distance the loud inspiratory effort. There was a struggle for breath, and yet the lungs were permeable and the air was freely entering the air cells. The difficulty of breathing lasted up to the very last moment, when he died 12 hours after in a comatose state. Unfortunately no *post-mortem* examination was made, but it left no doubt in my mind as to the cause of death in this instance, though some at a distance made a gratuitous surmise that he died of rupture of a liver abscess!

Prognosis is always of a serious nature. My impression is that one seldom recovers from this stage, though Sir Joseph Fayrer believes recovery possible by the disintegration and removal of the clot.

With reference to treatment, a stimulant is our sheet anchor, such as ether and brandy. In cases where such termination is apprehended, we must be on our guard to avoid any depressing cause, and cardiac tonics such as digitalis with carbonate of ammonia should be given beforehand to counteract that tendency. Ammonia has a twofold virtue as a stimulant and a solvent to the fibrinous clot. The quantity of brandy borne by such patients is rather large, and as much as half an ounce may be given every hour or two hours with good result.

ON ENTERIC FEVER.

By SURGEON W. E. SAUNDERS, A.M.D.

(Continued from page 97.)

V. Modes of Spread.—Having decided that a specific poison is necessary to cause enteric fever, we must now review the different modes in which the disease is transmitted and disseminated.

The virulent part of the specific poison, by which the disease is communicated, is admitted by most persons to be contained in the diarrhœal discharges.

Dr. Watson says, "if this fever is really contagious, it is not only erroneous but dangerous to hold the contrary opinion." To what extent it is dangerous can be gathered from the following. The reports of the Registrar-General show about 260,000 cases occurring yearly in England alone, which doubtless falls very far short of actual numbers, and each case manufactures a large quantity of poison, daily for 15 days in mild to 26 days in severe cases. (Louis); and in cases where relapses occur, much longer than this.

The disease is generally supposed to be contracted by one or other of the following modes:—

1. Through the medium of the drinking water, (soil).
2. By contaminated milk—
   (a) Water added, (polluted).
   (b) Dirty vessels, &c.
   (c) Diseases of cow, garget, &c.
3. Foul air from sewers, drains, cesspools, &c.
4. Attendance on the sick.

The condition which appears to be most influential in the development of enteric fever is the presence of human filth, under circumstances leading to the pollution either of the atmosphere, of the soil, or of the drinking water, occurring most commonly in conjunction.

Professional opinion is still divided on the subject of the *de novo* origin and infection by attendance on the sick.

Dissemination by means of drinking water.—Of all the different modes of diffusion in Europe, that by means of the water used for drinking being polluted with human filth is perhaps by far the most important one, from the fact that it is the mode in which the infective matter which gives rise to the disease can be most certainly and widely diffused.

The mechanism of the production of the disease through the medium of the water supply is less widely and clearly apprehended than it should be, although the detailed accounts of the various outbreaks of late years prove it to be the most readily and effectually controlled mode of propagation. This is equally true as regards India and other hot countries.

Greater uniformity of practice is indicated as regards the internal economy of regiments in the matter of protecting the wells and water-supply against what may be termed "chance" pollution; in the washing and culinary arrangements, and also the milk supply. It is obvious that, however much Government may be desirous of aiding in this matter, an immense deal must depend upon commanding and medical officers; for unless thorough co-operation exists between them, the arrangements will not be perfect.

The filtration of water and other measures will be worse than useless, and a considerable expense to the Government will have been incurred to no

purpose, unless every detail is scientifically carried out. The greatest care should be taken during the seasons when fever is most prevalent. The bazaars and villages in the vicinity should then be placed "out of bounds," for the men, after a stroll in the evening, regale themselves by drinking ginger-pop and other beverages prepared from the unfiltered and generally contaminated water of some bazaar wells or pools (tanks), which after heavy rain become still more polluted, being in no way protected, and receiving the surface drainage of the filthy ground in the vicinity of native villages.

The chemical analysis of water probably can tell us with absolute certainty when water is safe; but we must resort to the use of the microscope to find out when it is actively noxious, for that alone will inform us.

Diluted excreta, if fresh and from a healthy individual, would be unlikely to injure anybody; but as the excreta frequently contain the germs of enteric fever, the sewage contaminated well, which is harmless one week may become deadly the next, although analysis reveals no difference—(*Lancet.*)

The microscopical examination is one of the greatest importance, and should be always resorted to, for it is most likely to yield the secret of the transmission of disease.

The presence of the actual organic poison causing enteric fever was supposed to have been discovered in a certain well on the continent, and was termed the typhoid fungus. A species of bacillus has recently been said to be the cause of an enteric attack.

Neither chemistry nor the microscope has as yet, however, afforded any definite ground of determining what is deleterious and what is harmless, although much has been done in this direction. Chemists simply regard the quantities in which organic matters are present, combined with the circumstances under which they occur, as the measure of the impurity to which they are exposed, and as indicating the degree of liability of any water to become contaminated with the special poisons of enteric fever and other diseases.

The depth of a spring or well of course exerts a great influence on its purity, and although the presence of fissures communicating with the surface (a common thing in India) will render the deepest well impure, as a rule the depth of 100 ft. secures against contamination—(Professor Sanders)

The numerous investigations of Frankland, as well as a large number of analyses made in Germany by Wibel and others, show conclusively the almost constant contamination of well water drawn from shallow surface wells, varying in depth from 12 to 30 ft., and it follows that they are worse when close to the dwellings of natives in India and elsewhere.

A very sudden and localized outbreak of enteric fever is almost certain to be owing to the introduction of the poison through the medium of the drinking water.

So many cases are now on record where the cause has been traced to the use of contaminated drinking water, (and in some the evidence was so complete as almost to amount to the precision of a chemical experiment) that this mode of diffusion must be admitted to be the commonest one. The various outbreaks that have occurred of late years, *viz.*, Nunney, Lewes, Croydon, Over Darwen, Cambridge, Caterham, and others, have shewn as the result of investigation by some of our most eminent sanitary authorities many new modes of contamination of the drinking water, hitherto unsuspected, and which explained in a most satisfactory manner the origin of several outbreaks which would have been regarded as very mysterious.

Some of the ablest men in London for many years failed to detect the true cause of unhealthiness of Millbank Prison, and assigned causes for it, as is now done in India, which later experience has found to be unconnected with it.

The probability is that a similar error is frequently made elsewhere, and that the prevalence of enteric fever and other diseases is ascribed indefinitely to locality, malaria, heat and cold, climate, variations of temperature, moral depression, and other intangible influences, which act as aiding and predisposing but not actual causes, and would be entirely removed by the general disuse of impure water. At the stations I have served in, I have noticed that the water almost invariably became impure at certain seasons of the year, although the reports of previous years did not always record it.

At Millbank, in spite of the low site, the proximity of low and ill-drained ground, open sewers, moral depression consequent on imprisonment, we find that the prevalent diseases,—diarrhœa, dysentery, enteric fever, &c., were put a stop to by the substitution of artesian well water for Thames water; "and the health of the prisoners has since always been good, notwithstanding the surroundings, and as free from every form of disease as if the prison occupied the healthiest site in the kingdom."

I feel satisfied that the same result would follow the introduction of a purer supply of drinking water in our Indian and other foreign stations.

It is a remarkable fact that no case of enteric fever has ever occurred at Pentonville Jail amongst the prisoners, who have been imprisoned there for more than a month. The drinking water comes from a deep well in the chalk.

Since the introduction of artesian well water at Millbank in 1854, enteric fever is practically extinct, there having been no case for years.

At present, owing probably to the difficulty of making analyses of water, the exact connection between impure water and disease does not stand on so precise a basis as might be wished. In some of the cases however very little careful enquiry has been made into the state of health of those using the water, and that most fallacious of all evidence a general impression, without a careful collection of facts, has often been the only ground on which the opinion has been come to. As well observed by Mr. J. Simon in one of his philosophical reports, "We cannot expect to find the effect of impure water always sudden and violent, its results are indeed often gradual, and may elude ordinary observation, yet be not the less real and appreciable by close inquiry. In fact it is only when striking and violent effects are produced that public attention is arrested; the minor and more insidious, but not the less certain evils, are borne with the indifference and apathy of custom."

In some cases it is by no means improbable that the use of the impure water, which is supposed to be innocuous, has been really restricted, or that experience has shewn the necessity of purification in some way.

This much seems to be certain, that as precise investigations proceed, and indeed in proportion to the care of the inquiry and the accuracy of the examination, a continually increasing class of cases is found to be connected with the use of impure water; and it seems only reasonable to infer that a still more rigid enquiry will further prove the frequency and importance of this mode of origin of some diseases, more especially of the digestive organs, and particularly enteric fever—(Parkes).

The following is a very good example of an outbreak of enteric fever from the use of impure drinking water: During the Zulu Campaign Durban was the port where all the reinforcements were landed, and it formed at the same time the base for the lower column.

An outbreak of enteric fever occurred among the men of the General Depôt which was located there. On account of the large number of cases transferred to Durban from the Lower Tugela it escaped notice at first, until in fact the slowly increased numbers drew attention to the fact that many of the cases were in men who had never left Durban.

On investigation it was found that although there had been a solitary case in February, the outbreak commenced really in April and ceased almost at the end of August; for although cases occurred after that, it was found that it was confined to one corps, and due to the same cause, *viz.*, the use of impure water.

The following table shows the admissions for Enteric fever and Dysentery at Durban during 1879 from among the men who had never been out of Durban after landing there.

Number of Cases.	Jan.	Feb.	Marrch	April	May	June	July	August	Sept.	October	Nov.	Decr.
	Umgeni water.			Currie's Fountain water used.					Umgeni River water.			
Dysentery ..	0	1	1	5	3	2	0	10	4	3	2	2
Enteric Fever ..	0	1	0	3	4	5	6	7	1	2	1	0
Average strength ..	317	221	589	1323	635	829	827	952	809	867	441	200

The troops were supplied with the River Umgeni water to 2nd April, when, owing to the difficulty of bringing in the water a distance of over 2 miles, the contractor supplied the troops with water from Currie's Fountain, which was used by the inhabitants of Durban.

The 17th Lancers landed on the 6th of April, and furnished the first case of enteric fever on the 14th April, although no case had occurred on the voyage of more than 30 days.

Currie's Fountain, as it is called, is a shallow well 30 feet deep, situate at the foot of the Berea Hill, on which many of the well-to-do merchants of Durban live. The ground in which it is sunk, is really a swamp, and used as a grazing ground for cattle. This well is supplied from a spring in a layer of sand at the depth of 30 feet, and rises to the surface through a large iron cylinder. At that time, however, a pipe connected this with a large brick lined well of indifferent construction, which derived its supply from the same source, but was exposed to surface contamination. When we suspected this water to be the cause of the enteric cases, it was subjected to a careful analysis, and the result was that

the water was found to be very impure, perhaps more so than it usually was, on account of a heavy rainfall extending over 3 days, and the first for some considerable time, and probably due to one of those periodical contaminations to which all surface wells are subject. We found microscopically a remarkable absence of living animalculæ, but a few vorticellæ were observed, and much sand. Hearing that a severe form of fever was prevalent in the town among the civil population, of which some cases were admitted to be enteric fever, the result of our analysis was communicated to the public through the medium of the press. The corporation, and especially the major who had introduced this water supply to the town, were very indignant, and sent some samples of this water to England for analysis. Dr. Frankland and Dr. Paul analysed the samples independently with the following results :—

Results of analysis of 2 samples of water expressed in parts per 100,000. (Dr. Frankland, London.)

Total solids ...	82·00	Organic nitrogen	·035
...	81·22		·068
Organic carbon ...	·058	Ammonia	*Nil.*
...	·068		
Nitrogen as nitrates and nitrites		1.114	
...		1.109	
Total combined nitrogen. ...		1.149	
...		1.173	
Chlorine ...	32.0	Previous sewage or	10.820
...	31.8	Animal contam.	10.670
Hardness, tempy. Nil		... Permanent	·140
			·126

There were two other samples of river water, but the above were from Currie's Fountain. Dr. Frankland was not informed. Opinion: "all the samples are clear and palatable; they all contain mere traces of organic matter, but large quantities of nitrates and chlorides. If these waters were obtained from shallow wells, they are not safe for dietetic purposes; because the animal matters, from which the nitrates are derived, might under less favourable circumstances escape the thorough oxidation which has destroyed them in these samples; on the other hand if the waters are from springs, or deep wells, subject to no admixture of surface water, they may all be used with safety, &c. (Signed). E. FRANKLAND."

Dr. B. H. Paul, F.C.S., in his analysis found :—

Solid contents in solution.

	Parts in 100,000.	grs. per gall.
Fixed ...	74·5	52·15
Volatriable ...	17·0	11·19
Free Ammonia traces.	91·5	64·05
Organic nitrogen.	·006	·004
Chlorine	30·94	21·65

Lime and magnesia salts, very moderate.

On these analyses the corporation issued a notice that the water was very wholesome and fit for use. Enteric fever and fevers of a low type are very prevalent in Durban in consequence, and no doubt would be more so, but that many use rain water for culinary purposes.

After our own analysis about the middle of August, steps were at once taken to filter and boil the water used by the troops for drinking and cooking, until the contractor could arrange to bring water in sufficient quantity from the River Umgeni. The water was supplied to the troops by the 1st Sept., and afterwards the attacks almost ceased, the only cases came from the A. S. Corps, whose duties were in the town away from the camp, and it was found that, notwithstanding all warnings, when thirsty they often resorted to the hydrants and drank of the impure town supply.

A remarkable fact was, that the other continued fevers and dysentery [really a dysenteric diarrhœa] also rose and fell at the same time. The sanitary state of the camps was all that could be desired. The sequel bears out the case, for during the arrival of the reinforcements in large numbers for the Boer rebellion in the Transvaal during 1881, about the same season of the year, no outbreak of enteric fever occurred, although it was always rife among the civil population at Durban; the reason being that the Umgeni River water was used instead of Currie's Fountain to supplement the rain water used for the small detachment stationed usually at that place.

To this question of the diffusion of enteric fever by means of the water supply belongs the discovery of the propagation of the disease by means of milk.

Dr. Ballard, when medical officer of health for Islington, pointed this out very distinctly in 1871, and afterwards ascribed an outbreak near Leeds to the same cause.

Since then a great many outbreaks have been traced to the dairy, being due either to contaminated water used to wash the utensils, or perhaps even added to the milk for the purpose of adulteration; or else from the fact of its being some way infected by persons sick from enteric fever, such as the cows being milked by the person in attendance on the patient, or the utensils or milk even being kept in the same room as the sick person. Lately the attention of the profession has been drawn to the possibility of the disease being induced by some affection from which the cow was suffering.

Mr. Vacher of Birkenhead, at the meeting of the British Medical Association in August 1879, stated that on examining a sample of milk, to which it was supposed an outbreak of enteric fever was due, he found nothing in the chemical examination of the milk which would lead him to think that it was wilfully adulterated; but examination with the microscope showed that some of the excreta of the cow had got into it. It is not stated whether the cow was ailing at the time. Now it is more than probable that enteric fever may often be due to some disease in the milch cow. I am convinced that it occasionally happens in South Africa, and quite concur with Brigade Surgeon Sir Robert Jackson, who investigated the subject of horse and cattle sickness in the Transvaal in 1879 and 80, and was led to the conclusion that much of it was in reality enteric fever.

I had no opportunity of making any P. M. examinations on cattle myself, but I found that dogs can suffer from it, and it is in South Africa one of the chief causes of mortality amongst imported animals as well as anthrax, which is also said to be due to a bacillus.

During life there do not appear to be very characteristic symptoms beyond languor, loss of appetite, slight disorders of bowels, and rapid emaciation. I noticed a peculiar pallor of the mucous membranes of the mouth and a whitish furred tongue. The temperature, respiration and afterwards the pulse are much increased, and after from two to three weeks the dog died.

Post-mortem on a black Retriever "Sailor" 8 hours after death.—Lungs quite healthy. Heart healthy. Liver congested and friable, which, I am told, is commonly found to be the case in the colony. Spleen much congested and enlarged. Kidneys congested. Small intestine at upper part more especially, was rose-coloured from inflammatory congestion. The lower two-thirds much thickened and spasmodically contracted, the passage being almost occluded thereby. On opening the gut there was no great congestion of the mucous membrane. What I took to be Peyer's patches were enlarged and distinct, and several had ulcerated. The solitary glands were congested and enlarged, and in a few instances ulcerated.

The dog had only been 8 weeks in the colony, and was ill 5 of those. There was some vomiting and purging at the commencement, and then great languor and loss of appetite. Death was from exhaustion.

Now when one considers that the water-supply throughout Natal and the Transvaal is by small sluices into which the drainage of the roads is conveyed, and which in some places act in the double capacity of sewer and aqueduct for the supply of drinking water, as is the case in some of the chief towns, Lady Smith and Pretoria, for instance, it is not to be wondered at that enteric fever is often prevalent. The transport of the country is carried on by means of ox wagons, with spans of from 14 to 18 head of oxen. These animals stand about for hours in the streets of the towns and make the roads very foul. This is carried into the water supply by the wind or first shower of rain.

The subject of the transmission of disease from animals to man has attracted the attention of many observers on the continent, and especially in Germany. Dr. Walder has described a remarkable outbreak of enteric fever in connection with the use of diseased meat at a choral festival held at Klober, Zurich, and the same was noticed in India a few years since. No doubt there is much to be learnt in this direction.

Relation of the soil.—The relation of the soil to the spread of enteric fever, is a subject which has attracted a great deal of notice of late years; as yet, however, no very definite results have been obtained. Professor Pettenkofer's investigations on the subsoil water and the air contained in the strata above it, led to his bringing forward a theory on the etiology of enteric fever and cholera, which has influenced research throughout the world, aud brought the influence of the soil in disease into greater prominence than it had ever attained at any previous time.

His views were based on enquiries made mostly in the city of Munich, where the circumstances were tolerably favourable for such enquiry, there being no ordinary drains, and consequently greater impurity of the soil. He reckoned that only ⅛ of the excrement of the city was removed, the other ⅞ remained and was absorbed by the soil; but the disinfecting power of the soil is limited, and if there is a constant and daily contamination with sewage and the like, it very soon becomes saturated and filth polluted. In Munich it was constantly becoming worse, so that there existed a filth polluted soil seldom met with at the present time.

The influence of the soil depends much upon its composition and physical qualities, and also its permeability to air, water, &c. Locality also plays an important part owing to the differences in geological

formation and physical aspect of the place, and the amount and kind of rainfall and other conditions. The more porous the soil, the quicker would any change be manifested, and *vice versa.* Borings at Munich and Berlin have shewn that at a certain distance beneath the surface a water-tight level exists, which has many inflections, being sometimes near the surface and sometimes far from it, and which presents depressions and inclinations that exert a remarkable influence on the movement of the soil water as well as upon the height of its level. Pettenkofer has also shewn that decomposition in soil varies with their porosity, in consequence of the freer circulation of air in some with varying moisture, on which he lays particular stress. He appears to think the air circulating in the interstices of the subsoil is the agent conveying the poison. This emanating from the soil in the form of miasma.

Pettenkofer says that the subsidence of the ground water leaves a fitting nidus in the soil for the development and spread of typhoid and cholera germs. It is maintained that the nearer the surface the ground-water is, the damper the soil, and therefore the less pervious it is to those gases or germs that would give rise to typhoid fever.

The conditions he appears to think necessary for an outbreak are as follows :—

1. A rapid sinking of the ground-water after an unusual rise.
2. Impurity of the soil from animal impregnation.
3. Entrance of a specific poison.
4. A certain heat of the soil.

Pettenkofer found that by comparing the number of deaths from enteric fever with the level of the ground-water, he was able to come to the conclusion that the most fatal time was when that water fell after a previous rise.

The experience of others in Munich does not appear to have borne out his views ; indeed, the opposite has more often been found to be the case. If I understand them aright, Pettenkofer's deductions are annulled by his having taken the deaths from enteric fever, and not the dates of attack as should have been done ; now most deaths from enteric fever take place during the 3rd week of the illness, and to this must be added the period of incubation, at least 10 days, so that a month would be an early date to take as an average duration of the disease after it was contracted up to the time of death.

To know the exact influence of the water level, it would be necessary to know its state a month previous at least.

In fact to have even an approximate estimate of its influence, a constant record of the water level should be kept, and the history of each case compared as far as the date of attack was concerned ; it might then be possible to form an opinion.

It has been recorded that a rise in the level of the ground-water at Munich during 16 years, was simultaneous with a diminution in the mortality from enteric fever, but if my views are correct, this statement cannot go for much.

That there is a connection between the rise and fall of the subsoil water, I do not deny, but further investigations are necessary in a new line, for we have hitherto not been going the right way to work. Very likely, it will be occasionally found that the conditions will be very opposite at one place to what they are at another, as far as my experience goes, the time most productive of attacks is when a heavy rain occurs after a long period of drought, but this will vary under certain conditions, such as cesspits in the vicinity, their depth, and distance from wells, &c.

The influence, I take it, is through the medium of the water in the wells used for drinking purposes, but this Pettenkofer altogether denies, and puts down the cause to a miasmatic influence, which is by no means a new view. He appears to be satisfied that the participation of the drinking water in many outbreaks was impossible, and he seeks for other local influences, and finally falls back on the soil as the seat of the local condition which determines the epidemic. He seems to altogether disregard the strong positive evidence that has been accumulated in India, and elsewhere, to shew that the drinking water may carry the agent, and is not justified in drawing the influence that there can be only one mode of spread. (Parkes). If the poison of enteric fever was miasmatic, we should find more cases among those who live on the ground floor, than amongst those who live in the upper storey rooms, and also among the officers than among the men ; but such is not the case as far as my experience goes. Pollution may, and undoubtedly does occur, through an unusual rise in the subsoil water, or through the impurities being directly washed into the wells, or by soakage through the soil.

If the specific poison is present in an active state, an outbreak will follow in due course among those using the water.

I should consider the most dangerous period to be soon after the polluted soil was moistened, and the nature and composition of the soil and strata in which the well was dug, would materially influence the chance and rate of contamination.

The combinations of circumstances are, however, so varied, and so much modified by local conditions, that it is impossible to imagine any well being adapted to different parts even of the same town, much less of different parts of the world.

The observations of Dr. Frank, who was practically health officer of Munich, bear out the above views to a certain extent. Speaking of Pettenkofer's theory, he states that careful measurement of the ground water gives no support to his favourite theory.

Kuchenmiester seems to doubt the spread of enteric fever through the drinking water. Hirsch, however, seems to have no doubt of the influence of impure drinking water, but is not decided which of the following views is correct :—

1. Whether impure water contains something specific.

2. Whether the water merely exerts an injurious influence which predisposes to an attack.

I should certainly place the first of these views as thoroughly proven by experience, for in the case of the outbreak at Nunney in Somersetshire, and many other places, it has been clearly shewn that people may go on drinking a sewage polluted water for a long time without any case of the disease appearing, but on a case being imported, an epidemic shortly follows.

It has often been observed that the sudden digging up of previously moist soil is attended with, or corresponds to, an increase of certain diseases. Buchanan's researches, however, prove that the permanent drying up of the subsoil diminishes the mortality of both cholera and enteric fever.

Dampness of the soil in Europe undoubtedly fosters phthisis and rheumatism ; the air first aids in putrefactive changes, and afterwards by its watery vapour lifts the filth ferment into the air ; this is what some would have us believe with regard to the causation of cholera and enteric fever.

Foul air from sewers, &c.—Various experiments on sewage air have proved that continuous and long inhalation of air charged with the gases evolved from decomposing organic matter, particularly sewage, is capable of producing a feverish state accompanied by diarrhœa ; but when the cause is removed, the person soon recovers, which is not the case, however, if the specific poison of enteric fever be present. Undoubtedly the state of ill-health induced by the decomposing material of night soil and the like, whether inhaled or consumed in the drinking water, does produce a state of the system most favourable to the reception, not only of enteric fever, but of many other diseases, cholera, dysentery, and probably some other diseases as well.

Bad smells lower the vitality and predispose to the attack, but all effluvia are not deleterious in proportion to their offensiveness. Outbreaks of enteric fever, when there happens to be a few cases only and sporadic attacks, are often attributed to the foul air of sewers entering the dwelling, more particularly the sleeping apartments ; but unless the specific poison be present, I very much doubt its power to give the disease.

When the specific poison thus issues into the air, the atmosphere generated is, of course, immeasurably more likely to communicate the disease than that which immediately surrounds the fever patient. Dr. Buchanan found that in the Croydon outbreak of enteric fever in 1876,* the disease had for the most part picked out those very houses in the sewered area into which sewer air could find admission, and left untouched those houses into which it could not penetrate, especially in the higher portions of the town, where the liability to the diffusion of sewer air into the interior of the buildings is greater. But this commonplace defect did not explain all the phenomena of the prevalence ; groups of cases occurred which were certainly not due to defects of house drainage, and which appeared to be connected with the water-supply. Dr. Buchanan shewed good reason in his report, for the belief that the water pipes have in places such relation with the sewers, that during intermissions of the service, sewage may be sucked into the water-supply, indeed it was not even necessary that such intermissions should occur. Altogether about 1,200 cases occurred, of which 90 proved fatal.

It has been conclusively proved that the liability to enteric fever has in England a distinct relation to the number of communications between houses and sewers ; hence relatively larger houses of the better class are more liable to infection from enteric fever than small houses, which have often no interior sewer communication. But it may be no more than a predisposing cause, although many cases have been

* *Lancet*, May and August, 1876.

published, which seem to prove the disease to be thus originated.

Although the habits of the Chinese are very dirty, yet enteric fever is if anything less prevalent among them than any other nation. The public latrines are neglected and become very offensive, and even have restaurants attached, which ought according to our doctrines be a most prolific source of the disease. At Pekin there are sewers which are always bursting and overflowing after heavy rains, but enteric fever is not at all prevalent there.

The Chinese are very temperate and regular in their habits, eating plenty of vegetable food, and boiling all their drinking water. They generally drink it as tea, avoiding cold water which, they say, Europeans drink to quench the internal fire developed by eating so much meat. (Dudgeon.)*

However much foul air may act as a predisposing cause, we must look to something else as the exciting cause.

Military cantonments in India are kept in a very clean sanitary state. There are no sewers and only cesspits in a few places, the dry earth system being in pretty general operation, and yet outbreaks are constantly occurring.

Attendance on Enteric cases:—

As regards this mode of transmission of enteric fever, I have not been able to come to a definite conclusion, for in all the instances that have come before me, I could not satisfy myself that it was the cause, as the men had been living under exactly the same conditions as the body of men among whom the cases occurred, and therefore the cause may have been the same; perhaps the fatigue involved in attendance on the sick merely forming a predisposing cause. As far as I have been able to ascertain, the percentage of attendants attacked owing to the small number often appears high, but this is no doubt fallacious. There are many causes affecting the question, such as protection by previous attacks, &c., so that it becomes very hard to form any conclusion. Some cases have appeared in the medical journals† which would seem to make this mode of origin rather less rare than is generally supposed. In the present state of our knowledge, it would at all events be well to allow no one under 25 years of age to attend upon cases of enteric fever, unless they had gone through the disease, and such a one should always be chosen if possible for attendance on severe cases.

* DR. DUDGEON: Diseases of China.

† DR. COLLIE of Homerton Fever Hospital: *B. M. Journal*, November 30th, 1878.

ON THE PHYSIOLOGICAL AND MEDICINAL ACTION OF HYDROFLUORIC ACID AND THE FLUORIDES.

BY SURGEON L. A. WADDELL, M.B.,
Resident Physician,
Medical College Hospital, Calcutta.

[*Continued from page 99.*]

II.—PHYSIOLOGICAL ACTION.

THE only observer, so far as I am aware, who has already occupied a portion of our present field of enquiry, is M. Rabuteau*. His investigations, confined to the action of the fluorides, were, I am led to believe, more especially directed to a study of the absorption and elimination of these salts. I hope to be in possession of his pamphlet in sufficient time to enable me duly to refer to his results.

The course of my own observations in addition to the performance of several, experiments on animals—of which for the sake of brevity, only the leading results as a rule are given, includes also a record of the apparent physiological effects elicited by a careful observation of patients to whom these drugs had been exhibited. By the kind permission of Dr. Coates, 1st Physician, Medical College Hospital, I was also allowed in several of his cases, where these drugs seemed to be indicated, to regulate the doses with reference to this particular enquiry. In this latter work, while employing the usual instrumental aids to precise clinical observation, I have made free use of hæmometry with a view to definitely guage the action of these drugs on the formed elements of the blood—on which I have found they exert a most marked effect.

Most authorities are agreed as to the advisability of 'proving' drugs on healthy individuals, and, guided by the observed effects, the making trial of them in disease†. In utilizing this method of inquiry I was fortunate in securing the intelligent co-operation of competent provers in the persons of Assistant-Surgeons G. G. Sarkara and N. C. Basu, M.B., and Mr. Pogose, a senior medical student—who in their willing submission to the discomfort it

* "Étude expérimentale sur les effets physiologiques des Fluorures et des Composés métalliques en général." Par A. Rabuteau. Paris, 1867.

† Haller in his preface to the Swiss Pharmacopœia (*Pharmacop. Helvetica*, Basel 1771, p. 12) thus advises the proving of medicines on the healthy organism—'*Nempe primum in corpore sano medela tentanda est sine perigrina ulla miscela.*' '*Inde ad ductum phænomenorum in sano obviorum transeas ad experimenta in corpore ægroto.*

Historical proving Societies are those of Prof. Jörg, the Allopathic Proving Society of Vienna, and that formed by Rademacher's followers.

Rogers in his '*Present State of Therapeutics*' strongly advises this mode of procedure. And Parkes in his work *On the Urine* (Lond., 1860, p. 113) says, "it is obvious that the knowledge of the action of medicinal agents in health is an important preliminary to the study of their effects in disease."