coffee-shop", & has adjoining it billiard-rooms & tables for playing chess, draughts, dominos, cards, &c., & newspapers are literally offered from a regimentsal officers' fund. There is besides a regimentsal library, generally in the same block.

The canteen (at which no spirits are to be had) is usually a separate block again.

(II). Duties, & occupation of leisure time.

The bugle sounds " reveille" at 5.30 a.m.; the men rise, dress, & "fall in" in parade, by 6 a.m. This parade is usually a mere roll-call to ascertain if all are present; if it arms, accoutrements, & uniforms are clean & in good order. Very little, if any,
Drill, etc., are gone through in the hot season; but, in the cold season, it is usual to have drills four on till 7.30; once a week, the soldiers have a "Commanding Officer's parade," which detains him till 8.30 a.m. There are occasional Brigade parades by the Officer Commanding the Station; these generally terminate by 9.30 or 10 a.m. Field-day manoeuvres are largely indulged in at this season. In cavalry regiments, "riding-school" is mounted drill goes on all the year round, beginning at 4 to 6 a.m. ending at 7 a.m. The men generally manage to breakfast at 4 to 8 a.m. Their meals are cooked for them in detached cooking-houses by natives, who are almost invariably filthy clothed, with disgustingly dirty persons. They come from the filthy native quarters early morning, with their clothes in many cases, in a condition admirably adapted (from their dirt, soiled condition) for spreading whatever infection disease the bazaar may happen to contain at the time.
Their hands are rarely, if ever, washed preparatory to commencing their cooking operation. Moreover, the cook-house is a favourite "point d'appui" for their relatives and friends, who spend many happy hours there; and as these people are often a degree more filthy in their clothes and person than the cooks, we can easily appreciate the sanitary effect on any food being cooked in an uncooked in the kitchen.

These kitchens are inspected by the Medical Officer in sanitary charge of the regiment every Saturday morning, but, of course, everything is in beautiful order for the "doctor sabi" inspection. But the relation is strictly old order of things.

Orders are occasionally told off to superintend the cooking arrangements, but these men are usually young and inexperienced, and are ignorant of what dangers to beware of in the control of the kitchen. The native disregards such a thing as the possibility insanitary condition of the
cooking water of the viands. Should he draw it from the filthiest of puddles, should it happen to contain the diarrhœaism of cholera, dysentery, etc., it is simply "kismat" (fate), for the native is, like Napoleon Buonaparte, essentially "the man of destiny." How "destiny" may be a comforting creed, but it is a mistake in sanitary matters!

By 9 a.m., the sun is well up in the heavens, the men are confined to barracks till its intensity shall have abated,—i.e., by 4.30 p.m. The interval is employed by cleaning their arms and accoutrements, mending their clothes, reading, games in the recreation-room, but too often by sleeping till dinner-time at 1.30 p.m., or after that till the sun is low enough to allow them to walk, at leisure, casually along the hot, dusty roads to the native quarter. Here they indulge themselves with "dry drinks"—with or without alcohol—which are almost invariably made from polluted water close to the native shops.
The ground on which the bazaars stand has invariably received (for a longer or shorter — generally a longer — period) the soakage from their ordure, for convenience rules our Indian fellows-subjects even more than it does us. The neighbourhood of the houses, then, are too often cumbered with the defeces of the tenants. The soil becomes filthy, it quite unable to exercise any filtering action on the ground water which feeds the wells. Thus even if the water used in the preparation of the "bazaar-pak" or native aerated waters, was taken from the wells, instead of some stagnant pool, it would equally contain the specific poison of whatever disease might have happened to exist in that neighbourhood, in all probability. The young soldier, fresh from England, in most cases anxious to see his new acquired wife, to view, in their homes, his firstly fellow-subjects, to a section so far less reputable purposes. Prostitutes spread a
vast amount of disease in staff. Their
houses are alone free of disease, &
forever bed for most endemic poisons;
the soldier, while there relieves his thirst
with filthy water or aerated water,
made as described before. Again, the
person & clothes of the prostitute & her
associates are frequently the direct
means of communicating any disease.
I had frequently traced cases of Variola
among soldiers in bachelors, when in
medical charge of the 5th Lancers, to
the prostitutes' quarter. I have, at my
weeks inspection with the Regimental Quartermaster, occasionally discovered a prostitute
who was the victim of some venereal
to have had, while in this condition,
connection with several soldiers!

During the day, the common water,
which are provided in nearly every
regiment, are freely used. These baths
are completely refilled twice a month,
and one-seventh of their bulk is run
off of a corresponding amount of fresh
water run in. If this is neglected, as
it is occasionally, the water becomes foul, for two or three hundred run gurgling
without, daily; moreover, if an
ambulatory or wild case of E. I. should
take place, as is not unknown — there is
great danger to the healthy, as is obvious.
In the evening, there is often an hour
or two's drill, — bayonet drill, or lance-drill,
according to the corps engaged.
In most stations, there are "pleasure
gardens" for the men, where a band plays
several nights a week.
After supper, a smoke or short walk,
fills in the time till "last post" (10 o'clock)
announced, when they retire for the night.

(c) Diet, Water, Supply, and Clothing.
The diet of the British soldier in India
is very stimulating, large in amount;
not always of satisfactory quality.
Meat — mutton or goat — flesh — is cheap,
and hence there is a temptation to over-
indulgence in an article of diet which
is commonly held to be "sustaining"
and "strengthening," which is more out
of the soldier's reach in Britain.
But being "well-fed" in the tropics is not a condition so easily attained. Here, it means the adaptation of alimentary principles to the physical requirements — a lessened heat production, a more constant, quiet, contented life. Indeed, it has been shown that the great Eating & Spirit-drinking races are most prone to suffer from it. In India, the soldier receives daily one pound each of meat, bread, vegetables, &c, in nearly every regiment; he pays a small sum extra for his "extra mess," confectionery, tea, coffee, &c. The meat is the hot season is generally tough & indigestible from the short period which elapses between its being killed & eaten, as it otherwise quickly becomes "bight." The amount of beer consumed is also excessive, so, as it is "fortified" to preserve it, this makes the races more vicious. Ten pints "at a sitting" is not by any means uncommon, for India is a "thirsty country." But many men are but moderate drinkers, + 2½ or 3 pints is a fair
average. Many men conscientiously limit themselves to one pint a day; of course, not a few are total abstainers. Spirits are not now sold in Cantens. The way the meals are apportioned are coffee & a biscuit before early parade, which is often served at the Barrack, or in the Canten.

For breakfast, the soldier has part of his meat ration cooked, & also portakes of bread, butter & tea. As his favourite dish is beefsteak, & two eggs, onions! The sides off the remainder of his ration of meat & vegetables, with bread. Along with this meal, a pint of beer is usually taken. Some lads he has a meal of tea, bread, butter, & whatever he finds he buys,—bacon, pork, eggs, ducks, hot-stews, or carries.

The men's Rations are supplied under close European supervision, but the "Bahada" bought regimental, & by himself; in the Vegas are often of very doubtful quality. The milk—muff is also occasionally
very poor, if not injurious to health, but
the soldier behaves but little milk on the
whole. If butter is made from infected milk, it will cause E. T.
The water supply is apparently good.
In the plains of Upper India, it is
generally taken from wells sunk in
the alluvial clay or a sandy, water-
bearing sub-stratum, which everywhere
underlies the surface-soil at a depth
varying, in different stations, from 20
to 120 feet. The water is raised
out of the well by small leather
buckets, or then sucked into "mussucks" (a "mussuck," being composed of a stitched
up goat-skin, which is carried on
the back of the "blioti," or water-
carrier). Neither of these can be cleaned
after use, yet the "mussuck" is used
for waters of different qualities which
are wished for different purposes,
—drinking, cooking, washing, watering horses,
etc.— it must be contaminated.
The wells are generally deep* built
of brick-work which should be often
are faced with impermeable cement;

*Not true however, "deep wells" (i.e. more than 100 ft. deep)
as defined by the Rivers' Pollution Commission.
which may chip or crack off, & hence ground water may escape into the well at any level without the supposed salutary effect of percolation through a deep structure. Animals, too, bore holes into the wells, hence there is certain contamination. The earth, which serves as a natural filter for the water is too generally saturated with the "drippings" of ordure on the surface for the native defecates where he wills to drink—hence may literally poison the water it is supposed to filter.

The wells, again, are generally uncoved. Hence all sorts of filth may get in. One very common variety is the "washings" from a "bath of recovery" taken by very native on recovery from any severe illness. At this ceremony, body & clothes are alike washed; so, as it is more pleasant & convenient for the grateful native, he takes his bath by the well-side, & I have often seen the washings pouring back into the well.
Dead dogs, cats, rats, even human bones have repeatedly been taken out of a well—when very cleaned out—which has been in constant use for the drinking supply of troops.

Twice a year a medical officer is "sick off" to examine chemically, to report on, samples from all the wells supplied by the troops. I have performed this duty in the hot seasons of 1850 and 1851, at Allahabad, Secundernagar, Bareilly. All the waters examined were comparatively free from organic matter, chlorides, or other waters. But these waters are never examined bacteriologically; though the chemical examination is valuable enough in the indications it yields, yet the examination is multiplied as "it does not at all follow that there is an appreciable increase of organic matter, or any other chemically determinable ingredient, and be found in the organic contamination may have been simply by some introduction" (Parkes) from the solution.

"If any fluid, however small, of infective matter gets access to wells or other sources, it imparts to enormous volumes of water the power of propagating disease."—Nevada Local Government Board.
of the poison by ground water, whose percolation into a well has poisoned that particular source of drinking water.

The impression in India is that the standard of purity of the drinking water is really high in most large stations, but, as this opinion is founded largely on the results of the mere chemical examination of the water, I hold that till the matter has been tested bacteriologically we are wholly unwarranted in guessing what is at all probably a dangerous delusion.

I may add that at Delhi the well water is so bad that the water of the River Jumna is preferred here, with all its concomitants of floating cadavers consigned by the river to the sacred Ganges. But the Jumna has no large town above it for many miles above Delhi, so issues from a pure source in the perpetual snow of the Himalayas. Those impurities derived in its course from surface-washings are largely compensated by
subsidence oxidation. And even with firm ledges, focal particles this is so, for subsidence will carry down of the particles in which the microbes are probably encapsulated.

But looking to the general question of a country supplied by wells, with the many dangers inherent to that system, it would be more than rash to assert positively that there was no possibility of contamination: such opinions are too often heard expressed.

Clothing. In the hot season, the men are dressed either in white "drill", or brown holland ("châki") linen trousers. A flannel bider is frequently worn, over that a thin under-vest or very thin flannel shirt. The head is moderately well protected from the sun by the regulation white helmet.

In the cold weather, the clothing is identical with that in use in home-service.

(V) Conservancy arrangements.
The system authorized by Government is the dry earth, or the "night" coil is.

But Dr. Peary Frankland writes: The idea of any striking destruction of organic matter, arising a river's flow, reclines no sort of support from my experiments."
conveyed from the latrines by carts of
the Crowley, Bradley, or other suitable
material, to a spot selected by the
municipality—a body composed of
the chief Civil Servant, the Commanding
officers of regiments, the Civil Surgeon
—an officer invariably of H.M. Indian
Medical Service—the Senior Medical
Officer of the forces in the station.

This site is generally a mile or
or beyond the Cantonment boundaries.
Medical officers inspect this site in
rotation weekly, to ascertain that the
system is being efficiently carried out.
The "material" for working the plan
is provided at the troops' lines.

The latrines are placed in a spacious
mud-hut, which is freely ventilated,
and generally contains 6 compart-ments,
each of which is a flagged
earthenware—or, more rarely, iron—privy.
pan; a wooden box filled with dry,
fired-sulphurised earth, a wooden
spade for depositing same on the motion
when passed. Behind each latrine-hut,
is a high, and screen-well, there is always a "sweeper," or native scavenger, on duty who is ordered at once to remove any dung from the privy pan into an air tight iron receptacle which stands behind the screen wall. The "sweeper," after emptying the pan, scrubs it inside and out, with wood ashes (kitchen fire refuse) if it is an iron pan, but if glazed earthenware he is directed only to scrape it, then replace it. The use of water in cleaning the pan is strictly forbidden. The earth is brought to the lines by the rubbish carts which carry away the sweepings from the lines, though in many places the prefemorators plan obtains of using the fedhi carts on their return journey from the ordure trenches for this purpose. If this last plan is adopted there is every probability of the earth absorbing some loose faces or wind (infected were it with some specific poison from either an efficient case of cholera or a mild
on embolatory care of P.T.) which has come about by the spilling of part of
the contents of the iron receptacles when in the cart, or by their leakage.
Great care is taken to dry the fresh earth in the sun — or if not at all
particular reason, by fires — and to break it up and sift it.
The iron privy pans & air tight receptacles are covered, weekly, with a coating of
coral tar, applied cold.
The air tight receptacles may again be installed into iron felth carts, which
have to be inspected weekly by the Regimental Secretary to see
if it leaks or has any other defect.
The night soil is buried in trenches
1 foot deep & 1 ft. broad, & of a length
varying with the size of the garrison.
When filled to a depth of 3 inches
it is supposed to be full & should be
closed up. Practically, it is usually
filled half way, & then closed. The
next new trench is dug from six to
twelve inches distant from the old one.
Secrets from cholera, Interic, & Dysentery cases are disinfect on being passed, & removed on the dry earth system in separate receptacles & should be buried separately from the refuse from the lines. The leached area is not touched for 3 months; then it is leached to the depth of 1 ft. at right angles to the line of the original trenches, the earth contents well mixed; & it is then ready for cultivation. In dry weather, ground required for cultivation can be so treated at the end of 2 months. Rubbish & refuse crops are soon, one or more crops as to the taking off the ground before it is again used for night-soil trenches. Crops requiring much water when growing are unsuitable for planting here; so it is important to prevent, as far as possible, the ground being defecated on while the crops are growing. It will be seen from the foregoing sketch, that the system is thoroughly well carried out.
Arrivals are of glazed earthenware and are placed on raised platforms, on which a layer of earth in which each is laid loose and dry. Ion arrivals, if used, are placed on a large iron tray—similar to the “safe” of modern W.C. apparatus—both are securely painted with coal-tar. Orders are given not to place any dry earth inside the arrivals. These arrivals are emptied into a separate set of iron, air-light receptacles, which are usually poured into a separate ditch or trench, then covered up. The arrival is dried by rubbing it lightly with dry earth, or, if no earth is procurable, with water.

Rubbish and sweepings are either used as fuel for drying the earth for the privy houses, or carted away to a spot selected by the Commandant Authority.

2. On Service in the March.

On field service, the soldier's life undergoes a more or less profound change. He is either encamped on a fortified site—
which may be temporary or permanent—or in a camp for a few days; or again he may have to bivouac in the open with no protection from the weather in the shape of tents, huts, &c., with the minimum of camp-equipment. If by chance in a camp or a permanent site, he is very often housed in bamboo huts,—as in Asante, N. E. Frontier of India, & Shaukin campaigns.

"War," says De Groot, "is in its essence a conflict of crowds," in hot climates the evils of overcrowding in the shape of accumulated fecal, odoriferous, respiratory secretions will be immensely intensified. Thus the question of camp hygiene comes to be one of the most important topics in connection with the life of the soldier. What a camp should be will be briefly indicated in the Chapter on "Prephylaxis": what we have to describe now is what it generally is.

The site of a camp in time of war is selected; firstly, with regard to strategic needs; secondly, to sanitary requirements.
It may come to be a necessity occasionally to have a condition of over-crowding, as in the case of a camp or fort situated on a tongue of high land or on a hill-top where more space is an impossibility, where a certain number of men must be placed for strategic purposes. Prof. D'Annoumont showed, by means of tables compiled by him, "that the mere bringing together of a number of people into a community, even when there is no excessive crowding, is in itself a source of danger... and that the mere aggregation of human beings exercises a powerful influence on their health and vitality." Air soiled here suffers mainly by excrementitious contamination. Tents, especially when wet, are practically impervious to air, the opening of the tent-flies affects more the escape of the CO₂, produced by the occupants, rather than of the "putridable organic matter" exhaled by them, which, being less1 difficult, becomes attached to the tent-walls, and all articles inside the tent. A cumbersome form of tent is authorized which is often too heavy to be transported about; and in such cases a quick
"Kâl", i.e., a canvas roof with no walls, is often used, being immensely lighter. As a great deal of time is spent within the tents, there is a depreciation of health in consequence. In fact, men are generally healthiest when bivouacking in fine weather, though even heavy rains have not interfered materially with their health under these conditions, which is, at first sight, a very remarkable fact.

One of the chief causes operating in the rendering foul of the soil is the fact that men attacked with one of the commonest complaints when under canvas, diarrhoea or "camp-fever", have neither time nor inclination to reach the latrines, hence simply their bowels at the first convenient spot. At night, even the most conscientious man would hesitate before attempting to risk his neck through a piece of ground studded with tent-ropes. Even though sentries may be instructed to prevent men from defecating anywhere except in the latrines, they would certainly never arrest a comrade.
suffering from diarrhea, whom they discovered "in flagrant delicto", as they knew the difficulties that some may happen to them tomorrow.

But should the man be suffering from the early stages of cholera, or E.F., the result will be obviously very serious. If food of the soldier on service is purely his "kilo" of beef, — "bully beef", as it is called, — bread and vegetables, but the latter are generally tinned or preserved potatoes (which are usually distilled by the soldier in this form), pease, tomatoes, etc., in addition a ration of tea, salt, pepper, etc., there is usually an effort on the part of the Commissariat to increase the amount, for men of the ranks, so it is recognised that a man doing hard campaigning requires it, especially when he is unable to purchase any supplementary articles of diet, as he does when in cantonments.

In bivouac, each man has carried for him, by regimental transport arrangements, one waterproof suit, one blanket, this greatcoat.
The conservancy arrangements in temporary or permanent camps simply consist of a bare trench, or one or more, according to the number of men in camp; ordure trenches, which are dug from 25–100 yards to leeward of the camp, are closed when half full.

On the line of march, the troops are accompanied by a crowd of filthy, clothesless native camp followers, who no doubt do much to carry off E. F. by their dirty condition, the infected localities from which they come. Thus E. F. is got off more on the line of march than in camp even, but this is due largely to the fact that the men are most reckless in the way in which they drink from almost any water they meet with on the march.

Again, while passing through native villages of sufficient size, they procure aerated waters made from tainted water almost invariably; of uncultivated draughts, which also of the most detrimental antecedents. On a march, the heat + fatigue + the
empty stomach (for the men have only had a biscuit and coffee before the march) lower the resistance appreciably. Prof. Matthew Hay, of Aberdeen, has shown experimentally that the reaction of the gastric mucosa and contents (when there is no food in the stomach) is secreted by the stomach) is alkaline. It is highly probable that the acid secretion of the stomach is a powerful protection from pernicious ulceration of the gut lying beyond it. But when empty and alkaline in reaction, this safeguard is removed, and pathogenic organisms may feed harrassed to work their wicked wills on the portion of the "prima via." Their alkaline secretion is their favourite medium for development.

Marches are almost invariably performed in the morning from 6 till 9 a.m. or 5 till 8 a.m., as a rule. The practice is, to strike the tents at "revesille"—when the men are rounded—& to send them on ahead to be pitched by the (native) tenders.
lasers," so that in the arrival of the troops after their march the tents are ready for them; their breakfast also.

The march itself is a terribly dusty, fatiguing ordeal, though its usual distance is 10 or 12 miles; yet this produces nearly the effect of walking double the distance alone. The constant checks ahead, the crowding at intervals, the dust raised by those ahead, the heavy rifles and sidearms to be carried, all make marching but little of a pleasure. The variations of temperature under canvas is another condition which breeds much disease, for the day-temperature is generally very high, the night-temperature very low. When troops are marching from one station to another, which they may be in the cold weather, they generally halt at regular "rest-camps," which have tents pitched at all times during this season. These camps have, as might be expected, soils contaminated by pollution often of previous occupants.
- troops and followers. The water is also often of very doubtful quality, and occasionally deficient in amount, which leads to other sources being more doubtful being used by the men to supply the deficiency.

(B) Officers: The European battalion lands in India, in most cases, when about 20 or 21 years of age. In the case of a lad being appointed from Woolwich or Sandhurst to a corps serving in India he either proceeds at once to join it on receiving his commission, or goes to the Depot in Britain of the corps he undergoes his preliminary drill, etc., before leaving for India. There is, generally, an almost constant influx of young subalterns to a British regiment in India. Surgeon-General Sir H. Moore, K.C.I.E., of the Bombay Army, states the age of 24 to be the "ideal time for beginning an Indian career." This "ideal" is usually fulfilled in the case of medical officers — especially in
the Indian Medical Service—who vary
generally from 24 to 26 years of age
on landing in India. Most junior
officers of the British Medical Service serve
a short time—occasionally two to
four years—at home before being
ordered to India.

1. Cautions: (1) Dwellings.
The bungalow (Hindustani, bungla, etc.,
a thatched house), in the Plains, is
generally a large house surrounded by
a large garden, or "compound," in which
are placed, at a convenient distance
from the house, generally 10-20 yards
the cooking-house, stables, servants' quarters.
The structure of all these buildings is
sand-dried bricks covered with cement,
with wide verandas, on the fillers
of which flowers or "creepers" are
trained. The roofs are thatched or
tiled, 1 pointed preferably, 1 are
double throughout for coolness.
The rooms' walls are whitewashed,
there are no wall-paper, as the damp in
the rainy season & the insects would
destroy them.
The rooms are generally very lofty, mostly devoid of windows, but the deficiency is supplied by the number of doors which face each other on all hands, open into the inner chambers, and to the verandahs. The doors are double—glass inside, screen-latticed ones outside, called "jumillas" (shell phonetically). Outside the doors, are hung screen made of thin strips of cane painted green, which serve to lessen glare, exclude flies.

A fireplace—a frame parson in the hot weather—occurs in most rooms, but is in great requisition in the cold weather. The flooring of the verandahs is cement; of the rooms, wood, cement, or asphalt; the whole house is raised 2 to 3 feet above the level of the garden, but there is rarely an air-chamber underneath the house. Punkahs, khar-khar battue, thermometers, are used as at the barracks, only better manned, as crabs.
is to rise at 5.30 a.m., to take a cold "bath," dress, to have a light meal of toast, egg, & tea, of time to be occupied variously with various duties till 7.30 or 8 a.m. Breakfast is taken, if married, at home, but, if a bachelor, or his wife & family are away, at the mess. The meals at the mess are generally supervised by aMESS-COMMITTEE, whose principal duty is to audit as well as keep the accounts, which the officer commanding the regiment supervises from time to time. The details of the cooking & the procuring of viands — with the exception of bread & bottled goods, or, of course, in addition, wines — are left to the "mess-khansamah" or cook, who, in too many cases, cares more for his fairs than for the excellence of the food supplied to the officers. In British regiments, there is a (European)mess-servant, to a certain proportion of mess-waiters are privates belonging to the regiment, but these are assisted by a large staff of native "khidmatgah" or waiters. In a native regiment, the whole mess-staff are natives.
In mess, cooks are renowned far and wide for the filthy way they naturally carry out the cooking of the food. Filthy water is frequently used for cooking, making tea, for preparing aerated waters for the mess. Again the milk may be watered with foul water by either the milk vendor, or the mess cook, whose aim, as before explained, are not philanthropic but cumulative.

As to the meals themselves, a usual breakfast menu would be: boiled rice, calm with milk sugar or porridge, or some form of pulse similarly prepared; then stewed meat, kidneys, grilled chicken, omelette, curries, fruit. Tea, coffee, or a light claret are drunk at breakfast.

Then at 2, lunch occurs, consisting of 2 or 3 fish, meat, pudding courses. "Pep" of whiskey, soda or wine are generally taken with this meal or more "pep" in the course of the afternoon after exercise. Afternoon tea is indulged in
by far for in the hot weather trains it tends to produce, and preserves, to intensity "lichen tropica", or "prickly heat." Most people dine at 8:30, or 8, then again soup, fish, entrees, meat, fruits, 
cake, sweets, cheese, fruit are partakes of. The ordinary dinner—wines—sherry 
port, medica, claret, or "tup" are indulged in generally largely used. 

The ice itself is often a source of danger from the water which is used in preparing 
it, for it is made generally at 
native ice factories in the city. 

It will thus be seen that there is every 
temptation offered to eating a great deal more than either is required or 
can be eliminated, when the oxidation 
processes are lessened by alcoholic 
indulgence the evil is intensified. 

A state of turpitude of the abdominal 
viscus results, often in fact of 
the pyriform solitary bladder, as well 
as a generally furred condition, all 
of which favour the reception development of such a disease as S.T.
Besides, the accumulation of unoxidised ingesta; the hepatic turpitude produced by hot curries, chutneys, & other highly spiced articles of diet, not to mention alcohol; the diminished action of the succinate organs produced by the joint action of tropical heat—at first stimulating & later exhausting them—of a decreased amount of exercise; the extra strain thrown on the liver's oxidising & eliminatory functions by the increased respiratory activity—for heated air contains, bulk for bulk, less oxygen than cold air—are all tending to produce a favourable nidus for the disease, & what is almost worse, to place the body in a condition in which the combating of such a serious disease as B.T. is less easy.

As to habits—personal—the Officer is unable to move out after breakfast during the greater part of the year because of the intense heat. All the doors are closed from 9 till 4.30 a.m., & he has to while the time away in the darkened & comparatively cool rooms, by sitting...
under the junktah shading, sleeping, or amusing himself as best he can. At 4:30 or 5, he drives a ride over to the Club; plays racquet, tennis, etc., or to the polo-ground for a game at polo. At about 7, there is a general rally at the Club, & the papers are read, whisky, billiard, or conversation with "fellow-club" holds away the time till dinner. After dinner, bed is sought at about 11, but not necessarily. Sleep, for in the hot weather, the atmosphere may be too oppressive to allow even of the most fitful climbers, interrupted by interludes of remonstrance, pettitionation to the junkah-cookie not to "clamber softly," but to pull the junktah. Over every bed waves — or should wave — a junktah, a towel is generally pinned on to the frame so as to fringe the sleeper's face at every oscillation, so that the air-inflated may deter hone any mosquito focused on the "Sahib's" face. Hence, a long sound sleep is very rare in the hot weather.
Water supply and clothing. The water supply for officers is either obtained from a well in the garden of their house or from that in the mess garden. It is usually filtered, not boiled—young officers, especially, being careless or indifferent, as a rule, in these points. The filter, used alike by men and officers in India, is a very rough but ready arrangement, corresponding in most instances.

A tripod stand is made with three legs on each of which is fast an earthenware jar, usually of 3 gallons capacity. Into the top one (A) is placed the water to be filtered, which slowly drips into (B) by a small hole previously bored in the foot of (A). In (B) is a mixture of sand and charcoal, which is supposed to filter the water. From (B) the filtered water escapes into the bottom jar (C), it is supposed to be ready for use. The sand used in these filters is gathered by a native servant from an adjacent river bed—not the best for this purpose, but the nearest.
Now river-banks in India are favourite places for people (i.e., natives) to defecate. This sand is known to possess scarcely any purifying effect on the washings from stools, or matters of any sort. Thus when it is scraped up, it, in all probability, contains particles of excreta - infective or not, as the case may be. If it is placed in the filter, almost invariably without any preliminary washing, or, if it is washed, it is washed very imperfectly. Hence, water passed through such a filter often issues in a very much worse condition than when it was put in.

Personally, I never let a filter be used if I can help it, but insist on the boiling, cooling, reboiling of all drinking water, so I see that it is placed in vessels previously washed throughly with boiling water, & that these vessels are efficiently covered.
When pouring water out from such vessels, careful decanting is employed for particles which might cause intestinal irritation or even dysentery by their mechanical action. It is almost invariably the duty of the person who has been drunk to get rid of it by subsistence; the policy has destroyed any moralistic agent. It is not sufficient in India to order a thing to be done; one must see it done. Nowhere is it so true that, in Punch's words, "if you want a thing done, do it yourself"—nor is this true. Neglect of ignorance of this principle too often causes personal calamity to the "laissez-faire" individual. Even water used for brushing the teeth with should invariably be prepared as if for drinking, as this has often struck me as being an occasional cause in people who used boiled drinking water but unboiled tooth-water. Servants again are apt too readily to wash their clothes off persons at the well-mouthe from whence your drinking-cooking water issues.
Clothing. Light flannel, or cotton flannel mixed, or very light twed materials are used for chuffs, & outings. Silk, merino or thin flannel suits, drawers, & in many cases, a flannel or silk "cloche hat", are worn. A thick felt or felt hat to cover the temples, brow, & cervical region is used when exposed to the sun; but, when the sun is less strong at 5 p.m. & after, ordinary English caps that — except with tails — are worn.

The clothes are washed by a servant who lives in the bazaar & who washes for several families. This is a frequent source of infection, for the water used to wash the clothes in is some foul river-side pool in which some native or European kill from an E.D. case may very possibly have been washed; & again the clothes after being washed are too often placed in a room in the native house in which is the neighborhood of which cases of infectious disease.
capable of being spread by "smuts," may exist.

In Conservancy: The dry earth or zinc prepared, modified to the following extent. Attached to every bedroom is a dressing room, bathroom, &c., in the latter, is placed one or more lidded wooden boxes which contain removable, white, flagged, earthenware receiving pans. After being used, these are removed by a servant — the "sweeper" — & emptied into the drain from the chamber into a tar-coated, iron vessel which is air-tight, & which is kept in an out-house, as far as possible from the house. A fifth-cart supplied, kept up by the Sanitation Committee by buying a tax of one hundred monthly on householders, removes the contents once, twice, or oftener a week (according to local arrangements) to the "branches," where the cots & from the "branches" are buried. The dry earth is thrown on the tools when finished, into receptacles.
are generally cleaned by washing with water, - both of which points are practically theoretically incorrect. People, however, let so used to the prevailing notion that, so long as their attention is not directed to the matter by "mauvais odeurs," or illness arising from filthy causes in the house, they never think of ascertaining if their conservancy arrangements are perfect or not, or whether any possible source of danger exists.

But another much more serious omission is that the head of house never inquire into their servants' latrine arrangements. Consequently, the servants imply their bowls or bladders round about the cook-loue or near the horse, unless a bucket in dry or kept in a proper condition, - a fresh one being very weekly. It is strange how universally neglected this obvious matter is. It cannot fail to cause at frequent, as was proved in the case of an outbreak among medical officers at Rawal
Padi. Occasionally, an iron receptacle is provided for the servants, but I have often discovered it uncleaned, tainting powerful odors.

Civil Servants. Their residences, cookervour arrangements, clothing, water supply, & food are identical with those of class (B). Their duties, of course, differ considerably. Their age of arrival in India is generally about 21. Their work keeps them in the Court-house or office from 6.30 or 7 a.m. late 10, where they breakfast, after an hour's rest; which occasionally is denied them—return to their work which is often not finished till 6 p.m., or later. Their time after this is employed precisely as in Class (B) Case.

Ladies. The only difference here occurs in occupations, i.e., very often in the realm of occupation. Exercise is taken morning + evening, i.e., aside in such as tennis, badminton, etc., most ladies ride a great deal in India. The exposure to climatic influence
Extremes is much less with ladies as they are never under canvas, kept in the cold desert, nor are they exposed to the climate dangers of field service. Besides, the hot season trains are generally spent at hill stations, which are non-malarious, in which C.T. only occurs when imported by patients coming up from the plains in the stage of incubation, the "quarante." The standard of health in the hills is very high.

(2) "Ladies." This is a term applied in the service to the wives and female relative of non-commissioned officers and soldiers, to distinguish them from officers' wives. Married couples are housed in small one-storied blocks. The sizes of the two rooms allotted to a married couple are generally, respectively, 16 ft. \times 14 ft., and 14 ft. \times 10 ft., with verandahs of a width of 10-12 ft. Punchaks and punchak-coots are provided by government. The quarters are inspected weekly by a lady rarely if ever go into the native quarters or bazaar, thus aiding in conferring immunity from g. 
Medical Officer of the British Service, who
was they are in a good sanitary condition,
t clean, that no cases of communicable disease exist among the inmates.
A certain proportion of the women and
children are allowed to go, at government cost,
to the hills, always if their husbands
are sick. But many, stay behind, to
face the hot weather & unhealthy rainy
season so as to stay with their husbands.
Their time is occupied in looking after
domestic duties — their children, washing
clothes, perhaps cooking — and in a
good many cases — "chew! miserable
diet!" in vixing their neighbours affairs.
Their food differs from their husbands'
so that they do not eat nearly
much meat, nor so much food of
any kind. Breakfast is always
a light meal, dinner a little larger,
& the supper the consuming element
—a soup, or curry with tea is a
favourite supper — for it is their largest meal.
The clothing generally is suited to the
Climate. The water supply is identical with their husbands, being drawn from wells in the regimental lines; the conservancy arrangements consist of latrines separated from their quarters some 15 or 20 yards, worked in the same way by a female staff of 'sweepers.'

(b) Children. They may be sent to the Lawrence Military Asylum in the Himalayas or hill stations, where they enjoy the best of health, are well looked after generally; or they may stay in the plains, go to the Regimental school assigned to them.

They are generally put about the lines with or without their parents; they may go with them to the bazaar.

Their diet consists largely of milk - got from private cows or from the regimental cow-sheds; it they share in their parents' issue of rations when old enough.

Water-supply, conservancy, clothing, etc., are identical in character with their parents'?
In this chapter, a sketch has been given of the conditions of life and environment of the specific classes. Indications have been given as to possible etiological factors which will not again be specified in the chapter on the etiology of the Indian disease. And, moreover, it has been found more convenient to treat such things as water-purification, for instance, when describing the process. The defects and dangers of existing custom have been shortly indicated in describing them. This has proved the simplest and most fitting arrangement, besides leading to demonstrating the necessity of alluding to matters which otherwise might appear rather irrelevant or even redundant.
Chapter III - Definition of the Disease

The term "typhoid fever" is, for many reasons, to be preferred: (1) Because "typhoid" resembles "typhus" in sound as well as in print too closely; (2) the disease is more than the "typhoid state" (τυφώς, stuff), which is commonly observed towards the end of many acute diseases; (3) the main pathognomonic lesions occur in the intestine, or bowel.

Hence, it is defined as the disease as "an acute disease generated and propagated by certain forms of decomposing organic matter." That it is essentially an endemic disease we allow, but we hesitate in accepting the theory of the causation asserted by the official nomenclature of the London College of Physicians, i.e. it is placed under "general diseases, Section A," which "comprehends those disorders which appear to involve a morbid condition of the blood, but which are not all present in the most part, but not all of them." The following characters: They run a definite course, are attended with dyspepsia..."
"in the skin, are now or less readily con-
municable from person to person; of
"posses the singular & important property
"of generally protecting those who suffer
"from them from a second attack. The dis-
case itself is specially defined as "a
"continued fever characterised by the
"presence of very coloured spots, chiefly
"in the abdomen, & a tendency to diarrhia
"with specific lesion of the bowels.

This may be summed up by saying that (1)
the incubation period is usually two
weeks; (2) that the eruption appears usually
from the 7th - 14th day, occurring in crops;
each spot lasting about 3 days, & vanishing
on pressure; (3) that the haemochor is
early, spontaneous, transforms, the discharge
being, for the most part, liquid, coloie, of
a bright yellow colour, "alkaline;"
(4) that the average duration of the
disease is about 23 days, death in the
majority of fatal cases occurring towards the

*Hutcheson says it is generally 00; that a longer
duration up to 3 weeks is "very rare"; that, on
the other hand, it may be less than two weeks,
may be even only 2 days.
(5) that there are special symptoms associated with the characteristic bowel lesion - fulness, resonance, & tenderness of the belly; more or less tympanitic, grunting in the iliac fossae, & increased splenic fulness; 

(6) that the specific lesions are enlargement of the spleen, mesenteric glands, with enlargement, ulceration, & thickening of the fluids of Peric, the solitary fluid of the small & occasionally also of the large gut.

Of course, in many cases of certain 2., several of these symptoms may be absent or modified, but the anatomical characters are generally to be found unmodified in typical cases of the disease.
Chapter IV. History of the disease in Europe.

As this forms partly the history of the Indian disease, it will be necessary to shortly consider the history of the Indian disease, of its differentiation. There seems to be little doubt that the true c. f. of Jenner is a disease of great antiquity in Europe at least. As Hippocrates' writings there is evidence to show that it was a disease of, at least, occasional occurrence in ancient times; this is rendered more probable from the nature of the disease, cause, and almost universal distribution.

Ogygieus is the earliest notice of inflammation of small intestine, ulceration of ulceration of that portion of small gut next the cecum, as also of the colon. In 1576, Walter Devereux, Earl of Essex (the father of Elizabeth's favorite), died in Dublin from a disease known then as 'Irish disease,' afterwards called 'epidemic dysentery,' the modern Irish history of which has been given by Coghlan, who shows it to be manifestly a type of enteric fever. In 1652, Pancarulus, of Rome, observes
that in some cases dissected by him the intestine had the appearance of being cauterised. Willis seems to have been acquainted with two forms of fever whose description by him leads us to the conclusion that they were cases of typhus. Huxham, also, described a fever in which the symptoms were diarrhoea, vomiting, delirium, a coma, tendency, & spistaxis, distinguished from typhus by the absence of petechiae. Baglivi of Rome, in the latter part of the 17th Century, described the “hemiplegetes” of previous writers, under the title of “febris mesenterica”, held that it was always dependent on inflammation of the intestinal mucosa, & enlargement of the mesenteric glands. Hoffman, later in 1718—lancisi made a similar observation. Huxham, in 1739, described a “slow nervous fever”, which there can be no doubt was ST. Manningham, in 1746, described what he termed a “febricula”, & directs attention to its insidious origin, & to the
fact that its gravity was frequently under-rated at its onset.

Morgagni described certain autopsies in which the intestinal lesions were evidently those of S.F.

In 1766, there occurred at Stuttgart an epidemic of what is described as "Horbus mucosus," locally known as "Schleimfieber". This appears to have been an epidemic of true S.F. Many of the cases began as Remittent Fever, or certainague, emerged into from of continued type. During convalescence, it reverted to an intermittent type: this is a common enough history in India S.F. Would tend to show that the cases of S.F. were malaria-saturated previously.

For Stuttgart at that time was very malarious. Otherwise, it had all the symptoms of S.F. Roederer and Wagner described its morbid anatomy, and many of the cases dissected seemed to be either early deaths from S.F. or cases of Remittent Fever + dysentery.

A large proportion of the cases died on the 21st day, or occasionally on the 30th day, though a few succumbed on the 9th day.
In 1804, Croft, of Paris, described a form of fever, with a series of autopsies of the cases which died, succeeded in establishing the connection between the symptomatology and anatomical characters of the disease. It was "a continued fever, accompanied by inflammation and ulceration of the bowels." His investigations were carried on through a series of years by Broussais, Petit, Poëme, Ferrero, and Brebènecq. The last named observer (who practised in Tours) in 1825, seems to have been the first to indicate the association between certain symptoms of the lesion of the solitary typhoid glands of the ileum, under the name of "typhoenteric." His pupil, Trouessart, in the "Archives Générales de Médecine" for January, 1826, also confirmed and added to his observations. John Hunter (who died in 1793) preserved in his museum specimens of typhoid ulcers, which Sir James Paget describes. This shows that the disease was present in London in Hunter's time, though probably confused with typhus fever.
In 1822, Walz, of Strasbourg, published illustrative cases of the disease, due to the use of contaminated water. Louis, of Paris, in 1829, was the first to give a complete and connected view of both the symptomatology and pathology of "la fièvre Parisienne." His description was more exact, his analysis of the symptoms more scientific than Pestl's. His views were adopted in France by a school of which Aronel & Andral were the chief advocates.

In England, his description was not verified, in all probability, because typhus cases were directed. But many considered the anatomical lesions as mere accidental transient in occurrence. Inspector General Lawson states that he had found evidence of the existence of E. P. at the Cape of Good Hope, where stationed there in 1827. Dr. Richard Bright— at that time a man of middle age, of great experience—wrote in 1827 on cases seen by him from October to December, 1826, which
he described as "typhus with abdominal complication."

In 1829-30, a violent epidemic occurred at Toulon, which led to the opinion that there was a typhoid + typhus fever, - the former confined to Paris, the latter occurring in Germany, England, elsewhere. Louis himself adopted this view in 1841. In England the opinion was still strongly against the dual theory.

In 1836, Jerard Pennock of Philadelphia, were the first to indicate the analogies & differences between the two fevers. In the same year, Lombard declared his conviction that they were two separate diseases.

In 1840, Dr. A.P. Stewart, in the pages of the "Edinburgh Medical Journal" (p. 289) distinguished between the two fevers; states that his colleague at the Glasgow Fever Hospital, Dr. Perry, was the first to differentiate between the petechial rash of typhus & the Roseola of S.F.
In 1846, Sir William Jenner published an analysis of the observation of 2,000 cases with 66 autopsies, the result of his experience at the London Fever Hospital. Among the 66 autopsies, 43 had either mesentric or intestinal lesions, but 23 had the same "anatomical sign" as Louis described. He further noted that the symptoms, course, pathological condition of the latter group were such as to at once place them in a different category to the others. He further noted the fact (from which he argued a different specific cause for each fever) that certain districts had 27 cases, others, cases of lymphatic fever.

Later, Buschheim confirms these statements. Driemeyer was of opinion that the S. T. contagium was not of so intense a nature as the typhus, that "it clieps more to the fascia," hence that using bed pans, privies, might tools previously used by the patient was more dangerous than his presence. He notes that the opposite is the case with typhus.
The subsequent observations and arguments of Ruff, of Bristol, Peacock, Wunderlich, and Schreiber ultimately led to the adoption of the theory of the duality of the disease, now universally held.

We have now cleared the way, by the statement of these necessary preliminary facts, for the consideration of a most important topic, which fails to be considered in the next chapter.
Chapter V. History of Indian Intermittent Fever.

In the sake of completeness in the treatment of this section of the subject, I have divided this chapter into three subsections:

(1) The general history of the disease in India;
(2) The history of its prevalence in India;
(3) Its occurrence in tropical warfare.

(1) General History of the Disease in India.

Until 1853, the general impression among the members of the profession in India was that no such disease as "dolentemente de Bretonneau, or the typhoid fever of Stewart & James, existed in the tropics. The writers on Indian diseases, anterior to the publication of the classical works of such distinguished writers as Annesley Martin, Twining, and Clark, were chiefly naval surgeons, of whom Johnson heads the list. The observations of these writers were necessarily restricted to descriptions of diseases encountered by them when in port, or within a comparatively short radius of the port where their ships were lying.
it even the not cases of "fever with bowel complication", many of which must have been cases of true S.A.

Dr. John Clark gave a most interesting account of the fevers which occurred in the H.E. I. C.S. ships from 1770-85. In the ship "Triton", after leaving Bengal, there occurred so much "fever" that the sick list was 60, when they arrived at the Cape of Good Hope. "In the beginning of this fever, inflammatory symptoms chiefly prevailed, frequently with bilious vomiting, but in its progress it changed into a typhus, or was succeeded by a phlegm. Now, it is not too much to suppose that most of the cases of the first group, which changed into a typhus, were cases of S.A. I do not believe that the malignant fever of such a severe type could persist under the healthful malaria-destroying influences of a sea voyage. And there is now little doubt that the disease described by various old writers as "ship-fever" was S.A. Again, it is not improbable that a section of Clark's cases were malarial.
for the change of air, diet, nervous
disturbance, consequent on a sea voyage being
undertaken, frequently induce an attack
of Ape in a Malaria-saturated subject;
moreover, Malarial Diarrhoea would be
most likely to appear to persist in such
cases, being kept up by a scorbutic cast.
Bilious vomiting is common alike to Mal-
arial & Enteric Fevers. The disease
would not have been Dysentery, for
Clark must have had a large number
of that in his student days & subsequently.
In 1784, seven ships, stationed at the
mouth of the River Ngushi (Mooshy),
lost 170 men, the fevers which
prevailed were fevers “all purely
attended with Diseased viscera.”

Lynes argues, in the “Indian Annals of
Medical Science”, that Charles Curtis
purport of the “Mooshy” friate described the
fever in India under the designation of
“bilious fever of flux.” The general tendency
of the older school of Indian physicians
was to describe fevers with reference to
the seasons — “ardent-fever” in the
hot weather, "bilious fever" in the rains,
"congestive fever" in the cold season.
The first were called "Continued
Fever", "Bilious fever" was termed
"Remittent Fever", although all three were
presumed to own the same cause.
In Sir J. Ranzey's work, published in
1828, he notes "Marks of Disease of
the small & large intestines" which were
"confined to their inner linings.....that
"especially the duodenum & termination of
the ileum are very frequently diseased
"in their mucous surface which is
"inflamed in patches.....studded
"with small ulcerations, particularly
"the termination of this ileum....in
"several cases, the ulcerations which are,
"sometimes, large & far apart, at other
"times, small & confluent, have nearly
"penetrated the linings of the intestines; in
"a very few cases we have observed the
"occurrence actually to have erupted and the
"contents of the bowel being partly expelled
"into the peritoneal cavity, having pro-
duced peritonitis."
Dr. Trench, also of the Indian Service, who wrote in 1835, on the River of Bengal, was well acquainted with the St. as the "typhus with abdominal complication" of Bright, or Bretonneau's "Pothinierie." Yet he asserts that "typhus is rare in India," speaking of fever (conjecture of the cold season, says "in a few rare instances") (of a continued fever resembling that of St. F.) "when the patient have diar" of protracted fever of the sort, superficial ulcerations of the mucous membranes of the intestines were found.... They reason for not defining that pathological condition a primary condition existing at an early period of the disease is that active purgatives may be required for a long time at the commence-ment without producing irritation. In fact they almost always afford relief, whereas we do sometimes find that active purgatives produce a degree of irritation at a late period, when a fatal termination takes place afterwards, ulcerations of the small intestine are
found in these subjects. If more extended observations should prove that these alterations of small intestine exist generally in the cases which terminate fatally, it is very possible that such a pathological condition is really

Draper he would be inclined to adopt De Bodo’s opinion that a peculiarity of this disease would be ascertained which combined with the exclusive (sic) prevalence of this race in the old season, its insidious invasion, obscure symptoms, slow progress, protracted course, attended with protracted delirium, the organic changes in its latter stage might establish a resemblance to some cases of European typhus, although the resemblance be not strictly correct in all its details.

*Footnote. Richard Draper used also to teach that in recent cases of typhus there is generally

constipation. The bowels should be opened; but in the disease (typhus with bowel complication) they are irritable, therefore give only 3/32 of castor oil, or you will convert the disease into one of marked typhus with abdominal complication, a far more serious condition.
Sir Ronald Martin, of the Indian Service, describes, in his work on the "Climate and Diseases of Bengal," a condition which he terms "Cholera Contagiosa Fever of the Cold Season in Bengal." It notes its insidiousness, its frequency; the fact that even the most careful Europeans are attacked, often after seeing, but more especially; the very gradual onset; the fulness of belly, intense headache, delirium. He ascribes the cause to "exhaustion of the liver by the hot season waves," noting that the intestinal mucosa is inflamed, ulcerated. The patients generally recovered if no severe abdominal complications occurred, but when a "generally lyticous condition" supervened, there was "great peril." He treated his cases by bleeding, calomel, Cal. Jactilis, followed by active salines, ordered total abstinence from food and cool drinks. One can only be thankful that we live under a happier, more enlightened order of things today, as this treatment does not quite accord with the modern
expeculant treatment of the disease. Prof. Maclean, late of Meltega, saw two
E. F. in 1838, in Madras City, and afterwards at Secunderabad, and in China.
Dr. Morehead, of the Indian Service, writing in 1843, says: "A state of ulceration of
the glands of Buber at the end of the disease also occurs in cases of typhoid remittent
with jaundice symptoms, just as it occurs in European Continuous Fever
with typhoid symptoms, similar bowel complications." In this writer's
first Edition, he altogether denied
the existence of the disease in India.
He was accustomed to classify cases
of fever plus Perierythral ulceration as
Remittent Fever. It is only fair to add
that thermometry was unknown during
his period of Indian Service, in the clinical
study of fevers. In the 2nd Edition
of his work on Indian Diseases, in his remarks on the admitted existence
of Indian E. F. in the India Office Sanitary
Reports for 1861, Morehead steadily
maintains that the malady was long of
rare occurrence in India. According to Sir W. Moore, Allan Webb, at Simla, was the first to mention typhoid in India in 1842, but he probably referred to the typhoid state. So also Kirk, who, in 1848, wrote: "At the termination of the monsoon (rainy season) in the beginning of the hot season, congestive enterotice fever is abundant all over the country." Here are described the periods of prevalence in a way no former writer had done. But it was Assistant Surgeon Scriver, of the Bengal Service, who, in September, 1851, at Meerut created a very distinct epoch in the Indian history of disease by publishing an account of three cases observed by him in Bijnor, to him belongs the exclusive honour of identifying the Indian S.F. with the true S.F. of Jaunpur. In a later paper, in 1857, he describes the details of 7 cases of which 6 died, and 6 alone recorded. 2 died on the 22nd day of the disease, 1 Physician alteration, etc.
occiptally in the lower part of the ileum, involving the upper surface of the ileo-cesal valve, was discovered. The mucosa of the gut was injected but not ulcerated, and the small intestinal menses were inflamed. 

R 02 was practically the same. R 3 had, in addition, ulcers with partially separated sloughs, + splenic + pulmonary congestion. 

R 4 had no diarrhoea, but had a distinct + typical rousel. He recovered. 

R 05 + 1 had well-marked Persian ulceration, + inflamed solitary glands. 

All these men came from the same regiment; while attending them, Dr. Sweeney suffered from slight fever, lassitude, headache, anorexia, + diarrhoea, which he attributes to the same medical causes. 

He concludes the paper by noticing the differences between Malaria, Relapsing, 

Sun, + Enzymic Fevers of India.

In 1855, Deputy Surgeon General Harwood of the Royal Service described 37 among the native prisoners in the Ajmere jail, in Rajputana. It was the first
to recognize the existence of true D.T. in natives of India,—a discovery made quite independently of Serrien's first discovery of the disease among Europeans in India.

Prof. Edward Jodrell, Calcutta, also of the Bengal Service, described the disease admirably in a Clinical Lecture given at Calcutta in 1858, noting the mild onset, long duration, slowly progressive and insidious character of the symptoms. He cites 7 cases: (1) 15th convolution + elapsed between the 35th + 40th day; (2) 25th to 30th day; (4) 15th - 16th—probably longer; (5) 22nd; (6) 25th - longer; (7) 2 months, + 8 days. In cases 1, 3, 6, there were typical look (as in all the cases) + intestinal hemorrhage. In all, there were adynamia and nervous disorders. Pneumonia was uncommon. (Jenner says, "à propos" the rash, that it is often absent, than present in patients over 30 years old. West observes it but seldom in young children. The number of spots varies from 20 to 50 in Europe.)
These observations were supplemented and confirmed by Lyons, Hoppett, Mascay, O'Brien, Barclay, Clyburn, Greene, and others, of the Bengal service, mainly, in the Bombay Presidency, Surgeon-General Sir James A. Hambury, Surgeon of the 33rd Foot, at Dessa, in 1859; Peet, in Bombay City; and Madras Presidency, Surgeon-General Cornish, Rankin, and Jordan (in his "Report on Dysentery Fever in the Madras Command" issued by the Government of Madras in 1878). Murray, at Bangalore; all enriched the clinical and pathological knowledge of the Indian disease subsequently.

In 1861, P.T. first appears in the official returns; 74 cases are reported from Bengal; 2 from Madras; 1 from Bombay. From this period till the present, it has never been absent from the returns. Though the amount of cases fluctuates considerably, the admission of P.T. to a place in the Returns was largely due to a paper by that very eminent statistician, Dr. Byrdin, then Secretary to the Surgeon-General.
of the Indian Forces, which was entitled "On all lengths of service as affecting the sickness, mortality, invaliding of the European Army in India."

In 1869, Surg. Major de Rozy, 92 of the Bengal Service, noted many cases of E.T. as occurring among native prisoners in the last half of the year, "first in villages; that its severity did not vary concomitantly with that of the famine then prevailing, hence distinguishing it from Relapsing Fever. It affected more the native women than the men (p. 154), because they spent more time in the house and larger doses of the poison from the contaminated and water in the dwellings' vicinity.

And again (in the "Report of Measures adopted for the Sanitary Improvement of India from June 1869 to June 1870") it is stated (p. 60) that out of a total of 91 deaths from "fever", more than one-third, i.e., 35, are ascribed to E.T.

Footnote: Dr. Austin says that this is the special epidemic of humurous, conservative, rural districts."
Conversely, Dr. Surgeon Curran—who "made Indian fevers a special study"—reports that during the 15 years he was in charge of European military hospitals at large stations in nearly every part of India, he only saw one true case of S.T., that was at Jaurree, a hill-station in the Punjab.

Prof. Chevers, of the Bengal Service, stated that, in 1866, the splendid pathological Museum at Calcutta only contained 9 preparations of S.T. lesions,—two from Mr. Sivin, one by Laidwell, & three by himself. "Thus 120 beds in the largest hospital in India from 1869 to 1876 only gave 9 cases." 35. But I would here point out a fallacy, which is ignored in the above account by these writers. Many cases of S.T. recovered having been treated as Remittent Fever of a malignant or typhoidal type; many that died, probably of true S.T., were not allowed to die.

Chevers goes on to say that "if this disease has long been common in India, it
is a very extraordinary fact that several of our best most careful observers should have met with so little of it, although they sought it diligently in the light of home experience. (Then he introduces the question of the "personal Syphilis" - always a dangerous practice. He would question that such a man as Bright, for example, or any other of the "illustrious dead" of the profession who lived before Jenner, Stewart, \\
Serres elucidated the subject, were among "our best most careful observers" within day \\
and generation. But it is not given to all to be discoverers, nor was it given \\
to Twining, Herschell, or Annesley to be the differentiator of Indian "st.\\nThese observers did splendid work when they pointed out the frequency of cases \\
of fever with typhoid symptoms, of bowel lesions, cleared the way for the "renoncement" by Scribner in 1835.) Chevres, in 1866, states (p. 130) that he only saw two distinct outbreaks of syph. in \\
27 years service in Bengal, I after...
occasional cases in the wards, in private practice, says "that the impression of the profession in Calcutta was that St. had increased its consequence."

The great system of underground sewerage in that city: Calcutta.

Bombay, being of course, sewered as the dry earth system for such large cities is impracticable.

In 1880, Dean Surgeon General Pookerton Bombay, says that St. has existed there for over 50 years as "twenty-one days' bed Bombay fever"; that, among the natives, under the name of Remittance, or simply as "fiver," it causes great mortality all over Bombay Presidency. The further history of the disease will be found in the next sub-section.

(B) History of the Prevalence of the disease in India.

It was first drew attention to the great amount of sickness & mortality from this disease, pointed out the significant fact that the ratio of "fiver" mortality (in the Press) of last year, if taken in relation to months newly-arrived
represent is nearly absolutely identical with that of E.F. at the present time. That is to say, that the bulk of fatal fevers in India is, has been from the first, enteric in nature.
It is here to be regretted that the returns, in many instances, have been vitiated to a great extent by those in authority practically insisting on the adoption of their personal views by their subordinates.
For instance, a few years ago in one of the Presidencies, all Medical Officers were hindered from returning any case of EA as such, no matter as the Principal Medical Officer of that Presidency held that no such disease as EA existed in India!! "An contrary", another P. R. O. ordered all cases of fever to be returned as EA, which, at the autopsy showed alteration of the bowels. And another Senior Medical Officer ordered that all cases of fever lasting more than three days should be returned as E.F.!
Thus, a serious discrepancy must exist in some returns of E.F.
Since first the disease was allowed a place on the official returns in India, there is to be noticed a marked access of the number of cases during the later as compared with the earlier years. This results from the gradually improving diagnosis and differentiation of fevers into their proper categories, rather than to an actual increase.

Up to the year 1868, E.T. is given in bulk for each Presidency, with no information as to its prevalence or otherwise at stations or in corps, etc. Between 1859 and 1868, the main defects noted were bad sites of barracks, the existence of cesspits, an indifferent water supply, bad drainage, the danger from the proximity to native villages, towns, & bazaars, with all they entail in the way of bad sanitary arrangements surrounding, liability to air & water contamination from surface ordure, the communicability of the disease by contagion. The main improvement of this period are new barracks,
The introduction of the dry earth system of conservancy in Bengal and Bombay, but hardly at all in Madras, improved drainage of several stations. The water supply, chiefly by wells, with the dangers inherent to that system, and the dangers from the surrounding native communities remain practically unaltered.

This report on the prevalence of E.T. in India (in the A. M. D. Reports up to 1876), Surgeon-Major Blyden stated that: "it is a matter of popular observation that no regiment or battery escapes (E.T.) in its first year, whatever cantonment of India be selected. Out of 73 Regiments and Batteries, which arrived in India between 1871-72, 9 only remained free from E.T. in the first year after landing." In the same report, the comparative prevalence of the disease in the following stations and countries is thus stated, per 1000 of average strength:

<table>
<thead>
<tr>
<th>Station</th>
<th>Home</th>
<th>Bengal</th>
<th>S.ibrattar</th>
<th>Malta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Died</td>
<td>24</td>
<td>1.53</td>
<td>.89</td>
<td>1.57</td>
</tr>
<tr>
<td>Admitted</td>
<td>99</td>
<td>3.75</td>
<td>4.04</td>
<td>4.72</td>
</tr>
</tbody>
</table>
From 1870-77, the admission rate, in India, fluctuated between 2.8 & 4.6 per 1000; the mortality of those attacked varied from 50.88 to 39.149, or a mean of 43.73. In the Sanitary Commissioner's (with the Government of India) Report for 1877, 233 cases of M.T. are reported, of which 92, or 39 per cent., were fatal. The admission rate was 4.1 per 1000; of these 2.45 p.c. occurred at under 24 years of age, 1.55, at 25-29 years of age; and .99, at from 30-34; 0 per cent. occurred after that age. This resembles British India. In 1878, 132 deaths from L.T. were reported; 90 occurred in men under 22 months' service in India. The admission rate rose to 5.5 p.c., or almost double the highest rate recorded during 1870-77. It continued high during 1879 (viz. 8.0), and during 1880 (7.9); the death-rate, per cent., of those attacked remained much the same as it was during the period 1870-77, for it varied from 43.01 to 46.17, or a mean of 44.72. This increase was mainly due to the Afghan
War (1878-79-80), which, like all other campaigns, by its conditions provoked much the prevalence of S.F.

During 1881, the admission rate again fell suddenly to 5.6, but the percentage of deaths somewhat increased (47.26).

In the Report of 1883, the Surgeon-General with the Government of India says: "The tendency to return an increasing number of cases of continued fever as S.F. has been frequently noted in former reports... and this still continues. In "The Army of India, 429 cases of fever were recorded as 27, against 357 in "1882," i.e., 7.7 per mille of admissions for 1883, as against 6.2 per mille for 1882. There were 133 deaths from S.F. in 1883, or 2.4 per mille as against 2.55 p. m. in 1882. Therefore, S.F. in 1883 was more prevalent, but less fatal, than in 1882, when it stood first as a mortality-producer in all three Presidencies.

The percentage of liability was greatest among soldiers under 25 years of age, the
mortality was 4.34 among them, for men between 25-9, it was, respectively, only 1.5-0.1. 
In 1884, it headed the list as far as progress to the largest proportion of death in the Indian Army. The mortality was 3.31 in Madras, 2.05 in Bombay, 1.67 in Madras, all of which exceeded the usual rate of death. The Surgeon-General writes: "As far as the indications of statistics are to be relied on, the truth is that if the fever now called Intercis is really specifically distinct from natural fevers, they have always been so, though they have escaped observation, and probably not to be regarded as a newly-introduced disease into India. It was, indeed, long suspected that a more careful observation of fevers, stimulated by the indirect action of improved and accessible instruments of research would result in the separation of some of their forms as distinct which were formerly regarded as the same."

<table>
<thead>
<tr>
<th>Year</th>
<th>Bengal Admissions</th>
<th>Bengal Deaths</th>
<th>Total</th>
<th>Central India Admissions</th>
<th>Central India Deaths</th>
<th>Total</th>
<th>Madras Admissions</th>
<th>Madras Deaths</th>
<th>Total</th>
<th>Bombay Admissions</th>
<th>Bombay Deaths</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870-79</td>
<td>5.3</td>
<td>607.3</td>
<td>612.6</td>
<td>2.28</td>
<td>1.74</td>
<td>4.02</td>
<td>3.9</td>
<td>266.5</td>
<td>270.4</td>
<td>1.42</td>
<td>0.62</td>
<td>2.04</td>
</tr>
<tr>
<td>1880†</td>
<td>8.7</td>
<td>809.6</td>
<td>818.3</td>
<td>3.0</td>
<td>2.66</td>
<td>5.73</td>
<td>2.6</td>
<td>450.1</td>
<td>452.7</td>
<td>1.36</td>
<td>0.39</td>
<td>1.75</td>
</tr>
<tr>
<td>1881†</td>
<td>6.3</td>
<td>763.9</td>
<td>770.2</td>
<td>2.62</td>
<td>0.81</td>
<td>3.43</td>
<td>0.9</td>
<td>278.7</td>
<td>279.6</td>
<td>0.58</td>
<td>1.19</td>
<td>1.77</td>
</tr>
<tr>
<td>1882</td>
<td>7.3</td>
<td>600.0</td>
<td>667.3</td>
<td>2.9</td>
<td>0.77</td>
<td>3.67</td>
<td>4.0</td>
<td>171.5</td>
<td>175.5</td>
<td>2.09</td>
<td>1.27</td>
<td>3.36</td>
</tr>
<tr>
<td>1883</td>
<td>8.1</td>
<td>489.4</td>
<td>498.8</td>
<td>2.52</td>
<td>0.44</td>
<td>2.96</td>
<td>8.6</td>
<td>128.4</td>
<td>137.1</td>
<td>2.28</td>
<td>0.28</td>
<td>3.14</td>
</tr>
<tr>
<td>1884</td>
<td>12.6</td>
<td>682.8</td>
<td>695.4</td>
<td>3.31</td>
<td>0.36</td>
<td>3.67</td>
<td>11.4</td>
<td>168.0</td>
<td>177.4</td>
<td>1.67</td>
<td>-</td>
<td>1.67</td>
</tr>
<tr>
<td>1885</td>
<td>14.0</td>
<td>611.0</td>
<td>625.0</td>
<td>4.05</td>
<td>0.60</td>
<td>4.65</td>
<td>6.4</td>
<td>149.4</td>
<td>155.8</td>
<td>2.19</td>
<td>0.19</td>
<td>2.38</td>
</tr>
<tr>
<td>1886</td>
<td>21.6</td>
<td>490.5</td>
<td>512.1</td>
<td>5.7</td>
<td>0.99</td>
<td>6.69</td>
<td>11.9</td>
<td>259.8</td>
<td>271.7</td>
<td>3.85</td>
<td>0.89</td>
<td>4.74</td>
</tr>
<tr>
<td>1887</td>
<td>13.4</td>
<td>449.7</td>
<td>463.1</td>
<td>4.09</td>
<td>0.76</td>
<td>4.85</td>
<td>11.5</td>
<td>203.6</td>
<td>215.1</td>
<td>2.98</td>
<td>0.57</td>
<td>3.45</td>
</tr>
<tr>
<td>1888</td>
<td>16.2</td>
<td>427.1</td>
<td>443.3</td>
<td>4.15</td>
<td>0.34</td>
<td>4.49</td>
<td>7.4</td>
<td>302.8</td>
<td>310.2</td>
<td>2.26</td>
<td>2.19</td>
<td>4.45</td>
</tr>
<tr>
<td>1889</td>
<td>25.8</td>
<td>396.4</td>
<td>422.2</td>
<td>6.68</td>
<td>0.47</td>
<td>7.15</td>
<td>16.2</td>
<td>453.9</td>
<td>470.1</td>
<td>4.48</td>
<td>1.9</td>
<td>6.46</td>
</tr>
</tbody>
</table>

† excluding troops on field-service in Afghanistan.

The period 1870-79 includes troops on active service, I on the march.
This is supported by a glance at the Table opposite, which shows that the total mortality from all forms of fever does not materially differ from what it was several years ago, this is hardly compatible with the view that a new fatal fever—which came people supposed—Indian F. had been recently introduced into India.

In 1885, it is shown that, while the percentage of admissions from ague remained unchanged, that the increase from F. is exactly compensated for by a decrease in that of Remitted Simple Continued Fever. An increase was to be noted in the case of the Royal Army.

In 1886, there occurs, in the Reports, a summary of the views held by Medical Officers as to the frequency of F. in India. They are as follows:—

1. F. is the principal fever of India along with Ague & Simple Continued Fever, some of the cases returned as Ague & S. Continued Fever are in reality mild cases of F.
(2) There are separate diseases called E.F., Recurrent Fever, Simple Contained Fever, & Ague, the differential diagnosis of which is, or will be, possible from patience, perseverance, and increasing knowledge.

(3) There are cases which can easily be recognised respectively as E.F., Recurrent Simple Contained Fever, & Ague; but the difficulty of diagnosis when it exists corresponds to the reality that these affections shade off into one another, being due to one "causa constans", influenced by different circumstances.

(4) There is little or no European E.F., but a fever with catarrhal follicles, inflammation, ulceration of intestine is common, — an E. F. but not the E.F. After perusing this, one feels tempted to explain "quot homines, tot sententiae!"

In 1887, there was a fall both in the admission — & death — rate all over India (v. Table).

In 1889, the death rate from E.F. increased by 2 per 1000 over that of 1888 (6.11 p.m.)
the admissions by over 9 over 1888 (22.9 p.m.). Bengal came highest; Madras lowest for both admissions and deaths.

The great increase during the four previous years of non-enteric fevers in the Madras Army was due to the occupation of Upper Burma, which belongs to the Madras Presidency.

Bareilly, in Bengal, and how, in Bombay, had the highest admission + death-ratios; Bareilly being 77.9, admission rate, + 23.7, death-rate; Khairah, 75.4, admission rate, + 17.89, death-rate.

But of 27 per cent. of cases treated at Bareilly died, + 23.73, p. e. at Khairah.

The lowest ratios were at Fort William, close to Calcutta (0.9 admissions, 0.0 deaths), and Belgaum (1.8 admissions, + 0.88, death-rate: 20.83 per cent. of the cases treated).

The Report for 1889, which is published in 1891, is the last issued, one so far.

There are no further statistical information to be had till the issue of the next Report that for 1890, about April, 1892.

At various times, Committees have
been appointed to investigate into the prevalence of F.T. amongst troops in India, its causes & prevention. The most recent, and one of the most important of these is that of 1887, appointed by the Government of India to examine into & report on the subject. It was composed of Surgeon-General Sir Benjamin Simpson, M.D., C.C.E.E., of the Bengal Service; & Sanitary Commissioner with the Government of India; Surgeon-General W.A. Thomson, M.B., Army Medical Staff, P.M.D., R.M., Forces in India; Deputy Surgeon-General J. Richardson, M.B., Bengal Service, Sanitary Commissioner of the Central Provinces; Surgeon-Major J. D. Cunningham, M.B., M.C.S., Bengal Service, Professor of Physiology, Calcutta. They found a great diminution in the prevalence of the form of Recurrent & (continued) FEVER in Bengal had occurred, as the period of 11 years, from 1877-87, showed a decrease in its average admission rate of 28 per cent when compared with the previous 11 years.
But that, during the same period, an increase of over 50 p. cent had occurred in the prevalence of S.T.

The prevalence of the proof, of S.T. alone, exhibits periodic fluctuations manifesting themselves over widely extended areas, due to the incidence of widely different factors, the principal of which appear to be variations in the number of especially susceptible population + cyclical variations in climatic conditions.

With regard to the mortality from fever:

(1) From 1880-88 there is an increase in the average death rate as compared with the previous 9 years, amounting to 1.01 p. cent of average strength.

(2) During the same period, an very great increase in the rate of mortality ascribed to S.T. has occurred — 70 p. cent.

(3) There has been a simultaneous decrease of 40 p. cent in the mortality ascribed to Remittent + Simple Contagious Fever.

(4) The death rate from S. T. has diminished greatly in comparison with the admission rate, indicating an apparent alteration in the character of the disease.
looking to the figures alone, they indicate a
sudden decrease in the prevalence of, t
slightly increased mortality from the
cholera, very greatly diminished prevalence
of Remittent & J. Continued Fever, slightly
increased prevalence & diminished severity
of St. The figures regarding admission
& death-rates furnished by individual towns,
during the last decade, are hardly ap-
licable save as the result of a
mere change in nomenclature, of a
mere redistribution of a total into
parts of different proportions. This
has been rendered necessary by improved
or altered diagnosis.
In the beginning of 1869, while the
commission was siftig the evidence
at their disposal, a most important
epoch in the Indian history of the
disease occurred. Specimens of pleu-
rescentic fluids from two typical
cases of St. were sent to Prof. Ban-
hard Fischer, of Kiel, an eminent
bacteriologist, who reported that he had
found the specific "Bacillus typhosus."
in all the specimens sent to him. It will be shown in the next chapter that a very considerable majority of the best European bacteriologists agree that Sherrill's bacillus occurs in all cases of true S.F., with the exception of a very few in which they cannot be found because of technical difficulties, but because, probably, the bacillus does not last as long as the disease which it originated. And this bacillus has never been found in any other disease. So the conclusion is now practically certain that at least some of the fevers of India with bacillosis are identical with European S.F.

Of course, for the complete and final solution of the question, skilled bacteriological examination of many cases will be required to show if it obtains for all S.F. Surgeon-Major Rankin, of the Bengal Service, isolated, in 1899, from the albuminous urine of a patient convalescing from S.F., a Bacillus which cultivated in glycerine agar-agar.
for 57th, showed the characteristics of "Bacillus typhosus".

The constant association of this Bacillus with the disease — in the absence of animals which take it — makes it all but certain, an opinion shared in by the best European bacteriologists, that it is the "vera causa" of the disease.

(4) A Short Sketch of the conditions of tropical campaigns in reference to 57th Surveyor Major Duncan, of the Bengal Service, in his classical work on "The Prevention of Disease in Tropical Campaigns," recognising the impossibility of gathering the precise extent that 57th have played in tropical campaigns, notes the absence of separate returns for 57th in the Chinese War (1860), Abyssinian (1867), Suhoi (1871), Ashante (1873), Sunji-hia-wu and Malay (1874-6), Afghanistan (1878-80), Zulu (1878), Natal and Transvaal (1880), in Egyptian Wars (1882), all fearful having generally been returned as "furs" or "malarial furs." He says, "in the" "only campaigns in which the question"
is returned to at all are the New Zealand, "Natal, and Egyptian. In the latter, from"
were divided in the case of troops from
England into "contiguous" or "paroxymal,"
whilst Dr. Colin Smith furnished an
ideal return for the Indian expeditionary
force—viz., "febrile, 'malarial', 'f"
"tropical'. ... This coincides with the French"
German, and American mode of classifying"
fevers. The French returns were so definite
that Virchow was able to show that of
the 12,253 cases fatal in the Franco-
German War, more than on-half succumbed
to abdominal typhus! And from the
returns of the German Army for the same
campaign that 'abdominal typhus'
is the only disease of great importance
by reason of its signal influence on mortality.
I have quoted this to emphasize the
fact that S.A. is the most important
disease when campaigning in a malarial
province. If this was so at the scene
of the Franco-German War, a fortiori
it will be so in the Tropical Campaigns
we are so frequently involved in.
In conclusion, which obtained in the (1888) Sackin Expedition -- one most recent extensive operations in an enemy's country, will best serve as illustration of how it may be introduced, thrive under the conditions of warfare.

A picked force of 8,000 Europeans landed in perfect health. Before proceeding to the front were daily inspected by medical officers to weed out all doubtful material; the sick were all left behind at Suez.

In two months from this time, E.F. was raving among this body of men, 1 of a most virulent type.

The conditions were: great solar heat, camping on a virgin-soil in the desert of sand -- which, containing no clay, would possess no deodorizing or disinfecting constituents; the dry earth system was carried out by digging trenches. Owing to what was most of the prevailing wind, but which occasionally changed, swept the camp with foully-tainted air.
Later, the camp had to be formed up closer to reserve a smaller circumference to the Arab attacks, hence there arose an unavoidable overcrowding. The native contingent had a scavenger establishment—the men's cash forbidding them to dig trenches for the reception of even their own excreta; but the British troops had themselves to dig their own trenches, and there were but few men available for this duty; hence it was imperfectly done in many cases. Sometimes the ordure trenches would remain open with ten days' night soil in them, hence there arose a foul odour. The men, therefore, went anywhere but to the trenches, and thus the dump became foul all over. The house a few ambulatory cases, or mild attacks (indistinguishable from diarrhoea by the men whose shoes they would not probably apply for treatment), or commencing cases who had acquired the disease in the filthy town where they marched into the
desert with the disease incubating in them.) Would cause much screaming.

Again, strong sea-breezes in hot sun desiccated the soil, if this was inhaled, or got on to the food, or into the drinking water. Add to this the intolerable stench from the numerous dead, partially buried, or unburied, decomposing transport-animals, one has a vivid picture of the utter misery disease-producing pestilential conditions of this campaign, which resembles in its main features others elsewhere. The "gareebas" (i.e., four-foot-high thorn-fences placed round a camp as a barricade against sudden Arab attacks) were also the source of much ill, as they were occupied for a long time, the soil got terribly polluted, as the latrines were only a few yards outside the fences to prevent the men getting cut off by small band of Arabs. The more distant these gareebas were from making the realtives they were.
because they had been occupied a much shorter time than those nearer the base of operations at Sackim. As to the good of water, there were complaints that the water was very bad. Sea-water was distilled by "displacement," from the upper heat, in addition, the condenser was too rapid, whereas sea-water passed over uncondensed into the receiver. This water was stored in canvas iron tanks, tannin because very hot from the sun's rays beating down on the tanks. This would cause, or help to set in the fermentation of any decomposable matter in the water.

The bread supply was bad, the flour being of very poor quality, baked in foul bakeries by dirty bakers (among whom all these circumstances, it is not to be wondered at that 27.5 percent among the troops was encouraged, that where they went it accompanied them. From as predatory being agents, intense tropical heat intensified by the sand's radiation, reflection, overloading;
indifferent food, water, very heavy and exhausting duties, disturbed nights from Arab attacks; a foul atmosphere reeking with decomposing organic matter. Add to these the specific form, introduced from places like Suez, where it always exists symptomically, the result is a virulent and widespread epidemic of DF. It would be insufficiently redundant to cite further instances in support of the terrible frequency of DF in our tropical campaigns, so I now proceed to consider the views on the etiology of this disease in Europe for the purposes of comparison, application to India later.

The theories stated in the ensuing chapters would, I suppose, equally apply equally to India as to Europe; but, in the chapters following, I intend more fully to deal with what have been considered the more essential causes of this disease in that country.
Table of Percentage of Enteric Fever cases at different age-periods (Murchison's)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 5 years of age,</td>
<td>0.98 per cent. occurred</td>
</tr>
<tr>
<td>From 5-9</td>
<td>9.44</td>
</tr>
<tr>
<td>10-14</td>
<td>18.16</td>
</tr>
<tr>
<td>15-19</td>
<td>26.86</td>
</tr>
<tr>
<td>20-24</td>
<td>19.69</td>
</tr>
<tr>
<td>25-29</td>
<td>10.15</td>
</tr>
</tbody>
</table>

Thus one-half (46.55 per cent.) were between 15 & 25; more than one-seventh were over 30 years of age.
Chapter VI - Views of the Etiology of the Disease in Europe. This chapter naturally divides itself into two parts: (1) the predisposing and (2) the exciting causes of the disease.

(1) The Predisposing Causes:
   (a) Age susceptibility;
   (b) Sex;
   (c) Arrival in locality;
   (d) Atmospheric constitutional condition.

(a) Age susceptibility: It is shown that persons under 30 years of age are more than four times as liable to S.T. than those over 30. The mean age of 1772 cases admitted into the London Fever Hospital during 10 years was 21.26. The reason assigned is that at this age (i.e., under 30), the lymph structures of the foot are in their most complete (anatomically) and most active (physiologically) condition. Peir's glands are the satellites of the intestinal lymphatic system spread out for absorption. After from 40 to 45 years of age, they...
Dr. Collie's Statistics (based on 3,523 cases of Sibric Fever in the London Fever Hospitals) on the relation of age to Sibric Fever susceptibility.

<table>
<thead>
<tr>
<th>Age</th>
<th>Percentage of Cases of Sibric Fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 14</td>
<td>22.60</td>
</tr>
<tr>
<td>15 - 19</td>
<td>25.00</td>
</tr>
<tr>
<td>20 - 24</td>
<td>26.80</td>
</tr>
<tr>
<td>25 - 29</td>
<td>9.75</td>
</tr>
</tbody>
</table>
are normally, just apparent, or have almost disappeared.

Iosan records having seen characteristic lesions in a woman aged 64; with in a woman aged 70; tater observers at 72, 86, + 90 [name].

These exceptional cases are explicable from the absence of functional activity of glands, being prolonged for an indefinite period of years beyond the usual term of their existence.

And going to the other extreme of life, we find Mantin recording a case in which he found 87. lesions in a 7 months fetus (!), a few cases have been recorded of death from this disease during the first few weeks of life. Still these are rare exceptions.

Dr. Justice Smith, 1906 states that 87 is common in children, but usually runs a mild course, death being very rare.

"During the first five or six years of life children become less susceptible to the typhoid poison than at a later age" (p. 74)."

I have seen it frequently in native
children in India from the age of 2 up to 14 years.

61 Sex susceptibility. There appears to be no marked preference in reality. And this is Marchion's opinion. It has been stated that women, being more at home, are exposed more to endemic influences. There, I hence suffer more. But there is little or no proof of any part on this point. On the other hand, the statistics of nearly every fever hospital show the preponderance of male cases over female, but it is urged against this that the proportion of men attending at all hospitals for admission is much larger than that of women. To this I demur. On reflecting on the cases of Whitmore fever I treated in the two years of practice that I had in Britain before joining the Service, I should be inclined to say I treated about eight women to every man for ST. This is, of course, far too narrow a basis for exact observation, but I give it as my impression in the matter, and I treated a considerable number of ST cases.
Liefermeister asserts that pregnant or
infantile women, those nursing infants,
are relatively immune, but Nathan
Smith 107, on the contrary, states that, while
both sexes are equally liable to it, more
women succumb to it, because of its
appearance during pregnancy or in the
puerperium. It has been suggested
that some of these cases might be
infantile fevers of typhoid type, but
here again we want more than suggestion.
We want clinical records of cases.

2. Arrival in an infected locality.
Andral long ago stated that medical
students coming to Paris from the country
were almost certain to take S.T. and
I also note this.

Louis 75 points out that S.T. is very common
in towns, but rare in the country districts.
He notes that country people, coming to reside
in town, suffer largely from it.

Conversely, those inhabitants of a
locality who have resided there some
time, enjoy a relative immunity.

In Paris, Louis examined 129 cases
with reference to this point, though 73 had not resided in Paris longer than ten months, of that, in 102 cases, they had been less than 20 months there. Liebermeister notes the same thing. Murray states that, in the London Fever Hospital, 21.84 per cent. of the S.F. cases had been resident in London for less than 2 years; most of these came from the provinces, where in good health & comfortable circumstances at the time they arrived in London. A large proportion of cases were attacked within a few weeks after changing their residence from one part of London to another.

This point is, in my opinion, of the utmost importance with regard to Indian S.F. (d) Depressing physical or mental conditions play an indeterminate part in Europe at least; in India, in fever, etc. have not been proved to predispose. Indeed, S.S. seems to have, like Cholera, a preference for strong, healthy indiv.
idials, to avoid the sufferers from chronic ailments, & weakness.
As to seasonal prevalence, most authors agree with Vecchioni that S.t. is unusually prevalent after summers remarkable for their heat & dryness; that, in wet summers & autumns, it is rarer. Hirsch contradicts this & states, by comparison of a large number of epidemics, that the disease occurs almost as often in cool as in warm summers & winters.
Warme, damp weather, when the drains are offensive, is, however, the most favourable season of all for the spread of the disease.
The main theories are (a) the ground-water theory; (b) the hydroscopic; & (c) the specific.
(a) The ground-water theory of Poffenrother.
The author of this theory noted the apparent significant fact that, in Munich, there appeared to be a close relationship between the height of the ground-water & the number, type, & fatality of S.t. cases.
When the ground water was lowest, out-
breaks occurred of S.T., this was
especially so after a rapid fall, which
had been preceded by an unusual
rise. The other necessary conditions
are soil-impurity from animal infestation;
a certain temperature; the entrance of
specific forms. "But these alone are
not sufficient to explain the occurrence
of S.T. epidemics without any help from
such an accident as the level of the
ground water." 85

Virchow supported Pettenkofer's theory
by the statement that the mortality,
mainly in infants under one year old,
was greatest in July and August, when the
ground water was lowest. There are
two objections to this statement of Virchow's
being taken in serious support of the theory:
(1) it is not stated what the increased mortality
was from; (2) it appears true that,
as the mortality was chiefly among
infants under 1 year old, the cause
of death could not be S.T., as children
at that age are practically immune,
owing to their undeveloped Persian habits, they are fed at the breast. In opposition to Pettenkofer's theory, Rankin pointed out that no E.T. resided in the vicinity of Munich except that imported from Munich, although the soil and water conditions were similar in Munich and its environs. The soil was a fine sand with great power of retaining, but not destroying, organic matter, cesspools were very common from which Rankin says, 90 per cent of their contents escaped into the surrounding subsoil, and surface soil. The streets were well-paved, hence the houses became the sole or main outlet for the poisonous gases from the soil. Siehler considered that the E.T. in Berlin is due to contaminated water alone, that the soil-wasting is an accidental and unimportant matter. Roth supports him, and remarks on the subject of Pettenkofer's denial that drinking water was an inadequate medium for the spread of E.T., "how can
a poison developed in the ground, during
the sinking of the ground water, avoid
getting floated into the ground — or
spring — water?

Pettenkofer denied that the connection
is indirect, so says that the drinking
water was analysed, proved good.

Here is another fallacy: it was not
examined bacteriologically, hence the
analysis is practically valueless.

In England & Scotland, the connection
has not been traced, as in some
epidemics the ground water has been
rising, not falling. Todor notes that
at Buda-Pesth, the rise of mortality
from St. accompanied the rising of
the ground water. Sir Wm. Moore 78
notes that St. & Cholera prevail whether
the ground water is 8 or 800 feet from
the surface (p. 276). Dr. Buchanan
quotes a case in which the sinking of the
ground water was coincident with the
occurrence of St., but it was "mere
accidental" for the cause of the epidemic
was found to be drinking water contami-
nated by S. F. Vaccinations.
Parks noted that in Britain, where drainage has lowered the level of the ground-water, ST. has not increased, because a pure water supply has been introduced from a distance. Again, the greatest prevalence of ST. in Britain is from August to November, as shown by the various local statistics, and also by the "Buchan Mitchell curve" based on the London mortality rates. There has thus been adduced a good deal of evidence which does not, after its consideration, promote feelings of confidence in the ground-water theory. Yet such a theory should never be lost sight of, as it may help in the elucidation of an otherwise obscure epidemic. Personally, I have no confidence in it whatever.

(6) The Pythogenic Theory. This is a theory believed in by a large number of sanitarians, but there seems stronger more convincing evidence ranged on the side of the Specific Theory.
lucky, both specific phthisic or have
the same practical outcome, the
rendering harmless of human microbes.
If they are from an ST case especially.
But the phthisic theory are closely associ-
ated with the names of Koch, von Feuer,
it's abscess fever--Kuhn, advocates.
The term "phthisic" signifies "born
of putrefaction"; the theory asserts
the power of water, air, food, clothes,
or other media, when contaminated
by zymotic exhalations from normal
human or animal "blood," to produce
ST. after reception, or contact with blood.
This is apparently caused either by the
creation of a specific poison inside the
patient's body "de novo" or by
the fermentation of the ingested substance.
The arguments which served for the
demolition of Liebig's theory of spontaneous
generation suffice for the destruction of
the "de novo" theory, his nihilism, while ful.
The fermentation theory is not so easily
discharged of.
ho admitted by contagious fever disease
our orients in any other way than by contact with emanations from the sick, hence S.T., being a contagious disease, can be spread in no other way. Murchison's term for S.T. was "flea-borne of putrefaction"; he thought the poison was some decomposing animal product. And one might even coin an aphorism thus: Malaria from decomposing vegetable matter; Scarlet fever from decomposing animal matter.

Let us now try to consider the "modus operandi" of S.T. Normal stools, or being passed from the human body, if left unimpeded by disinfecting solution, gradually become particular — more quickly so if passed in the liquid condition, as in the case of a slight non-specific catarrhal attack from some more or less trifling digestive derangement, dietary error, or from chill. The drying up process leaves the fecal particle composed of an outer fibrous coat, a more or less fluid envelope, shielded from the oxygenating action of the atmosphere.
In this nucleus of fecal matter, it is likely that archetypal metathrombic, the formation of new chemical substances, occur. These may be produced by the presence of bodies in the particle which react chemically on one another, or by the action of imprisoned organisms on the nitrogenuous constituents of the particle (for micro-parasites swarm in even healthy human feces), producing ploasmaes or animal alkaloids. In the bulk of the forms present may be saprophytic life in the dead organic matter, producing, in the process of preparing their food for absorption, new compounds.

This fecal particle may again find its way into the human body by some of the common media—air, water, food. The imprisoning shell will be dissolved by the person’s digestive juices, the chemical

*x should not be taken to term such compounds “chemoamines,” for ploasmaes are produced by the action of fungi on living animal humic. Most animal alkaloids produced by putrefactive decomposition belong to this miscellaneous group, which is produced sterically. Bondard found that the ploasmaes, actually present in urine, were notably increased in E. coli, were mostly chemoaamines.
substances already formed inside the shell will be free to act on the system, if absorbed, if not prevented from doing so by the antisepctic bile, or other digestive juices' chemical action on them; for the mere presence of a strongly acid or alkaline medium, as in the stomach and intestines, may determine the formation of fresh chemical compounds, and the new bodies may be either active or innocuous in their action on the human body.

Now this is more or less pure hypothesis, but it is at the same time a likely enough "life history of a fecal particle"; it is the appreciation of such possible changes that has founded the Pathogenic Theory. But that such chemical bodies or non-specific organisms can produce true T, I cannot believe.

Let us glance briefly at the action of decomposing fecal matter, introduced into the system by drinking water. When this has occurred a train of
symptoms has been observed, commonly
comprising one or more of the following:
headache, sickness, listlessness, marked
depression of spirits, pyrexia, vomiting,
vomiting, abdominal pain. These
are mostly signs of the action of either
an irritant poison, or a nervous tonic.
A prolonged course of exposure to
the inhalation of an atmosphere, in the
bathing of tainted water generally confers
a degree of tolerance, which may
mean, in the case of the nervous
system, a general functional depression;
condition of lessened sensitiveness for
reaction to, that particular form
of poisonous substances. In the gut,
it too often produces a condition
which highly favours the incidence of
morbific organisms, for, by deranging
the alimentary functions, it causes
vitalised secretions to be poured forth,
these may not, probably, suffice
to destroy the chance forms, which
find their way into the "prima via."
And it is highly probable that the
Bacillus typhosus exists in all communities for the disease caused by it is spread all over the inhabited globe.

In this way, then, may the pythogenic causes lead to the occurrence of E.T. The bowel, which is the seat of development of the Bacillus typhosus, is made the "locus resistitiae minoris" by the action on it of these pythogenic compounds, whose absence would have favored the successful repulsion by the human system of its deadly implacable foe, the typhoid fever.

Not to content ourselves with general statements alone, we may adduce the experiments of Dr. Barker on the action of the prolonged inhalation of an atmosphere charged with gases evolved from decaying organic matters. He found that syphilis, irregular thrushes muscular twitchings, diarrhea were produced. When the cause was removed, recovery took place without the occurrence of any specific disease.

It was a temporary narcosis, like morphia.

Again Sommerich, of Munich, Frank
from the filthiest ditches with incurability. Indian scavengers, who remove
the night soil do not suffer more
than other persons from the local
infections, or long as the bodies of
cholera or S.A. are present. Bond-hoards
of cases are also of the greatest value in this
situation. The supporters of the Pyhogenic theory
have on "trump card," if one may use
the phrase—which appears to them a
very convincing proof of their theory as
the "de novo" origin, from phytogenic
causes, of S.A. That is, the occurrence
of S.A., apparently spontaneously, in either
desert spots, or "isolated country houses."
But, in reality, these are not the valuable
facts for the Pyhogenic theory they declare
for it is utterly impossible to adduce
proof that, in the case of the desert,
the disease poison was not received
into the system a considerable period
before the arrival at that particular.

* In the case of Jenner's experiments, I consider
that the sphere of observation was far too limited.
It may have been naturally insusceptible; or may
have passed through a mild attack of S.A. in childhood
or later, unknown to himself.
spot. We know that the incubation period of the disease varies within exten- 
sive limits. Again S.T. is endemic in all communities, has been proved to occur among all races of mankind. Hence there possibility of meeting the specific poison even in the wildest places, which may formerly have been 
camped in by cases of the disease in nature of the country. As to "isolated country houses," its 
apparently spontaneous origin there, this is as full of fallacies as the "desert 
spot" is. As or near most country houses 
their premises, concealed cesspits, or manure heaps, or other heaps of 
sifted earth, the vector long ago showed experimentally that all these were very 
good "soil" for specific forms, opinions to 
multiply. Here the virtue of the 
diseases find a resting place, when 
seasonal other conditions are favourable, 
display their full power as epidemics of the 
diseases in question. To such a house 
or its neighbourhood come mild, ambulatory, 
* not readily determinable.
or consequent cases of the disease in
the shape of visitors, new servants, tradesmen.
Not only has this to be considered, but
can any living being give a complete
account of the conditions to which
his food, milk, water, even his linen
have been exposed, — not to mention
the composition of purity of the air he
has been breathing for, say, the last
month? The man then who states
that he "has excluded all possibility
of introduction" is more than rash.
Again, in most country places several
is wanting or defective, thyreogenic
components are life in proportion.
It is about for long periods, but,
when imported, attacks the community
with great virulence. There is an
inordinate spread by reason of the
proportion to, the degree of defect of the
local sanitation.

Besides, were we to admit hypothetesis
as the cause of ST. we would be driven
to so in the cases of the other exanthems,
EF. Variola, which like ST. often occurs
without our being able to trace its source. But it would never do today to assert "de novo" because we could not trace the cause, in the face of the overwhelming evidence against that theory. So with E.T., all the evidence for spontaneous generation is negative, consists solely in our inability to trace with the eye the continuity of the chain whose connecting links are invisible, and are known to be so. To conclude from this that no chain exists is absurd. If the same evidence were true, it would follow from the spontaneous generation of plants and animals, which are not propagated spontaneously, but are propagated by the law of continuous succession, which seems to be the law which best and most correctly explains all the difficulties of the problem of theology. Let us now see what the evidence for this law—the specific theory, in short—is.
Specific Theory. Many years ago, Bouchut, related to the French Academy of Medicine an account of the communicability of typhoid fever from person to person, and its modes of propagation. This statement

were, however, not accepted by the professors. In 1847, Cavenat 38 explicitly stated the facts of the specific character of the disease, that the LT. clothes were the carriers of the disease; this was splendidly argued by Dr. Budd, of Bristol. This theory, then, is: given, an LT. case: the surroundings — water, air, drains, food, etc., are the media of its spread. An LT. motion is placed, without disinfection, in a water-closet, from which it passes into the drains & sewers. Should these be imperfect in construction or continuity, there is a probable contamination of the water supply (for domestic use) by the percolation of the sewage into the source; or by its passage into the dwellings or streets. Let us consider (1) the modes of passage of the poison among the community, & the evidence that exists on this subject.
OF the evidence that exists as to the Bacillus typhosus being the vera cause of the disease. The water supply of a town may be poisoned at its origin, e.g., a river into which drains empty themselves, &c. An intermittent water supply may be a danger from the vacuums, caused when the water is turned off, the pipes are empty, clogging sewer faces from the adjacent drains, sewers, or subsoil, should it be contaminated into them.

Again, an excessive rainfall may, in a village or small town, wash the contents of cesspools into wells, hence excessive rainfalls come to have the opposite effects in town & country.

Again, the subsoil water may form the feeder for the town wells, & at the same time, a reservoir for its supply. (2) Sewerage may be aspirated into houses which contain highly heated rooms, especially with tight-fitting doors & windows, if the basement is clogged by cesspools leaking oil-pipes;
In perfectly trapped cells & sinks, & cases have occurred where a person while being shampooed by bending over a basin of the type of which sewer gas was passing, contracted &? may run passage into the house on it. Houses in elevated situations are in greater danger from the pressure of gas upwards to the higher portion of the sewer system. A newly opened-up drain, cess-pool, or privy may cause the disease, especially if they have previously been close, & devoid of ventilation. Near-surface drains are generally harmless, so are well-managed sewage farms. An overflow pipe opening from the cistern into a drain is another common cause of drinking water's pollution, the sewer gas poisoning. If water supply.

(3) Again, carpets, bedclothes, or wearing apparel, when soiled with &c. dregs, may all communicate the disease; also the eating of oysters & mussels, which have been grown in polluted estuaries, especially if more or less stagnant, have been shown
by Sir Charles Cameron, M.D., to have caused 24. in several cases at Dublin, from the sewage discharging sewage containing 24. defecata which had got into the shellfish. Dr. de Fabre, 28, of Naples, confirms this observation, and cites additional cases from the same cause, which occurred at Naples. Salad have also become fouled by 24. defecata, have produced the disease in the persons who partook of them. But water seems to be one of the commonest vehicles. The belief that water is a medium for the spread of the disease was first affirmed by Salz of Scarborough, in 1822; other cases have been reported by the following:— Müller, at Mayence, in 1823; by Richter, at Vienna, in 1848; by August Hirt, in 1852; by Carpentier, at Croydon, in 1852-3; by Routhe, in 1856; by Buck, in 1857; by Sir John Simon, at Bedford; by Schmidt, at Munich in 1862; in the Rattle outbreak in this country in 1866 or 1865, by Dr. Slatin, Buchanan, Thorn, Thorn, the medical officers to the Prizy Committee; Perry, at Glasgow, in 1868; Surgeon-
General de Renty, J. A., i. & Clifford Allbutt, with reference to Millbank Prison, 94 by
Horne, 10 at Calebra, in 1878; and J. Simon gives a table in his 2nd Report of the Prinz
Council (new series) of 146 epidemics inves-
tigated by his officers in 1870-3, in all of which great fecal pollution of both air
and water occurred. Moore's 22 cases are
of the utmost interest here also. Symptoms
of poisoning by fecally contaminated water
(febre harbera, sickness, languor, diarrhoea)
occurred in a boy's school, when the
leaking drain was repaired all symptoms ceased. Two years later a boy with St.
come's disease in the house, it was the
means of producing an epidemic of the disease.
Lastly, Wiede considers that drinking water
is the commonest vehicle of all; Budd
states that "St. spreads almost wholly by
discharge from the intestine," largely by water.
Trousseau says, "la contagion de la dolhi-
contie est incontestable;" Budd tritely remarks
that "contagion is the master face in its history," an opinion Sir Thomas Watson shared.
The word "contagion" as this connection should not, we are told, be too literally interpreted, but should include more what has been called "contagion through the air," but this seems something "Hibernian!"

Coming now to the question of how soon the stools of an S.T. patient became dangerous to the healthy if allowed to stand undisturbed, we find Corfield remarking that the fresh stools were...
common S.t. breeding conditions.
As to the mode of entry of the specific poison, Delboeuf found that anatomical investigations have afforded no evidence of the admission of the B. typhosus through the lungs. But this is an almost impossible thing to prove, as the way would be to subject a human being to air saturated with B.t. germs; arrange it so that he would die shortly after, so that the poison might not have had time to reach the lymphatics of the lungs; then examine the lung lymphatics bacteriologically.

For no animal appears to take B.t., or any disease comparable to it, to Jaffé's opinion is that the lungs probably, occasionally, the point at which the B. typhosus enters an entry, and this appears to me to be supported by the fact that there are such a number of cases of typhoidal pneumonia where the fever poison seems to have exercised its most violent effects at its
probable point of entry: the lungs. In such cases, characteristic \( \text{II}_\text{I} \) lesions are observed in the fat of a mild nature, however. But against this hypothesis there is this to be weighed: this patient's pulmonary lesions may be, by inheritance or as an acquired state, peculiarly liable to severe inflammation. This has been brought about by the hydrostatic congestion present in nearly every case, however mild, of \( \text{II}_\text{I} \). Hence, the case through a mild case, as regards bowel complications, may have terminated fatally owing to the severity of the pneumonia, if this fatal issue might have occurred irrespective of the presence of the \( \text{II}_\text{I} \) poison in the system; all that was necessary was a "starting cause" for the pneumonia.

But the usual path of infection is doubtless through the lymphatic system of the jaw. This receives a strong "a priori" support from the carefully conducted experiments at the Public Health Office.
Berlin, with anthrax ofres. Here sheep were fed on these thores in such a way as to exclude all possibility of injury to the mucosa of the buccal cavity. All died of anthrax.

Similarly, the B. f. ofres, or Bacilli, may stick in the mucous of the mouth or nose (when inhaled) the swallowed, pass without damage through the stomach, and multiply in the intestines, infect the system by penetrating the mucous membrane at points, the solitary glands which are not suited for their reception.

From here to the mesentric glands, thence into the blood current, infection is accomplished, in an individual not immune. Now come to the question of the proof which exists as to the Bacill.

Typhus being the specific cause of E.T.

In 1871, von Becklinausen described forms in typhoid abscesses which were supposed to be specific; but the search for something new was reserved for Eberth, in 1880, who, quite independently of one another, described rod-shaped microbes.
broad, with rounded ends, which were capable of forming filaments up to 50 μ in length. These were discovered in inflamed Peyer's patches, in the spleen, mesenteric glands, liver, larynx, lungs. These organisms were capable of forming spores which appeared at the end of the rods. A marked feature of these organisms was that they occurred in small clumps, were hard to smear, and were stainable by Leifler's or Kluver's methods.

Hugle says that it is "only after the examination of a large number of sections that one or several of these deposits can be found."

Dr. Koch, of Berlin, and Coats, of Glasgow, confirmed Kluver's observations.

Saffrey, of the Berlin Hygienic Institute, first made pure cultures of this organism in 1884, and was successful in 93 per cent.

* Also found beneath the typhoid ulcers in the gut. In a case where cerebral symptoms were marked, they were found beneath the pia mater.
of the cases of St. pneumoniae after death, in cultivating the bacillus from the sputum. He found that, in fresh media, this bacillus grows into very long threads which, like the individual bacilli, are motile from lateral flagella, their movement being snake-like. The bacilli were proved to be both aerobic and anaerobic, but in the presence of oxygen outside the body they develop great resisting power to harmful agencies, or acquire a saprophytic habit. Whilst in the anaerobic condition, especially in the intestine, they break up albumen, develop their specific toxins. The compensatory element here is that, in the intestine, they are less capable of resisting autolytic Maragliano has found this organism in the blood of St. patients during life, and found that they disappeared as convalescence approached.

The bacillus has also been found in the soil, in breathing-water, fish-nets, by Wolff, in milk by Hoffmeyer, and in the blood of patients during life.
the gelatine as small, white-points, on the surface as a moist-looking, grayish colonies with irregular margins.

In test-tube cultures: They grow along the line of fracture, first appearing about 24 hours after inoculation as a faint streak, which in 48 hours has become a distinct white growth of a peculiar adolescents milkiness—on the surface "They have a mother of pearl look" gradually spread over the gelatine."

On potato: The growth is said to be characteristic — though my very limited tests were raised as to this on the potato. But the most appearance of the potato on which this organism is from at a suitable temperature — 37°C. — is probably pathognomonic. The unusual reaction of the potato is a faculty acid as when the firm is from an alkaline, potatoes it forms a dirty yellowish or grey growth with defined edges — quite different from the typical growth.

In blood serum, the Bacilli grow well, and form a whitish-grey layer.
Are animals immune from human SA? Jaffé says: "no animal takes SA." But some observers found that 50 per cent of rabbits inoculated with culture solutions of SA forms died with splenic, lymphatic, and perineal glands in a swollen state. Frankel killed monkeys with injections. Dr. Almejeid, of Stockholm, inoculated a dog from culture experiments from the bacilli of SA from the blood of patients suffering from that disease. On the 17th day he found Peyer's patches swollen containing the same bacilli. Again, Chantemesse and Widal produced septicemia by injecting SA cultures into mice peritoneal cavities; after a few days it was followed by diarrhea and rapid emaciation, but many animals recovered. In several instances, the pericardium was, after elimination of the gastric secretion, sutured over the intestinal peristalsis by an opening made by injecting the bacilli into the fat. Most of these cases died (? from the bowel injury, I would ask), the bacilli were found
in the mucous tissue, but not in the blood. But Biggs' paper shows that in normal healthy subjects, the lymphatic tissue of Biggs' glands contains bacteria either free between the lymphocytes, or aggregated in groups in the protoplasm of the large lymphocytes. This is confirmed by Klein's. But it must be observed that the were not stated to be Eberth's bacilli, thus their carry little weight with them. I would ask attention to the fact mentioned in Chautanocini's and Vital's experiments, that the "septicemia" may have given rise to the diarrhea-repudiation association.

Mr. Bouchard, of Copenhagen, described a bacillus which, after 5 years study, he had found in all the pathological formations occurring in connection with it. But he states that all his inoculation experiments with animals failed. This was probably because the bacillus was an accidental contaminant of the disease, possessed no pathogenic properties. There is some evidence to show that
The calf, which suffers from a form of "specific enteritis" which is held by many to be closely allied, if not identical, with human YF, Dr James Allan, of Pichertowitzburg, holds this view strongly. I have had conversations on this point with some of our ablest scientific workers, and the prevailing opinion is that all animals are immune. Dr Woodhead and Dr J. Eadie agree with these opinions, and many others equally well qualified to judge from special research. In my view, they hold the question as an open one, with a probability against the susceptibility of animals to YF. This may be the most convenient place to mention a few facts which will come up again in their practical application in the Chapter on Prophylaxis.

Janowski 58 + Bellman found that the chemical rays of the sun independently of any oxidation of the food-material—paralysed and killed the B. typhosa. Most organisms become markedly weak, as regards phagocytic production of the
eliminating sporeta, when exposed to the light.

Dechaux states that fresh air and sunlight are, as proved experimentally, two of your greatest aids against sporeta.

Janeway also found that a temperature of 55° C. for 10 minutes, killed S.T. Bacilli; but, if for 5 minutes, it did not. 14° C. killed the Bacilli when in a fluid medium, but when dry this temperature was insufficient. This shows that intense cold cannot be

not necessary immune, practically we know this to be the case.

The specific theory must then be regarded as the best working hypothesis at present till we can satisfy Koch's postulates by finding an animal which when inoculated with the S.T. Bacilli will die of the disease, whereas the skin of healthy (intestinal) system will yield the Bacilli. This point has been worked at, but the results have not been accepted by most scientists. But there is little doubt, practically, as to the causal relation between S.T. Bacilli and...
There exists for this theory more convincing scientific proof than for any other: so much so, in fact, as to render its truth all but certain. One of the most recent authoritative utterances on the subject may well be quoted here as showing the present state of opinion on the subject.

Dr. Burdon Sanderson states that though the actual causal relation of the B. typhosus is not established by scientific proof in the absence of any animal that will take the disease, either in the ordinary course or by inoculation, yet it is certain that the constancy of the observed relation between the occurrence & distribution of the bacillus seems to leave no doubt as to its etiological significance. And he states that most pathologists accord with these views.
Chapter VII - Etiology of the disease in India.

We will now have to consider this large and vitally important topic.

There are, we may say, three groups of theories which I will class as (1) the minor theories, (2) the climatic theory, and (3) the transmission theory.

(1) The minor theories are: (a) Stich's self-poisonment theory; (b) Storrs' theory; and (c) others. Most of these will be dismissed in a very few lines.—(1) Surgeon-major Martin's vicarious theory; (2) Collin's Transfusion theory.

(2) The Climatic Theory will be considered under the heads of (a) Tappen's theory; (b) others.

(3) Transmission theory will not be again considered. It includes host-specific theories. Its applicability to account for the facts, as against the other theories, will be shown. Thus the logical end will be attained by a process of exclusion.

(a) Stich's self-poisonment theory asserts that S.A. may arise by chemical or physical changes induced in the contents of the alimentary canal "under the influence of disturbing causes." Now it is true,
I have frequently observed it in India, that many newly arrived men suffer from the following conjunction of symptoms: foul breath; slight abdominal cramps; tenderness; headache; diarrhoea. When a purge is given much undigested decomposing animal matter come away. This may doubtless predispose to P.T., by favouring intestinal catarrh but the presence of the Bacillus typhosus is required to sire the train.

Laveran has pointed out that this theory has not a single precise fact to rest upon. I would also ask why might such a condition induce typhus or scarlet fever as well as P.T.? A similar want of accurate statement and a total absence of any demonstrated facts characterizes Dr. W. Hoare’s theory. Here the “argumentum ad hominem” is almost permissible. Dr. W. Hoare’s views on most tropical diseases are more striking than accurate or in accordance with observed facts, e.g., his view on the etiology of malaria.
With regard to S.F., he gives us as his opinion:

(1) that it is not a specific disease at all, but is simply a phase of fever;

(2) that the roseola of S.F. is "only a febrile eruption"; he believes that all fevers belong to one genus, that no fever is specific; he contends that the eruptions of scarlet, purpura, bubo, and other fevers are identical. But the roseola is not a fever, he says, while the other three do not. These facts—his premises—being false, there is no necessity to discuss further this theory. So W. Moore is, I believe, the sole disciple of this theory.

(3) Martin's Vicarious Theory ascribes the causation of S.F. to the exhaustion which results, sooner or later, of the liver's function from the prolonged stimulation by tropical heat, so the pressure work thrown upon it, by reason of the friction of the factors detailed at pages 42 and 43 of this thesis. When the liver is unable to meet this strain any longer, Martin thinks that the intercalar glands assume "vicarious and..."
(due to an idiosyncrasy) proneness of the fluids to this abnormal function, a supplement to the hepatic insufficiency. This eliminatory function thus thrown on the intestinal fluid at length leads to a supplicative enteritis. It would thus explain the occasional spontaneous origin "of all" its non-occurrence or rarity among the natives of tropical climates.

But the premises are wrong. There is absolutely not an atom of proof for this "vicarious action of the intestinal fluids", the Nigerian lesions are only the local expressions of a constitutional state, in all probability. They do not occur till the fever has been on for several days. Martin would make the intestinal the cause instead of the effect; the starting point of the process not the effect. Again the process is not a "supplicative enteritis" for the Nigerian solitary fluids alone are generally affected - heberden's follicles + round fluids being almost invariably unaffected, except by cloudy swelling of their cells - which would occur equally in any
Febrile condition.

Again natives suffer very frequently from SA (v. post.) i.e. liver a European lives in India the more his liver becomes weakened. Hence we should have more SA, or Martin's theory, in this case, in old residents, which we have not. Nor is functional hepatic derangement a prodromal condition of SA. These facts will suffice to show the fallacies and inaccuracies of Martin's theory, indeed it starts from a misinterpretation of the functions of the solitaire and Begerian glands which are absorption not eliminatory or secretory structures. No physiological reversion could accomplish such a radical change, we may safely assert there is an allude theory to Martin's, which I may as well discuss here. It is that the young soldier's constitution changes after arrival in India because of altered conditions of life, diet, etc. Hence the exaltation of function of the abdominal viscera - not eliminatory as in Martin's theory - may at least pass.
The physiological limits become pathological, hence S.F. may arise. The same arguments as have been stated in the case of Ménétrié's theory apply equally to the hypothesis of this.

(8) Colin's "Transformation Theory."

Prof. Leon Colin, of the Val de Grace, an eminent French Army Medical Officer, has promulgated a theory which has attracted a good deal of attention. He asserts that "saludal typhoid" is the result of the combined action of saludal and typhoidal poisons, that the term introduced by Capt. Franklin Woodward, of the United States Army, of "typho-malarial" well describes the condition. Also, that many cases of malarial fever merge into typhoid; that "all acute febrile conditions accompanied by a marked alteration in the secretions, the gastro-intestinal symptoms may induce the spontaneous development of typhoid fever." 30 (p. 276)

That in such cases it would be impossible to recognise the affection during
Life "for the two die cases have ceased to be distinct," the Remittent Fever being transformed into S. F. While admitting the etiological duality of certain epidemics of "typho-malarial fever," "il est élévé que l'on ne peut pas chercher en dehors de l'organisme malade les conditions pathogéniques de l'aléation des fluedos de Breyer dans une fièvre palédéenne d'origine. Les arguments invoqués sont la banalité des lésions de l'intestin folliculaire, et l'identité des circonstances étiologiques au milieu desquelles apparaissent les fièvres graves sans lésion intestinale (p. 366) . . . . . . . . . . Indépendamment des observateurs, se refusant à voir dans la typho-malaria une maladie complexe, l'ont considérée soit comme une modalité spéciale de la fièvre typhoïde (Borelli), soit comme une forme grave de la fièvre paludique (Aitken, Obédonar), ou comme une entité morbide distincte (Manson), . . . . . . . . . . which he put in 150 say is due to a "wounding" of nerves see essentially distinct.
Il semble que nous ayons prouvé que le corps peut recevoir, à la même heure, deux "miématismes aigus".  

Surplus, m. Lelch Thiener, de l'armée française, exprime les vues suivantes : (p. 352) : "Ce qui nous, dans certains cas, une difficulté l'âle à se faire la fièvre rémiée typhoïde et la douleur nécrotique ou de la typho-malariaire. . . . Inutile que les uns admettent que les symptômes typhiques de cette fièvre relèvent de l'intoxication palustre seule, les autres font passer ces symptômes de l'ajoutation d'un élément étiologique nouveau, d'un miasme d'origine animale associé au poison tellurique : la rémiée typhoïde serait toujours un processus étiologiquement complexe . . . . C'est la rémiée typhoïde, sans lesions intestinales, si l'élément palustre prédomine, la fièvre typhoïde malarienne, avec l'attaque caractéristique des plaques. 

De Peyer, si c'est l'élément typhique qui l'emporte sur son congénère.
But although it is true that P.F. Malaria are in no respect antagonistic, there is in reality no evidence to indicate any causal or essential connection between them. P.F. is not a form of Malarial fever. It occurs anywhere in the Plains of India where Ayre is unknown, even when the two diseases coexist in the same station. They do not prevail contemporaneously, nor are those stations which are notoriously malarious specially remarkable for the prevalence of P.F. In fact, the reverse of the appears to be the case.

Again, Ayre generally attacks men of all ages, while P.F. does not, practically; nor do any number of attacks of Ayre (except as those mildly length of yet since an

This is proved by the fact that a olden, formerly intensely malarious, when drained is inhabited, has furnished P.F. cases. The explanation is simple: when the place was no more of malarious it was uninhabitable or very (bly inhabited). After drainage, a communicat has sprung up there, i.e. the widespread commingle, disease - P.F.- has occurred when imported to that of (by some accident):
India) confer immunity from SF. Moreover, SF. does not respond to
smirice, which Cures Ague
Colin, in his remarks on the marked
alteration of the intestinal glands
affected in SF. falls into Martin's
error of supposing them anything else
than absorbing structures.

(2) The Climatic Theory: (2) Fayerer; (3) Bayle-Jubault.

(2) Sir Joseph Fayerer, of the Bengal Service,
practically created this school by the
publication of his Croonian Lectures
in 1882 on "Climate in India.
He does not deny the existence of true SF.
in India, caused by the specific causes
as in Europe, yet he holds that a form
exists caused by the perversion of change
of the physiological functions due
to landing in the tropics from a
temperate climate. "Psychical
position, climatic influences, heat, moisture,
organic decomposition, miasma,
to a variety of aerial vitriolic conditions
are more likely than a specific
cause for India."
But what are the facts on which Sir Joseph bases his argument? Surgeon-Major Duncan, of the Bengal service, in criticising this view of the etiology, says: "In the collection of opinions forming the basis of the theory (which are detailed in the Armenian lecture, 1882), we find scarcely any definite post-mortem accounts; cases are described which I consider to be utterly irrelevant to the point at issue; whilst, finally, there is an absence of proof that the cases brought forward to illustrate it were not due to a specific or telluric cause. From an examination of the cases, the argument reduced to logical expression is the following: Cases of ulceration of the cutis are caused, in warm climates, by a variety of aerial, telluric conditions. But S.T. is accompanied by ulceration of the cutis. Therefore, S.T. is caused by a variety of aerial, telluric conditions. Finally, Sir J. Fraser himself condemned his whole superstructure.
for he proposes to call this fever "endemic" S.F., as distinguished from the specific (or true) S.F. S.F., as Ismechius remarks, is the endemic disease of Ireland, as it is of France & America. It is a peculiar of the disease that it is endemic everywhere. "Two conditions are necessary..." to demonstrate as fully before they can establish these peculiar doctrines on a scientific basis. The first is, that the fever in any given case is actually S.F.; the second is, that all specific or hypothetical causation is absolutely excluded. But at present these two conditions often have not been established... and the condition for S.F. are invariant in warm climates, especially in the pyxalenic theory. These words of Dunscore I heartily endorse in.

The logical philosophical rule to have recourse to known laws where they seem capable of explaining phenomena rather than to seek in some new & totally unknown direction is, as Mr. Smith, counsel.
We must first, therefore, have these conditions of heat, moisture, soil & climate, which are said to be capable of producing the disease; defined, & demonstrated as existing, before we can make any progress.

In India, it will be shown there is no necessity for an appeal to a climatic cause, for there is no lack of those fitness causes all over the country in which the B. typhosus finds its favorite "nidi" outside the human body. Soil which is often looked on as "virgin" is frequently found to be the very reverse. The Calcutta Maidan (plains) was considered never to have been infested by any community, as it had been occupied for many years on rice-fields, yet when a well was sunk there, the water analysed, it became only too evident that a village must at one time have occupied that spot. Dr. Chevers, pertinentlv asks, "Is there any bazaar in India, accessible to European soldiers, in which a merely
man is not likely to drink a draught of filthy impregnated water." And Surgeon-Major Ranking, of the Madras Service, unknown
ly, answers the question thus: "There is no water in India, however carefully
the sanitary condition may be attended to, where fecal contamination of
water, easily accessible for drinking purposes
— but not intended for such — does not
exist in perfection.”
Many climatists deny altogether the
adequacy of infection, even of filthy
conditions, to cause S.F.
I cannot conceive a stronger proof to
than that furnished by the perfect
immunity of the European garrison at
Fort Asigarth, in Central India.
The conditions here existing for protection
against S.F. introduction are perfect;
not, to my mind, amply demonstrate
the fact that the cause is not the
ought-situation in climatic meteoric
conditions. This fort occupied an isolated
rock, much as Edinburgh Castle does,
but there were no native villages near
it, it was far distant from a railway station. The water drunk there was,
it is, rain-water collected in excellent tanks, kept rigorously clean; it is, in addition, 
well-filtered by carefully-supervised filters. The dry earth system is most 
efficiently carried out; the ordure is 
lowered in baskets over the fort walls 
to the plain below where animals, 
(from the diverse fouls there) soon make 
a clean sweep of it. The food is 
well-supervised, also the milk—sally. 
The soldiers cannot wander into any 
of native villages, drink foul 
water, aerated or not—nor mix, 
& come in contact with, filthy clothes 
& persons—for no villages exist to wander in! 

The emergence has been that for 
a great number of years, in a 
large European garrison composed 
of soldiers at the most susceptible 
age, there have been no cases of S.F., 
but Ague has always been present. 
now, here the conditions of tropical 
life,—for high temperatures & rapid
variations occur there as elsewhere — have been at work for many years on excellent material for the production of S.F. yet it has not occurred. Why? Because the specific element has been excluded.

With the advent of nature's filthy ways come, in most cases, the introduction of S.F. into a community. I have experienced how much unremitting toil and forethought are required to stop even a small native village near barracks, or within Cantonment bounds, in anything like a good sanitary condition. I have learnt how easy a thing it is for nature to strike the strictest regulation, a sanitary precaution.

Downhead Payne lays much stress on the fact that the "anatomical sign of S.F. is common to Remilitarized Fliers with distinct symptoms; acute enteritis, malarial pneumonia with ulceration of small intestines (but this may be true Entzed Fire as shown at p. 130); tubercular ulceration; cholera; protracted
diarrhoea; scarlatina; malignant endocarditis; cerebral dysentery; diphtheria; "Reynolds' System of Medicine" notes it in a case of nephritis where it might rather have been due to tuberculous causes induced by the disease, or by some intercurrent condition—perhaps a mild attack of typhus fever."

"But," says Prof. Sir W. H. Bartlett, "who has had considerable pathological experience at kelty, is well qualified to speak authoritatively, "my experience leads me to maintain that the lesions of the bowel, in typical cases, of these specified diseases are very different from each other, so characteristic of each disease that one ought not to be mistaken for the other, are misinterpreted. And, in this country, "a large number of cases with which we have to deal in hospital are not typical.""

Suryam—Szurea, Gorden described cases, in Madras, of continued typhus with intestinal
complications, "post mortem lesions," in distinguishable from cases of S.A., which he ascribed to material or climatic origin. These are, when compared with typical cases of S.A. occurring in Nepal and Bombay, at once seen to be typical cases of S.A. with "a thread of malaria running through them," just as malaria complicates every disease in the tropics.

Brydon's theory was that the disease was the result of the action of heat on the nervous systems of "unacclimatized" men. This observation he founded on the fact that "most" of the disease occurs in the hot weather, ignoring altogether the fact that it occurs also in the hills at the same time, where the climate resembles an English summer during the Indian hot season — in fact, the mean temperature of the hill-stations there is 68° F. He also forgets that it occurs at all seasons of the year.

We had better discuss this question under these sub-headings: (1) Seasonal prevalence;
(2) Distribution of the disease; (3) The physical factors in the soldier which are said to predispose him to the disease.

(1) Seasonal prevalence. Malay 37 cases are returned in every month of the year, the bulk of the cases occur (a) from April to May; (b) in August and September. Different years show variations of this rule in the different provinces.

In 1884, in the Fugdet Province, 37,000 cases occurred in the cooler period than in the earlier one. In the same year, in August and September, as in May and June, there was a very large mortality.

In 1885, the maximum prevalence was again in the Fugdet Province, Punjab, in the hills; in August and September, in the Central India; in Mysore, Rohilkund, in May and June. The malarial fever maximum occurred in September and October, in the Fugdet area, Ajra, Central India, Mysore, Rohilkund, and in June in the Punjab and hills.

Was 37.6 maximum, for instance, observed much later in the Punjab and Hills than the malarial maximum.
In 1896, the 2nd quarter of the year had a well-marked maximum for all fevers, + S.T. reaches its acme then for the year. The 3rd quarter is S.T. 2nd maximum, + then occurs the acme of Remittent Fever. In 1888, the maximum prevalence was in April, May, + of Remittent Fever in August + September.

In 1889, S.T. + Simple continued Fever (a large number of these latter cases were almost certainly mild cases of S.T.) were most prevalent in the 2nd quarter, Remittent Fever, in the 3rd quarter, + Ague, in the 4th quarter of the year. (Remittent + other malignant fevers are, in the third quarter of the year, most prevalent throughout the whole world.)

With regard to S.T., it has been shown that the general rule is for the acme to occur in the 2nd quarter, + the next maximum in the 3rd quarter, in Bengal, in Madras + Bombay, the 3rd quarter is the sole maximum.

But moisture are the two prominent features of the tropical climates, the
former is especially unnatural to the British soldier, as universal except in hill stations and some stations near the sea-coast. But LF occurs equally in these stations, in the hot and cold seasons alike. Again Surgeon-General Thomson, M.D., notes the fact that at Sheesa, where there was a large parrison of young soldiers, there did not occur a single case of LF from April, 1887, till June, 1889, although the weather was extremely hot. If the disease had been due to climatic causes, such a parri-son, all of the proper age and material, must have suffered.

Another point to be laid great stress on is that the disease is present in every month of the year, especially in May to September, — in the former in slight excess of the latter. The number of cases gradually increases with the heat, but commences to exceed before this culminates; advances again in the rains; reaches rapidly again in the cool, dry weather. Now, heat produces rapid
Infection of most animal substances, and hence emanations from feces, etc., in India quickly follow. Great heat soon induces desiccation, and reduces the ordeur to a fine powder, on which the wind can easily act and diffuse into the atmosphere. Dust storms, which are most frequent in the hot weather, help to spread these ordeur. Here, in my opinion, come to be considered as factors in the production of E.D.

The native defecates everywhere about a station—a fact which the sense of smell right but beyond room for doubt. In the hot weather there is no rainfall to dissolve or carry below the surface this ordeur, hence great aerial contamination occurs. Coincident with the great heat, the water supply diminishes, becomes more concentrated, and if a well is contaminated, the dye of the poison is in a draught of water in a bottle is relatively larger. Hence a small dose of the dye poison diffused through a larger bulk of water might possibly be converted by the ordeur.
which has to yield to the onslaught of the larger dose.

Again, when water is scarce, the ignorant or indolent seek the nearest source without reference to its purity, which is often further afield for a good supply. This inclination is accentuated in the hot weather by the carefree and indifference of the majority of mankind in the hot weather—European and native alike—from the nervous exhaustion produced by the great heat.

With all these factors to be considered, the great thirst which prevails in the hot weather—which is relieved, in most cases, without doubt, being cast on the quality of the water.

Later, when the rainfall occurs, moisture is added to heat—in assisting evaporation of surface impurities; in aiding the development of forms (fitted to, perhaps, latent); and also in mechanically conveying the cause into the water-storage places, bringing it thus into contact with the air in its course
best - the Persian foolitary land of man.
In this way would I explain the second prevalence; I would direct attention to
the fact that in India we find every variety
of climate arranged in zones, according
to the altitude. If we believe the climate
theory, we must also believe that
at some level - as we enter a climate
similar to that of the temperate or some
Arctic zones - we must leave behind
an equatorial ST. But this is just what
we do not, for it occurs at the highest
as well as at the lowest altitudes alike.
As to the so-called "meteorological cause"
of ST, I agree heartily with Billings,
of the U.S. Army, that there are merely
another phrase - which sounds very
mysterious and impressive, no doubt,-
for want of knowledge. And with
regard to the theory of "epidemic wave,"
"atmospheric waves", etc., I would protest
Prof. Maclean's [Ed.] retort that
when he was a student at Edinburgh
typhus was rampant there, but its absence
now is not due to the non-appearance
of "epidemic" or "atmospheric waves" but improved sanitation. So will it be, let us hope, with India in the future.

(2) Distribution. This is universal—no station being exempt. The cold climate of the hills, the moist one of the seacoast, equally with the dry hot Punjab, Central India, the moderately hot moist climate of the North West Province, are all equally prone to it. A disease which can alike flourish in Arctic snows, a torrid heat is manifestly independent of geographical distributions.

(3) Physiological factors predisposing to the disease. Under this heading will be considered the subjects of (2) youth of our soldiers landing in India; (3) the effects of recent arrival in that country, which concurs with "want of acclimatization"; (4) alimentary conditions.

(2) Youth. The table at p. 103 (not here shown) shows that cases occur, in Britain, between 15 and 25 years of age. This is peculiar to the age at which most of our soldiers
Table showing the Relation between Enteric Fever & the different age periods, as to liability to attack, & death.

<table>
<thead>
<tr>
<th>Year</th>
<th>Under 25 years old</th>
<th></th>
<th>From 25 to 29</th>
<th></th>
<th>From 30-34</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths per mille</td>
<td>%</td>
<td>Deaths per mille</td>
<td>%</td>
<td>Deaths per mille</td>
<td>%</td>
</tr>
<tr>
<td>1879</td>
<td>6.17</td>
<td>54.1</td>
<td>2.73</td>
<td>23.9</td>
<td>1.78</td>
<td>15.6</td>
</tr>
<tr>
<td>1880</td>
<td>6.25</td>
<td>56.2</td>
<td>3.15</td>
<td>28.3</td>
<td>1.09</td>
<td>9.81</td>
</tr>
<tr>
<td>1881</td>
<td>4.56</td>
<td>57.2</td>
<td>1.57</td>
<td>20.6</td>
<td>0.79</td>
<td>10.37</td>
</tr>
<tr>
<td>1882</td>
<td>4.32</td>
<td>56.1</td>
<td>1.55</td>
<td>20.1</td>
<td>0.78</td>
<td>10.14</td>
</tr>
<tr>
<td>1883</td>
<td>4.34</td>
<td>66.3</td>
<td>1.50</td>
<td>22.9</td>
<td>0.70</td>
<td>10.70</td>
</tr>
<tr>
<td>1884</td>
<td>4.61</td>
<td>62.0</td>
<td>1.83</td>
<td>24.6</td>
<td>1.74</td>
<td>8.76</td>
</tr>
<tr>
<td>1885</td>
<td>5.16</td>
<td>61.0</td>
<td>2.30</td>
<td>27.2</td>
<td>1.02</td>
<td>8.65</td>
</tr>
<tr>
<td>1886</td>
<td>7.44</td>
<td>63.0</td>
<td>3.08</td>
<td>26.1</td>
<td>0.68</td>
<td>6.87</td>
</tr>
<tr>
<td>1887</td>
<td>5.37</td>
<td>54.2</td>
<td>2.63</td>
<td>26.5</td>
<td>0.84</td>
<td>9.42</td>
</tr>
<tr>
<td>1888</td>
<td>5.46</td>
<td>61.2</td>
<td>2.36</td>
<td>26.4</td>
<td>1.83</td>
<td>12.03</td>
</tr>
</tbody>
</table>
arrive in India. The table of deaths, which
I have compiled from the official returns,
will incontestably prove how important
factor this is. We have thus an condi-
tion for the wide prevalence of the disease
— men at the most susceptible age, and
healthy, as the disease, 00 to speak,
prefer them; for between 23 & 30
men are, generally speaking, at their
best, physically. Under 23, they are
undeveloped; while, above 30, the heat's
thirsty activity, of the "Jack" (or recruits
in the rigid campaigns of to-day) have begun
to deteriorate.

(3) Recent arrival. Dryden attached
more importance to this than to age,
for he states that in the first 2 years of
Indian service, the mortality is just as
high among men from 25-29 years old,
as amongst those under 24.

At page 106, there adduced evidence to
show how great is the risk to arrivals
in an endemic locality. There has also shown
that nearly every station in India is an
endemic centre of the disease, as the Returns
ample proof. Surgeon-General Ker-Jones states that the disease cannot be introduced from India except in very rare instances, as the disease rarely occurs aboard H.M. troopships during the month's voyage to India. "The experience of the connection of H.M. with local filth causes has been elsewhere so constant that where the sequence of events was such as to leave no doubt as to its infectious character, it would be unjustifiable (except in the strongest evidence) to consider India as the sole exception. The disease is often got in the way of the country, in the march to a first station, or in rest-camps on the way, but may not appear among the troops until they have taken up their quarters in some cantonment. If such be in a particular sanitary condition, the tendency is to attract the disease to climate, but the fact is that the disease has of late spread itself in the station, having been received into the body 2 or 3 weeks previously. In fact, Breyer's theory may be said to
Table to illustrate the relation between the different periods of Service ratios of deaths from liability to Enteric Fever.

<table>
<thead>
<tr>
<th>Year</th>
<th>1st + 2nd years</th>
<th>3rd + 6th years</th>
<th>7th + 10th years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths p. mille</td>
<td>Percentage of liability</td>
<td>Deaths p. mille</td>
</tr>
<tr>
<td>1879</td>
<td>7.99</td>
<td>67.2</td>
<td>2.18</td>
</tr>
<tr>
<td>1880</td>
<td>9.08</td>
<td>75.9</td>
<td>1.78</td>
</tr>
<tr>
<td>1881</td>
<td>4.55</td>
<td>60.0</td>
<td>2.07</td>
</tr>
<tr>
<td>1882</td>
<td>4.68</td>
<td>61.1</td>
<td>1.93</td>
</tr>
<tr>
<td>1883</td>
<td>4.98</td>
<td>70.3</td>
<td>1.55</td>
</tr>
<tr>
<td>1884</td>
<td>5.47</td>
<td>70.0</td>
<td>1.55</td>
</tr>
<tr>
<td>1885</td>
<td>6.55</td>
<td>68.87</td>
<td>1.93</td>
</tr>
<tr>
<td>1886</td>
<td>8.63</td>
<td>64.12</td>
<td>3.31</td>
</tr>
<tr>
<td>1887</td>
<td>7.13</td>
<td>66.5</td>
<td>2.37</td>
</tr>
<tr>
<td>1888</td>
<td>6.39</td>
<td>62.4</td>
<td>2.77</td>
</tr>
<tr>
<td>1889</td>
<td>11.65</td>
<td>57.02</td>
<td>4.20</td>
</tr>
</tbody>
</table>
re莊 on the fact that the greatest prevalence occurs among young soldiers during their first hot weather. Statistically, it is shown that during the first year of service, 33 1/3 cent of the total deaths are due to E.F.; during the first 4 years of service, 22 1/3 cent.; from 5 to 7 1/2 years, 5 1/3 cent.; and after the 7th, a mere fractional per cent.

The percentage of mortality, during the first 2 years, is 64.12; during the 3rd to 4th, 24.59; and from the 7th to the 10th, 8.52.

Thus, the first 2 years are shown to be, as they actually are, the most dangerous and fatal periods of the soldier's life; but the susceptibility to the disease is practically exhausted after the 4th year (v. Table opposite).

But these two factors, "per os," do not predominate to any greater degree than in temperate climates. It is the arrival in Indian stations which (except the hills) are active breeding centers of the disease—active from the more rapid decomposition and distribution of fecal particles—that induces such a number of cases of F.P. just as Channel of Auruel showed for Paris.
"want of acclimatization" is by some read, with a considerable show of reason, to mean "ignorance of how to guard one's health in the tropics." But it has been again and again shown that in India "acclimatization" neither lessens the influence of E.F. on the human frame, nor confers immunity from the disease. Rapid objection to tropical heat does not augment the disease ratio; it is inessential whether a corpse arrives at the beginning or the cold season, or not as regards E.F. in prevalence. Again, the European never gets acclimated to malaria;—his most indurate tropical enemy. The poison is slowly cumulative, it is eliminated from time to time by an attack of fever. The real "acclimatization"—but it is not so really—towards is that inhabitants of an endemic locality acquire a relative immunity as has been shown for London, Paris, + other towns (Ref: 166).

Physiological factors, etc., as to elementary conditions, sufficiently.
much from it in their native villages in
U.P. Surgeon-Major O'Brien, of the
Drugal Army, reported, in 1850, cases of St.
money one of the Burka battalions stationed
in Assam, of 3 observed cases of St.
in the Burka Regiment I formerly belonged
to. The European soldier is similarly
a meat-eater & spirit drinker, this is
said to predispose him to St. by causing
insufficiency of the Peyerian solitary glands
& abdominal plethora & turgescence
of the viscera. The statement as to the
infestation is pure hypothesis, so far as
I can learn. That excessive indulgence
of any kind — alcoholic or ilexicum —
may predispose by inducing fasting
intestinal cataract & vitiated secretions
seems more than likely. Yet I have
often seen cases in the natives who
ate charily. But this proves nothing
either way. There is an impression that
total abstainers suffer more in India,
this has no doubt arisen from the
fact that beer-drinkers consume beer
made from pure water imported from
Britain, or not from the hill-brewhouse in India, for, generally speaking, the hill-water is good. On the other hand, the abstainers drink aerated waters made from well-water, which may not have been boiled previously.

For instance, at Kurnool, 27 men in one regiment were attacked with SPT all from different barracks. The latrines were in good order, the drinking water was from a carefully guarded well, twice always passed through a filtering tank, and afterwards re-filtered in barracks. How could the disease have arisen except from a climatic cause, the climatists would ask on these facts? But of the total abstainers were attacked, for the water used in the regimental "recreation-room" was taken from a different well, which was thought good enough for cooking purposes, which was situated close to the old of a former latrine, and the surface drain from a wash-house passed within four feet of it, from which there were signs of percolation into the well.
The water, on analysis, yielded an excessive amount of organic matter. The well was closed, the floor ceased. We will conclude the chapter by the consideration of a few points still unattended, by a very brief recapitulation. There is yet a most important point against the climatic theory, that is the question, "Do natives suffer from S. R.?" The reply is, "Most assuredly." The climatic theory, if true, few its effects would be a terrible blow to their theory. For the cause, according to them, is the operation of climatic influences on the "unacclimated" European, if the native does not suffer, because he is by evolution self-becoming "acclimated.

Burton - Journal de Ranzy 93 in his Report on the Punjab, in 1869, states that S.R. prevailed among the native prisoners in Ramnul Pindi Jail. It gives a perfect history & pathological details. 50 per cent of the prisoners were attacked. Typical cases have been reported by Prof. Cheveres, of Calcutta; Combie for
Burma, and O'Brien for Assam. It has also been reported from Madras. In all these cases, host-mosquito details were given of the fatal cases, which showed that the cases were typical of those in S.A.

Prof. Sir Surya Hunter, M.D., Litt.D., President of the Chair of medicine in Bombay, who is a man of vast experience, says he has seen a very large number of cases among natives of every race and casti.—Hindus, Mahommedans, Parsees, etc. Sir F. Venkaveni amply confirms this.

Hirsch, indeed, shows that, throughout the world, there is no such thing as racial immunity from S.A. And Turpin—Major Rauking, M.D., states that “Native” suffer far more than Europeans, at least more than those who boil and filter their drinking water. He goes on to notice the omnipresence of fecally contaminated water throughout India, and says:

“...these very conditions are those which affect the native community, who are notoriously careless about their drinking and cooking water.”

Dr. Cleghorn Holmes, M.D., both men of
### Table of Relative Prevalence of E.T. among Men, Women, and Children

<table>
<thead>
<tr>
<th>Period</th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Admissions</td>
<td>Deaths</td>
<td>Admissions</td>
<td>Deaths</td>
<td>Admissions</td>
</tr>
<tr>
<td>1870-75</td>
<td>4.6</td>
<td>2.03</td>
<td>1.6</td>
<td>0.83</td>
<td>0.9</td>
</tr>
<tr>
<td>1880-85</td>
<td>8.4</td>
<td>2.9</td>
<td>3.1</td>
<td>0.98</td>
<td>1.0</td>
</tr>
<tr>
<td>1886</td>
<td>18.1</td>
<td>5.08</td>
<td>5.6</td>
<td>2.36</td>
<td>2.1</td>
</tr>
</tbody>
</table>
incense Indian experience, state their conviction that most natives purchase immunity to an attack during childhood, which is simply looked on as an attack of "feverish diarrhea." We know how common S.F. is among European children, this renders this statement a very probable one.

We must now very shortly consider the prevalence among officers, cadets, women, children. Civilians, officers suffer about equally. Comparing officers, women, children, with the men, a fair average prevalence is the following, per 1000 of strength:

- Officers, 2.2
- Women, 1.09
- Children, 6.7
- Men, 4.94

In the table opposite is shown in greater detail the relative prevalence in men, women, children. In a violent outbreak of S.F. among the men of the 33rd Regiment, at Kalmifier, the Medical Officer in charge reports that no officers, women, or children were attacked. In fact, here it was precisely among the class which would be most likely to object themselves to the danger of contamination outside barracks, for the single men were alone attacked.
Ladies suffer less than officers or civilians for they are less exposed to unhealthy influences, provided their houses and gardens are in good sanitary condition. The milk consumed by them, in the case of married ladies with families, by their children, is got from private cows or goats, the milking closely supervised. Their drinking water is generally carefully boiled: they are more particular as to their food supply. They rarely, if ever, visit the bazaars, as all their purchases are made by deputy, or from a pedlar at the door, or from English firms in Calcutta and Bombay. The soldiers' wives generally suffer very much less deeply than the men. They go more into the bazaars than ladies, but do not stay any length of time when there, rarely enter the houses. A good number of the women have been stated to enjoy immunity from being generally older than the men. This is a mere suggestion. Children suffer very little—almost less than at home; it would seem officers—next to the men, suffer most.
This is due, I think, largely to the exposure on the march, in rest-camps, and while out-shooting, when young officers especially are apt to be careless. Another cause is the mess-cooking arrangements. There are not those judicious inspections of the cook-house, or wholesome supervision of the cook this ways, which obtain in a private house, where there is a lady to supervise these matters.

In many cases, foul ordure trenches in the garden have caused attacks of dysentery in officers, who are often infected by clothes washed with water polluted by typhoid, or kept in an atmosphere impregnated with typhoid. Again, aerated waters (co-fuel taken in the form of "ale" or whisky soda) may be the source, or the ice may be made from infected water.

The reason they suffer less than the men is simply because they do not go so much to the native quarter, and are more particular as to their personal hygiene generally.
I have then come by exclusion to the adoption of the specific theory as that meeting the requirements of the case best, as being the one which offers most hope for the final eradication of the disease. As the climatist cannot alter climate, hence his theory leads to relaxing sanitary precautions, which even supposing the specific theory to be wrong would be a great mistake, for infective hygienic conditions are known to intensify every form of disease, tend to their epidemic prevalence.

The great prevalence has been shown to be mainly due to the arrival of susceptible men in endemic areas of the disease—indeed, in India it is one vast endemic area, at least in the Plains, which is well known to be a powerful cause; again, to the close admixture, in domestic matters, of the native community, who suffer largely from E.D., whose persons + clothes serve to disseminate it from the bagaar; also to the contamination of water + air by the
means previously explained; of the food by exposure to infected air, or by this coming from the latrines, with the bases on their legs soaked in infective material; in many cases from food or drink, i.e., by milk, water from the nearest tank, or kept in a native house absorbing noxious effluvia; by cows feeding on, or pastured on, contaminated grass; from drainage carts passing from barracks or elsewhere, giving out poison effluvia; by breathing air from fields manured with infective stools (native, generally); or by inhaling air (in the bazaars, or in a dust-storm in barracks) laden with particles of dust or on which is the specific poison of the disease. The margin of error in ascribing most of the sporadic cases to an outside community, the cause acting through similar media as in the localized outbreaks, seems infinitesimally small.

These, then, are the conditions which we must rectify to the utmost of our ability, against which we must wage unremitting war.
Chapter VIII: Prophylaxis of the Disease.

(2) in Europe; (3) in India; (1) in Cantonments & Cities; (6) on Field Service.

(2) European prophylaxis.

The patient, all appertaining to, or connected with him, must be isolated from the other members of the family, & the community. The disecta (urine & stools) of the patient are the carriers of the disease: we must render them inert.

May: Insect: the sickroom; (i) the bed that has been of the patient; (iii) the privy, cesspool, or drain into which the discharges may be carried; (iv) by seepage through the soil. Thus the water supply.

The tools were formerly disinfected by green copperas (FeSO₄) — of a strength of 1½ lbs. to 1 gallon of water — of which solution a hairpin was placed in the bedpan, or chamber-pot, before being used. Chloride or sulphate of zinc, or sulphate of copper (blue copperas), commercial chloroalum (but preferably, chloride of aluminium, which is much stronger), & lead nitrates are all more or less useful.
Koch's & Wyman Blythe's experiments on pneumococci show it is an unreliable disinfectant. Chlorinated lime is not suitable for bed-
pan disinfection, because of its strong smell. But I would decidedly give the palm away disinfectants to corrosive sublimate or 
residuum of mercury. The former is 
hastily acidulated, according to Dr. 
Parson's formula: [formula missing]. 
Hydriodic acid, 3 f. 
Ammoniac acid, 3 f.; Aniline blue, 2 oz. 
Water, 53 gallons. The aniline blue 
colors the solution, & prevents possible accidents. 
After corrosive sublimate, a 5 or 10 percent 
carbolic acid solution comes next in efficiency. 
But there is no disinfectant whose 
action has been so fully established, by 
both the experience of the laboratory 
and in the room, as corrosive sublimate. 
A solution of 1-2000 at least should 
be previously placed in the pot; after 
the motion has been broad, an excess 
of the solution should be added, & the 
Motion of solution thoroughly mixed 
by means of a stick (to be burnt immedi-
ately thereafter). The pot then imbudes
should stand at least an hour in a W.C., or outhouse—if possible, set apart for this purpose—covered & left for some time, for Wystan Blyth has shown that the longer the time a disinfectant acts, the more complete is the disinfection effected. Since the stool should remain in the powerful antiseptic for at least an hour, before consigning it to the sewer, where, if they have not been thoroughly disinfected, a certain amount of the morbid material will be at liberty to germinate & work mischief. The nurse alone should carry out this procedure, & the lid which has been used to cover the pot should be burnt at the end of the illness. All splashing in emptying the pot must be carefully guarded against, or soakage into the floor of infective matter which, while the heat of the room is sufficient, will rise as a poisonous effluvia. I consider the ideal plan would be to use mill-board bed-panes or chamber pots, with glazed interiors, into which
sufficient sand-dust is put to ensure absorption of the moisture; then to burn in a fire at once, used for no other purpose, if possible, as if cooking for instance; it is carried in three sublimated particles, of the wheels might be carried into the cooking hot, etc.

Such mill-board pots could be very cheaply manufactured, and only be squares - 1 ft x 1 ft - 1 with a rim all around 3 inches or so high.

The sickroom should have its air disinfected by such means as metallic iodine placed in boxes with freely perforated lids, or by subcooled carbolic acid, 1 part, & Ether, 2 parts.

All bed clothes should be at once plunged into a bowl containing either corrosive sublimated solution, or Chloride of lime or MacDougall's powder 3 lb - 1 being put in for a half-pint of water; afterwards, the linen should be well-boiled.

The privy, or closet, should be flushed once or twice a day, with White Carbolic Acid (1-5%) 

* Place the pot 6 months downwards on a "red" part of a good fire, to prevent sublimation of the particles.
Of course, the traps, drains, siphons should be of the best form of construction, frequently inspected for defects, breaches of continuity.

If the patient dies, his coffin should be thickly dusted over with chloride of lime, then should be buried soon. All the drinking water, milk used in the house should be boiled—preferably reboiled after cooling—placed in correctly thoroughly-sealed receptacle.

The attendant should see that free ventilation of the sick-room is carried out, all superfluous furniture, draperies should be removed at the onset of the illness. The nurse should not mix with the family at all; should wear light-colored, washing clothes, which should be treated like the patient's linen, before sending "to the wash." The patient's bed—laid-linen should be frequently changed, it should be previously well aired; the "bed-nap blanket" of his bed should have under it a yard or indiarubber sheet to prevent soarking.
The nurse should sleep in a different room from the patient; and, on no account, eat or drink in the sickroom, nor must any part which has been used in the sickroom be conveyed by the family. This is a heaven's economy, often. The nurse's hands should be frequently washed with carbolic soap, and she should on no account splash her hands in, up on her face. Another detail is never to "flesh" up the patient's night-shirt or bed-clothes if he is lying to have his lungs examined, or be attended to. This procedure of "fleshing" detaches infects particles from the linen, which are perhaps inhaled by the doctor or nurse. After the termination of the illness, the sickroom should be once washed, thoroughly disinfected; feathers or hair mattresses should be subjected for some hours to a moist temperature of 200-250° F. The moist heat is important for this, highly-heated water particles penetrate every part of the mattress, if the exposure is only long enough.
If possible, the family should be isolated and watched, for it is probable that they have all been exposed to the same disease-breeding conditions, and the poison may be incubating in them, for "mild diarrhoea" denoting the onset of the disease may be the means of spreading the disease further. I must frankly own that I have set up a high standard of hygienic perfection "to live up to." But I think the general truth of the measures' usefulness will be allowed, and, in such matters, thoroughness is a matter which affects the lives or deaths of perhaps many persons. There are very real difficulties in the way—ignorance, inertia, indifference, or difference of those whom we are endeavoring to benefit. As to the isolation of a family, this would be practically impossible for the working-classes, who could not abstain from their bread-winning for a fortnight or so, but perhaps in their State-supported reception-houses may meet this difficulty, in some measure.
The mere question of difficulty is no excuse for our not carrying out the practical application of our science & its teachings to the limit where the desired results may be obtained. Here it is a question of the greatest good for the greatest number. Let us remember Buddha's words "that a fever which consumes thousands to the grave consumes less of thousands to a worse fate, for the few out of the parents having the wretched offspring to fill the future ranks of prostitution, mendicancy, servitude", we must relax our efforts to obviate or the terrible scourge of F.D., or our splendid hygienic efforts have effected such terrible national scourge as plague & Variola.

(3) Indian Dysphagia: (a) Intermittent: (b) Continuous. The young soldier, landed in India from H.M. troopships at Bombay, should be carefully shielded from all chance of infection on the way of convoying in the train. Messrs. on landing are naturally full of curiosity, ignorant of the dangers which beset them on all sides, in quarters which, at home,
were considered quite harmless — although, of course, invariably so.

It is generally very hot in the train travelling up country, hence great thirst prevails, which is relieved by draught of water from the "thirst's reservoir" (already referred to at the railway stations, by the purchase of aerated waters, made from tainted water.

In many ordinary passenger trains, ice & aerated waters of fair quality are carried in the train. Now, this should be done in the case of troop-trains, & the source of the ice & aerated or other water should be irrefutable. And a similar quality of fruit & food should be carried. There are many native European contractors who would willingly submit to the close scrutiny of their articles supplied, if they got the contract for these troop-trains, which would be a great pecuniary benefit to them. It is "nobody's business" to recommend these changes officially, hence the old evils go on uninhibited.
It has long been urged on the military authorities to send all—or at least a large proportion—of newly arrived troops to hill-stations for their first two years or so of service, so as to learn how to take care of themselves in the tropics. At these hill-stations, the men should be spread over as wide an area as possible: the water, milk, food supply, and conservancy arrangements, should meet with the most unremitting attention of the Medical and Commissariat Departments. By stationing more troops in the hills, economy would be created for smaller barracks (because of the lesser cubic space necessary there as compared with the hills), and the enormous cost of the larger proportion of deaths & invalidisms from P.T. would be shared by the government. The troops would preserve their health as well as in Britain almost, and stand campaigning far better for this reason.

Road-making, drills, &c. should occupy
the men in the morning; it offers times
—such as cricket, paper chases, football
the afternoon. Being out somehow on the
own is well known to induce a very
great tolerance to its effects.
As to diet & drink, a pint of beer should
be the limit — this must be enforced
by the example of the non-commissioned
officers; best-behaved men in regiments.
Many regiments now serving in India
have a very considerable proportion —
in some cases, an overwhelming majority
of abstainers; there can be no question
that abstinence or the most moderate
indulgence — preferably in claret, a
class of wine out of the men's reach —
in alcohol is the safest rule for men
on Indian service.
Thus the proper function of the hills
as preservers of health— not curers of
disease— would be fulfilled.

But if a regiment must occupy a
Plains' station, how can we try to
preserve the soldier from E.T. here?
Dinner, Budi, Simon, + Hirsch anika
That drinking water is the commonest medium of
again bad water, though not tainted with E. coli,
poison, predisposes to E. coli by irritating the gut.
The difficulty in getting a pure source in
the plains is practically impossible, for
the water percolates through soil soaked by
torrents for ages. But we can educate
the troops and community generally to go or
drink for their drinking water to a source
of issues from which it could be issued
efficiently boiled and filtered, where the
quality would be guaranteed by frequent
chemical and bacteriological examination by
medical officers. If people knew that
absolutely pure unpolluted water — parted
otherwise — was to be had at such a
place, be it canton, or recreation home
for the soldiers, or the officers' houses
for officers and their families and civilians,
the great majority would avail themselves.

But Arnold 13th thinks that, though this is possible,
yet it is unusual, for the B. typhosa has
its growth hindered when water is the medium
in which infection can only occur when the water
contamination is direct. 

of it. Similarly, any small subscription or tax necessary for such expenditure, i.e., for such an undoubted gain. Again, the carelessness and indifference of the many have to be overcome, even when appertaining to their own health or lives.

The milk supply has lately attracted a good deal of attention. In 1887-8, Surgeon Colonel Hamilton, M.D., notes an epidemic of F.H. at the Lucknow Camp, consisting, among the young Bengal Cavalry officers, which the medical officer of the regiment traced to poor milk, supplied from cows kept milked under most insanitary conditions. Therefore, the following points should be attended to:

The cows should, if possible, belong to the regimental Recreation-room or Canteen Committee who should take shifts to see that they are in good condition, carefully fed in the presence of orderly detailed for the purpose, who should be instructed in the manner by which the native milkman washes the milk under the very nose of the
supervisor. Cows at present are often fed by native contractors on stabb-litter & garbage, which being got "gratis" increases the contractors profits immensely.

The milk-cans should be well scalded with boiling water; the cow's udder & the milkers hands washed well; & the cow milked. The cans must then be closed, plastered & sent to the ice-house, where there is one, of this regiment.

The food supply must be carefully supervised. The ration must be made into food only made with barley, rice, &c, in preference to the tough, because newly killed, stabbles, which are, alas! the soldiers favourite dish!

All food which is on the table in the barracks, or elsewhere, should be so covered with a clean napkin or muslin as to prevent the access of flies to it.

*mainly by previously placing water in the milk-cans; & even by concealing a water-bouquet under his clothes, from which a small gush issues, it is concealed on the palmar aspect of his arm. The man runs in water as fast as he milks the cow.
food vegetables are always to be had from the Contingent Garden, which are in charge of a retired soldier. Generally jams of cape gooseberries, citron, mangos and guavas - would, says Surg. Col. Hamilton, be a favourite article of diet if they were more accessible in price, by increasing their manufacture locally.

It is a very hard matter to prevent the surface defiling by natives. When caught, they should be punished, "in terrorum." When I was in charge at Lawson Camp, we managed to check natives throwing out orders behind their horses by fining the rear of horses behind which the order was found. I thus established a local police system interested in the prevention of surface-contamination.

The evil was soon checked, for any malfeactor was promptly handed up to save common punishment. In all cantonments, public latrines for natives should be provided at
short intervals to prevent this risk. "Absorption pits" are another possible source of danger. They are shallow pits dug for reception of bath water, etc. Soapy water attracts flies because of the organic matter from the surface of the body mixed with it, especially the soapy film left after washing. All waste pipes from bath rooms should empty into a pit about 30 ft. from the barracks, which should be 10-12 ft. deep x 5 ft. broad.
The bottom should be filled 3 ft. deep with broken bricks. A brick shaft should run down to this, the rest of the pit should be filled with earth, quickly growing trees planted on the top. An open brick drain should connect the bath room + the pit, + both extremities guarded by gratings, to prevent blocking with leaves, grass, etc.

The water would be absorbed by percolation into the ground + tree roots, the disease would be rendered innocuous, + would shortly become an inhabitable pond.
Of course, these pits must be well away from all wells.

The direct rays of the sun should be avoided in the hot, rainy, and dry seasons, between 9 a.m. and 3 p.m., as much as possible, for it is probable that the nervous exhaustion induced by solar exposure lessens the "vis resistente." In a hot climate, it is highly probable that the respiration of persons are less, hence as little exposure to heat malaria as possible is advisable.

A high standard of personal cleanliness should be maintained, and out of short military exercises in the early morning or after 4.30 p.m. should be indulged in, "short of fatigue." Surface and subsoil drainage should be efficient, so as to prevent the stagnation of water. The decomposition time of animal or vegetable matter forming refuse beds for both R. Malaria in India — raft in the cities of Calcutta, Bombay, and the Madras Presidency — neither sewers, soil-holes, cess-pits,
As a result, public concern over the disease is...
the upper or back rooms of his house, and the front room may sell meat, groceries, vegetables, fruits, or clothes, which cannot fail to have become contaminated. There is usually also great overcrowding and want of ventilation; the houses stand on soil saturated—often for centuries with excavated filth; the conservancy arrangements are generally imperfect to a very marked degree; and the natives are generally most careless in their habits of personal and domestic cleanliness: in short, the terribly insanitary condition in which the native of India lives has to be seen to be realised.

How are we to reform these conditions? By explanation of the necessity and the benefit of sanitary reform to educated natives who may use their influence to further improvements, in many cases, to contribute to them, for there are very many natives who are most philanthropically inclined; by diffusing gradually, by means of head men of villages, native doctors, treated...
hospital assistant knowledge of obvious sanitary defects & their modes of being easily simply remedied among the popol of the native villages & towns; by public explanation or lectures from time to time on simple sanitary precautions; by an infectious diseases notification being made compulsory, the cooperation of the native practitioners by rewards (such as obtain in this country) for each case notified; by providing proper conservancy means, attempting to ensure a good water supply - if possible, leading it into the town from a distance. Of course, money is required for the practical attainment of these measures. As Lord Lansdowne remarked a few weeks ago in a Viceroyal speech made in India, that country is constantly menaced by war, famine, bankruptcy. But a certain amount as a government grant might be looked for, if the matter was carried through vigorously.
Self-hearted way, as if the idea was a mere chimera—desirable, no doubt, but quite unattainable. From what I know of native gentlemen, I should expect that many of them would come forward readily to subscribe handsomely to a scheme which would mainly benefit their fellow-countrymen and the European population of India would correspondingly benefit.

(b) On service, on the march, in camp.

In the case of march, great care must be taken with regard to drinking water. The troops are accompanied by "whiros" whose filling muskets (foot-skin, water pouches) are a perfect source of the disease. Hence, before a march the third element of the train of camp-followers should be paraded to see that their muskets are empty. The soldiers should have their water-bottle (one of which is carried by each man on the march or on service) filled either with previously boiled water or better still with cold tea,
an often swiftly should be carried,
on camel- or mule- transport, in suit-
able and well cleaned receptacles. This
replenishment—supply should be
sent on ahead of the men to the
first halting point, or to a point
half way, depending on the length of
the march. The men should not be
allowed to break their line on the
march, nor to drink by roadside
streams, nor to purchase native
alcohol waters.

On the march, a quick pace, often order
should be the rule; much carriage
should be provided for the men’s "kit,"
which should be awaiting them at
their halting place, so that they can
at once wash, v change their dusty,
sweat-saturated clothes. A little
beyond the half way point of the march,
a choice spot should be selected to
breakfast (previously prepared before
the march begins) should be taken here,
according to some Medical Officers. It
issues better to let the men finish their
march before taking their breakfast. The men should arrive to find their tents pitched by the "tent-cars," so that there is no delay in their washing, changing their clothes, breakfasting. A light flannel binder is a great protection against chills & bowel catarrhs on the march, or in camp.

As to camping & field expeditions, let us remember Helmholz's remark that "a man who avoids breathing the exhalations of privies or dairies (for which read "camp-kitchens") exhalations of dejecta generally, who does not handle diseased food with typhoid dejections, who does not drink unboiled water from infected springs, is as safe in a place where typhoid epidemic is raging, as in one where not a case of the disease exists."

But let us first consider a few preliminary. The men we should select for an Indian campaign should, if possible, have served some years in India, preferably in a hill-station.
him under 23 or 24 yrs of age, if possible, be excluded, as they would be more liable to E. F. And any men who have recently suffered from E. F. should be considered unfit, for Bristowe has shown how prone such men are to the development of tuberculosis & pneumonic after E. F. and this liability would be accentuated by the hardships of a campaign & its fatigues. Besides Landorev & Sirey have established, by their researches, the injurious effects of E. F. on the heart & blood-vessels. Men suffering from malarial cachexia should be weeded out, for Scriber showed that such men were peculiarly liable to E. F. 

The farm should be pitched on high & dry ground—permeable soils that with a moist subsoil being avoided, for E. F. forms would develop more readily in damp soils—the huts must be in the most open order obtainable, & truly ventilated.
The site should be changed as often as possible, in accordance with the old Roman rule, the result, as doubt, of experiences of "camp gutric." Nest. Surgeon Horbury, R. R., states that he has never seen S. P. occur in actual flying column, but always in a camp of some permanency. All water used in camp should invariably be boiled well—preferably twice, à la "discontinuous sterilization principle" of Tyndall and Koch. If milk is to be obtained, the villagers from whom it is got should milk it in the presence of some responsible person, as it would be safer to boil it also. The food should be supervised as to course & quality; if there is any choice in the matter, but the best can only be made of locally supplied. It should be covered to protect it from flies, when possible. As to mosquito arrangements, (v. pp. 32-33 above) the kuehls should be well to leeward of the camp.
having regard to the prevailing wind in choosing "leeward." So that no water contamination can possibly occur.

Separate trenches for S. P. debris should be dug, and such infective objects should be treated as far as possible at the lines laid down at S.<179>81; where mercuric chloride will be found the most portable and efficacious ointment for disinfection; and the solution for caustic use should be much stronger — at least 1/500; or if carbolic lotion is used, 1/400. The trenches should be filled in when one-third full, the earth should be well beaten down to minimize the chance of exhalation from the ordure, which, if the soil was looser would more readily work its way upwards.

If the camp is on sandy soil, let the trenches be made in the lee of any sand-hills, for if to windward the sand, being very light, will be blown out of

*Chautensesse* found that 1/20,000 corrosive solution destroyed S. P. lines vitally, but Carbolic lotion 1/400 had no effect whatever on them.
the trench, the ordure laid bare.

The precautions in the isolation & management of the sick, should as far as possible conform to those stated at pp. 182-3. But in camp, mattresses will never be found kept at the base of operations in service. If used here, I advised, they must be burnt. The straw, etc., on which a man has lain, while suffering from S. P., should be carefully burnt. At the conclusion of the case, the tent-walls should be washed well with 1-1000 corrosive sublimate.

In a campaign or in camp, it is safer to keep, & treat as much, all cases of fever with diarrhoea, & of prolonged fever as C. J.

Another point of great importance is to lessen communications with native villages or bazaars to the utmost, & put them "out of bounds" for the men.

If C. J. should unfortunately become epidemic, the camp will have to be shifted, & pitched to windward of the former one.

Finally, common sense, the utmost care,
rigid conscientiousness, precision, in the carrying out of all details for the protection of the community should be made a "one qui est" with every Judge Officer, for crucial issues depend on his care, forethought, and thoroughness, as we have been discussing.
Chapter IX General Conclusions.

In the preceding pages, I have endeavoured to give as complete, correct, and succinct an account as I was able to of a very difficult and important subject. The history of the disease in Europe and India have been contrasted as well as detailed. I have shown that the disease which was formerly held as non-existent in the tropics has come now to run the danger of excluding altogether, or rather of supplementing to a marked degree, the disease which it has in a great measure replaced, i.e. Remittent Malarial Fever.

This is a point on which I would desire to state my conviction that, these risks for too great readiness on the part of a certain section of medical officers to assume that every case of fever continued fever in India is E.F. This is often done on the most insufficient and illogical grounds. I have referred to one case where a
Senior Judicial Office of a Station held that all cases of pyrexia lasting longer than three days should—in fact, must—be returned as cases of true P. F. And there is a grave danger of this too easy creed spreading: it makes the very difficult differential diagnosis of severe Remittent Fever from E. P. very easy. Therefore, I would plead for a perfectly open mind, absence of bias in either direction on the part of the Indian clinician: let every case be rigidly judged on its own merit, irrespective of probabilities or probabilities of its being E. P. in any other prevailing disease.

There is not a shadow of doubt that many Europeans natives die every year from Malarial Remittent Fever, as the deadly Terai, Peshawar, Burmese "jungle fevers" were not to treat Remittent Fever as E. P. and withhold quinine the case would probably occur. Therefore, it behoves us to approach every case with the maximum
of observation & caution, the minimum of prejudice.

The dangers & fallacies of the climatic theory have been discussed; the tendency that this theory must have on its holders to rely on antiscy precautions, & to abandon search after local causative agents, have been adverted to.

Though the pithopathic theory has not been absolutely disproved, there exists a vast amount of strong positive evidence for the most scientific & generally satisfactory theory—that of the specific origin of the disease.

It is fortunate that both the most likely theories—the pithopathic & specific—have the same practical issues—the destruction of the "contagium vivum" in the stools of the rinderpest victim. Finally, the preventive measures have been sketched; for each case calls for more detailed measures according to its individual requirements.

In conclusion, I can only express the hope that I have rendered myself intelligible, may have helped, however slightly, in the elucidation of a very difficult matter.
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