

## CERTAIN CONSIDERATIONS REGARDING CHOLERA AND FEVER.

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to the Queen.

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MR. PRESIDENT,—1. *Health Conditions in India.*—Here is an exact transcript of a weekly Health Report\* of India, recently given in one of the public papers devoted more especially to information regarding Britain's greatest dependency, namely :—" *Bombay* : Health good. *Bengal* : Fever prevalent in twenty-four Pergunnahs, Moorshedabad, and Rajshaye, Burdwan, Rungpore, and Purneah ; cholera still in Cuttack. *North-West Provinces and Oude* : Health good, except in Bareilly, where fever and cholera (thirty deaths) have appeared. *Punjaub* : Health fair. *Central Provinces* : Fever still prevalent. *British Burmah* : Rangoon and Akyab, health good ; Bassein, a little small-pox ; Prome, cholera decreasing. *Assam* : Health fair. *Mysore and Coorg* : Fever prevalent. *Central Indian States* : Morar, cholera disappearing ; Rajpootana, Mewar, fever prevalent. *Others* : good."

2. *Examination of Particulars.*—Let us examine the particulars just given, and these are the results which present themselves. The general health condition throughout India was unusually favourable ; with the exception of places named it was good ; at places far asunder as the Punjaub and Assam, "fair", that is, not absolutely good, and yet disease not prevailing to an extent to attract special attention. Elsewhere, however, one or other of the three forms of disease which most prevail throughout that country existed at different places, although, fortunately, with inconsiderable intensity, as compared with their manifestations in the same localities on many previous occasions. Thus, fever was prevailing throughout the stations of Lower Bengal ; also far away in one direction in Mysore and Coorg, and far away in another in Rajpootana ; it lingered in the central provinces, while at Bareilly, far away in a third direction, fever and cholera had both appeared, the advent of the latter malady

\* Week ending 8th October 1880.

signalled by the death of thirty victims. Elsewhere cholera alone is reported as present; in Cuttack as still prevailing; at Promé as decreasing; at Morar as disappearing; while, at an extreme corner of the Empire, near one of the estuary mouths of the Irawaddy, the record says there is a little small-pox at Bassein.

3. *Deductions*.—That is, during the same week health-conditions at the several parts of our Indian Empire differ absolutely from each other—a circumstance in accord with existing differences in physical condition and aspect of places far apart from each other; differences in climate and seasonal changes; differences in kind and condition of vegetation at the same time in those places; differences in the conditions of their several populations; and, doubtless, also to the operation of certain great ulterior influences as yet only cognisable in their effects, but not solvable by the theory alone that a specific organic poison introduced from somewhere else, or suddenly vegetating on the spot has, for a time, exerted its evil and deadly power upon humanity, then, itself, becoming dormant, asleep, disappearing or passing onward in its work of devastation—the manner of its disappearance or progress as unaccountable, according to the same theory, as were the circumstances of its original development.

Two months elapse. At the end of that time the health-conditions are thus reported.\*—*Bombay*: Fever continues, but is abating in Guzerat. *Bengal*: Fever still very prevalent in many places, and deaths reported very numerous in Nuddeah and Jessore. Cholera in Cuttack, Pooree, and Maldah, and some cases reported from Budruck and Deoghur. Small-pox in Pooree, Chumparun, and at Jhaldah in Manbhoom. *North-Western Provinces and Oude*: General health good, with the exception of slight fever in Bareilly and Agra, and some cholera in Fyzabad. *Central Provinces*: Good. *British Burmah*: Cholera in parts of Pegu, but few fatal cases; a little small-pox, otherwise public health good. *Assam*: General health fair. Fever about Gowhatti. *Mysore and Coorg*: Health good.

We compare the general results of these two health reports thus:—At Bombay, where health was good at the date first referred to, fever has, in the interim, occurred, and continued to prevail. In Bengal, both cholera and fever still prevailed in the localities formerly named, with two exceptions, viz., Nuddeah and Jessore. Cholera had ceased in Cuttack, but appeared in Maldah, Budruck, and Deoghur. Small-pox oc-

\* For week ending 9th December 1880. See Allan's *Overland Mail*, 29th December 1880.



curred in several places previously free from the epidemic, particularly Pooree, Chumparun, and Manbhoom. In the North-West Provinces and Oude health continued good as before. At Bareilly, where fever and cholera previously prevailed, only slight fever was reported; cholera had left that town, but appeared at Fyzabad. In the Central Provinces, where fever formerly prevailed, the population had become healthy. In Burmah the state of health was unaltered; but in Mysore and Coorg, where fever had prevailed, the state of health had become good. Thus, in what may be termed the ebb and flow of these three diseases, indicated by the reports before us, we find ourselves face to face with some of the great problems of epidemiology.

4. *Method of Inquiry.*—If, then, we endeavour to follow the natural history of these scourges of mankind, either on the occasions now referred to, or on the others, when, with varying degrees of intensity, they have swept over continents, it seems to me that such endeavour is more likely to obtain that measure of success incidental to the pursuit of subjects from their very nature abstract and abstruse, if we take a comprehensive view of the various conditions under which they severally or together occur, than if we confine attention to one set of those conditions to the relative omission of others perhaps less tangible. If organic pollution alone of air, earth, or water be the cause of cholera, how are the sudden appearance, culmination, decay, disappearance, absence for long periods of these diseases, to be accounted for, conditions of air, earth, and water meantime remaining unchanged? How similarly with regard to fever, or a particular kind of fever? How far the circumstance that fever and cholera on one occasion prevail independently of each other; on another contemporaneously; on a third alternating with each other; individual cases of fever passing into cholera; others, at their onset presenting the ordinary symptoms of cholera, developing into fever; and yet a third set, at their commencement, manifesting symptoms characteristic in equal proportions of both those forms of disease? How, with regard to an acknowledged infectious and contagious disease, viz., small-pox, on the first occasion named, limited to a spot of inconsiderable size, remotely situated in the Eastern division of our Indian Empire; on the second disappearing there, but occurring at places completely apart from each other, as are Pegu, Pooree, and Chumparun, to the exclusion of the vast intervening territory between those three localities? By what explanation do we account for its being so limited in both these instances to the localities named; whereas, on other

occasions, it spreads onwards directly from place to place, within certain limits, devastating populations in its course? Are these several phenomena to be accounted for simply by the theories of organic pollution and contagion? For my own part, I say—No; they are not. And, from this point of view, I proceed with my further remarks.

5. *General Considerations.*—The teachings of past experience point to the circumstance that the law or laws, in accordance with which small-pox has its periods of prevalence and of dormancy, are not much dissimilar, if at all, from those by which cholera is regulated. We have been informed that particular forms of disease comprised in what may be termed the small-pox group, have their corresponding rise and fall. It is not assumed that actual affinity exists between that disease and cholera. On the contrary, there is this great difference between them—that by means of vaccination\* individual susceptibility to small-pox becomes limited; that to cholera is decreased by any similar or allied process. But, as regards cholera, so with small-pox, the bulk of evidence is to the effect that, so long as the general epidemic of either disease is active, and what, for want of a more definite name, is indicated as diffusive energy remains in full operation, isolation of individual cases does not retard, far less prevent the expansion of morbid influence over the population of what French authors appropriately describe as the epidemised locality. Neither has it in bygone times been found practicable, even by means of inoculation, to extend small-pox during the intervals between periods of epidemicity.†

More intimate is the relationship which phenomena of cases and manner of prevalence of both cholera and fever, as observed more especially in India, justify the belief that there exists between these two diseases. On this subject one of the very recent writers‡ on Indian diseases expresses himself in this way:—"Owing to the marked association of epidemics of cholera and fever in Northern India, and to the

\* Is it the case, as stated by Copland, that, as small-pox has decreased since the introduction of vaccination, scarlatina, measles, pulmonic, and cerebral inflammations have increased?—Art.: "Epidemics"—*Dictionary*.

† As a foot note I mention that in India the deity of cholera is Maree, or, as the name is respectfully alluded to, Maree-Ama; her handmaid is Seetala, goddess of small-pox. In China the deity of small-pox appears to be Niang-Niang; she also must be mentioned respectfully. Thus, when in 1875, the late Emperor died of it, the *Pekin Gazette* announced the event as "the enjoyment of the heavenly flowers". The Chinese theory of small-pox and measles is that they depend upon a poison inherited from the parents, which resides in the system till excited by external causes, like fire concealed in the flint.—*Customs Reports*, January—March 1875, p. 35.

‡ Macnamara, p. 120.



frequent similarity, especially on the North-West frontier, of bad cases of malarious fever to cholera seizures, some observers have been led to ascribe the two diseases to an identical cause." He adds—"The identity of the miasms of cholera and fever is not pleaded, but only their similarity, which is chiefly shown in the external conditions that favour them both." Northern India\* affords many examples of the impossibility of predicting from the physical conditions of a locality the degree to which fever will flourish there.† Elsewhere throughout India a similar observation is applicable with regard to cholera, and the circumstance is recognised, that in localities noted for the occurrence of malarial fever, diarrhoea, dysentery, and affections of the abdominal organs generally prevail. Even in England, cholera, when it has occurred, has been most severe in low-lying places, such as were formerly the favourite homes of ague, and such as have subsequently furnished numerous cases of what has been described as "paludal enteric fever", a mixed type of malarial intermittent and typhoid;‡ in other words, malarial fever, attended by intestinal complication. In India the occurrence of bowel affections, with and without other organic lesion, and with and without fever, has as distinct an apparent relation to season, as is presented by the course of vegetation in the same locality, or, indeed, any other natural phenomenon. So, also, in respect of fever distinctly "ardent" in type attended by cerebral complication; so with that, the complication of which is pulmonic. Fever, diarrhoea, and dysentery§ in that great country prevail simultaneously or alternate with each other. In all, affections of the spleen, the liver, as also of other glandular and glanduloid tissues, sooner or later, occur as complications. In many instances ostensible causes of illness are apparent, but in many others, such causes as are usually assigned fail altogether to account for their occurrence.

\* Dr. Livingstone relates that in some parts of Central Africa he found some dry, sandy, and clean tracts, more dangerous, as regards fever, to encamp in than others covered with reeds and rushes. Mr. Hyde Clarke mentioned an instance of a town in Africa built in an healthy situation, and healthy until cultivation began. Three years afterwards fever broke out, and ran through it all.

† Macnamara, p. 121.

‡ Russell, p. 28.

§ Sir Joseph Fayrer, in his Lettsomian Lectures, 1881, mentions that in India dysentery is often accompanied by malarial fever; that among the complications of the former is the typhoid form; that a close analogy exists between dysentery, diphtheria, and typhoid fever; that the disorganisation, although principally in the large bowel, has a tendency to pass the ileo-cæcic valve.—*British Medical Journal*, 29th January 1881, p. 149.

*Types and Unity of Fevers and Cholera.*—Both cholera and fever take place under various circumstances and conditions—individual and general. They also present, in particular instances, various types or modifications in their own special characters. Thus, cholera is met with in one set of localities in India, occurring in isolated cases throughout all seasons, those isolated cases in certain seasons being the precursors of a general outbreak, in others not so; at times apparently induced by unwholesome articles of food or drink, at others following the administration of therapeutic evacuants. In a second set of localities cholera occurs in the shape of regular outbreaks at certain intervals of time during the intervening periods, all general conditions remaining precisely as they are during those outbreaks, and even sporadic cases so extremely rare as to be considered almost absent. When outbreaks of cholera do occur, they present certain modifications in their phenomena, these modifications observable when the epidemic of one year is compared with those of preceding years, the characters of individual cases with those of others; and even in certain instances where direct importation of the disease has been traced, assuming new, and it may be exaggerated, characters, in its new locality. Then, again, the disease presents various characters in individual cases—congestive or algide in one, asphyxiated or spasmodic in others; rapidly destroying life in one set, more slowly in another; the attack sudden and without premonitory warning in one; in another, preceded by malaise or diarrhoea, or both; sometimes for a few hours, at others for some days. But neither in designating these several modifications, or others here unenumerated, in which cholera occurs, do we find a term applied in a specific sense, either as implying a particular manner of causation, a particular series of pathological changes—although such do occur—or a particular method of treatment to be followed. In all these fevers cholera is simply recognised under that general term, causation being looked to in reference to public measures of mitigation, and with a view, whether to be realised or not, of future prevention of a similar outbreak.

With regard to fever,\* so various are the characters and modifications, according to geographical position, climatic

\* Dr. Chevers records the occurrence in India of Pali plague, and relapsing fever, in 1815-19; of cholera in 1817. He states, in reference to the severe epidemic of fever which prevailed in the gaols of Agra, Umballah, Futtyghur, Allyghur, Jeypore, Malwa, etc., in 1864, that it was variously described as true typhus, contagious fever, typhoid fever, and relapsing fever, in the same year of the Burdwan fever epidemic.



conditions, seasons, etc., acting upon individual diatheses, temperaments, habits, and other personal circumstances, that while, as already related, ancient Hindoo physicians reckoned thirteen different kinds, this category has in more recent years, on the one hand, been so expanded as to embrace some three hundred different species; on the other, it has been so compressed as that only one fever is acknowledged to affect humanity, this one fever presenting so many modifications according to circumstances and conditions as related, yet itself preserving its unity in this multitude;—fever, with this modification here, that other there, and so on.

Partly as a result of improved sanitation, partly also of a circumstance which has more than neutralised all sanitary measures that have been adopted in India since 1864, attacks of fever among our troops in that country are, in the mass, less violent, less acute, less ardent than in days before the great Sepoy Mutiny. On the one hand, measures for preserving health, begun by army medical officers, while sanitary science was yet recognised only as “medical police”, have been developed upon the lines then laid down; space in barracks has been increased three-fold, intemperance diminished, inducements created for men to remain in or near the barracks, instead of wandering. But against all these, and outbalancing them, is the one measure of short service, with the constant stream into India of young immature lads incidental to it.\*

Individual cases from time to time occur in which the symptoms, beginning with hyper-pyrexia, gradually merge into such as are adynamic. In former years, cases of this nature would have been described as of synocha; more recently, but yet a good many years ago, the expression typhoid would have been applied to the latter condition, not, however, in a specific sense, but adjectively; the counterpart, as it were, of ardent, acute, inflammatory, and so on. Still more recently this term, instead of being applied thus adjectively, as expressive of a condition, appears to have a specific significance attached to it, and the resulting turmoil has been considerable. It were well, I think, to indicate

\* Article in *Encycl. Britan.* By Professor Traill, Edinburgh. Surgeon-Major Don, in his paper read before this Society (pp. 285 and 286 of *Proceedings*, 1880), observes, with regard to Bermuda, that “the robust, big-chested and muscular man, often a hard drinker, did get fever, but not enteric. The man of altogether reverse physical type and development, often temperate, or even teetotal, was the victim of enteric in an especial degree.” Also “that the age at which there is the greatest proclivity to the development of struma, tubercle, and such-like diseases of low nutrition, is that in which there is the greatest liability to enteric fever.”

clearly in future Reports in which of these senses, or in what other, the expression typhoid, when applied to a case of fever, is intended to be understood. In some instances, the forms of fever\* met with in India admit of being referred to one or other of the headings in accordance with the official "Nomenclature of Diseases". In the great majority this is only approximately practicable. In China, "mixed fevers" are described as such in published reports. In India, cases of fever assigned to climatic causes were, and still are, indicated as "malarial"; this in brief. They are of all degrees of severity; those of greatest violence tending rapidly to arachnoidal effusion and heat-apoplexy—such are, in India, termed heat fever; in China, pernicious fever; † others, as already remarked, passing into cholera. But, in reference to a particular type and complication occurring in India, the question is asked by our highest sanitary tribunal, ‡ "Is there such a specific fever as enteric fever at all?"

7. *Specific Origin Theory.*—That certain diseases are due to the action of specific poisons upon the system is a circumstance familiar to, and recognised by, all observers. Syphilis and rabies furnish examples of this class. In both, the poison appears to increase in, and pervade the system, but is itself only transmissible, at least in its acute state, by means of inoculation. Other specific poisons multiply and increase similarly, and are transmissible both by inoculation and infection, including contagion. Of this class are small-pox, scarlatina, puerperal fever, etc.§ That these diseases occur, however, under conditions where neither inoculation nor infection can be traced, or with good reason assumed to have been in operation, is a point forcibly brought to attention by the records of epidemics contained in current medical literature.|| Certain of these poisons are said to be capable of producing now one disease, now another, accord-

\* For views of the older medical officers, regarding fever generally, see my special reports, I, p. 164; and II, 56-76.

† *Chinese Customs' Reports*, July—September 1872, pp. 94-95.

‡ The Army Sanitary Commission. In the *Chinese Customs' Reports* July—September 1873, p. 56, these remarks occur in reference to dysentery and typhoid fever: "Whether the former disease is always specific is fairly open to doubt, and the specificity of the latter is denied by one of the greatest living authorities on the subject."

§ Puerperal fever is one of several diseases which arise spontaneously when puerperal women, wounded men, etc., are crowded in hospitals. See Copland's *Dictionary*, Art. Epidemics.

|| See *Transactions of Epid. Society*, vol. iv, part iii. Among others, Dr. Longstaff (p. 421) indicates that particular groups of disease prevail, some seasonally, others not apparently affected by season. The diarrhoeal group has the greatest mortality in the summer quarter, and is most fatal in years with dry hot summers.



ing to individual conditions and local circumstances, insanitary and otherwise; and, as a result of recorded experiments, certain animal fluids, originally innocuous, have, by artificial means, had their characters so transformed as to acquire such properties and their infective principle, then called pyrogenic. But, according to my view, analogy justifies the belief that, if by artificial means, transformation or evolution of this nature can be induced, equally may it be so by means of the inherent vital forces which regulate and determine the general organism of which organic matter is a part.

By analogy, also, the same or a similar principle applies with regard to various changes which occur in some instances during life, in others after death, and are capable of inducing disease in persons into whose systems matters so altered are introduced. Instances in illustration present themselves in peritonitis, erysipelas, pyæmia, etc.\* in cadaverous poisoning, in the several affections induced by fish and flesh meat in various stages or states of decomposition. But, on the other hand, we trace many illustrative exceptions. Thus, the flesh of animals dead by diseases the most horrible has been eaten—glanders, for example—in a cooked condition, without evil effects; animal poisons have been swallowed without ill effect; black vomit in cases of yellow fever has been swallowed; cholera matters have been tasted, and even inoculated into animals and people, with similar negative results. Hence, I venture to remark, the necessity for caution before we assume that, because a particular circumstance happens at one particular time and occasion, therefore precisely the same circumstance must of necessity occur under all and every combination of conditions. Such an assumption is obviously in disaccord with actualities.

During more than forty years has search been pursued zealously, but vainly, for specific poison of fever or cholera germs. Microphytes, bacteria, vibriones, etc., have each been indicated as the actual cause, each in turn, as a result of further observation, relieved from such onus. Thus, we can only say that cholera as a phenomenon from time to

\* Dr. Alfred Carpenter believes that the poison of typhoid fever may arise *sua sponte*; Dr. King that it may be produced *de novo* by the putrefaction of albuminous stools; Dr. Lowe that it may arise from a process of "evolution" in decomposing matters; that inasmuch as puerperal septicæmia, pyæmia, erysipelas, or hospital gangrene may develop auto-genically under a given combination of circumstances, and then spread by contagion—why not enteric fever? Dr. Cayley, on the other hand, says the weight of evidence is against the *de novo* theory. It has been remarked that "at bottom we are all humoralists and believe in infection; it is not until we have to say where and how, that questions arise."

time recurs; that it affects individuals and communities; but, in our present state of knowledge, or rather ignorance, of its laws, all circumstances of a positive nature with regard to its prevalence that have been adduced, have their counterparts negatively; all of a negative character, their counterparts positively.

Certain forms of fever are assigned to causation of a specific kind. Those to which attention is now necessarily restricted are such as by custom are referred to "malaria"; and such as are referred to a specific poison originating in, and propagated by, means of decomposing animal, more especially faecal, matters. That certain organisms are said to have been detected in the atmosphere of "malarious" places, may or may not be a fact capable of standing the test of further minute investigation.\* Even in the event of their being so, the presence of such organisms in those localities is itself due to the sum of conditions which induce particular and distinctive phenomena of life in the animal and vegetable kingdoms generally, in those localities, not as apparently is implied, themselves the cause of those phenomena. Their own development, judging from published reports on the subject,

\* "MALARIA.—At the meeting of the Royal Academy, a memorial was presented, entitled 'New Studies on the Nature of Malaria', by Signors Cuboni and Marchiafava. These studies corroborate at every point the conclusions drawn by Professors Klebs and Tommasi-Crudeli as to the vegetable parasite which produces the malaria fever. These observers have also discovered new facts which may serve to clear up one of the most interesting pathological facts, that is, the contagion of infectious diseases. They have been able to communicate the true malaria fever to animals (dogs and rabbits) simply by inoculating them with blood taken from malaria patients, which means that they have rendered contagious a malady which, under natural conditions, can neither be transmitted from man to man, nor from man to animal. They have also found that the presence of the *bacillus malariae*, in its sporadic form, in the blood of malaria patients, is a constant fact. This parasite is found in great quantities in the blood during the cold stage of the fever, while in the warm stage it has almost totally disappeared, leaving only traces of its spores. These, in their turn, can produce a second generation of parasites. In an appendix to the memorial, the authors quote a letter from Dr. Lanzi of Rome, who declares that he constantly noticed the same fact in the blood of twelve patients in the hospital of San Giovanni in Laterano, examined by himself during the cold stages of the fever.—There was further presented for insertion in the acts of the Academy a communication by Signor Tommasi-Crudeli. In it the author shows the utility of making experiments on the possibility of rendering the human organism impervious to malaria by small doses of arsenic taken daily. He says he has good hopes that he is well on the road to certainty, and describes the methods he has adopted; but, having instituted a new series of experiments on animals without having been able to obtain a final result, he invites all students to undertake similar experiments, and thus contribute to the solution of so vital a problem." That is to say, a theory is, in the first instance, elaborated, in the second, facts in support of it have to be sought for.



is not constant; it depends itself upon conditions which only occur at intervals, and on each occasion are temporary in their duration. Certain organisms, bacteria, for example, differ even according to the age of materials from which they are produced; sterilised solutions were obtained from new hay; non-sterilised, from old hay\*—according, so runs the explanation, as to whether they have lost their inherent generative energy.† Another abstract expression, you will observe.

As to the general disease, fever, I take the definition given recently by one of the highest of living authorities. "It is not only a state but a process; the state of fever once established, it may vary in its course, duration, and local inflammations which accompany it indefinitely."‡ According to views now generally accepted, this state or process may be induced by various causes, some of a nature extraneous to the individual, others inherent in himself.

As far as documents at my disposal authorise a conclusion on the subject, the conclusion at which I thus arrive is, that with regard to fevers in India, ardent in their characters, attended by cerebral, pulmonary, hepatic, or other complications, except ulceration, involving the glands of the lower part of the small bowel, observers have seen no necessity to assume the operation of a poison, specific in its nature. But when the latter complication does occur in the course of an attack of fever, with or without the presence of low adynamic, that is, typhus or typhoid condition of the patient, the tendency for some years back has been too much to assume the operation of a specific poison, the actual existence of which remains undemonstrated; too little to consider the operation of general conditions as they affect man, individually or in the mass.

The theory of specific poison is thus expressed by its advocates: "enteric fever arises from a specific poison contained in, and transmitted by means of, sewer emanations"; also, "the poison, the manifestations of which present that group of symptoms called enteric fever, and which, in fatal cases, is invariably found associated with lesions in Peyer's patches and mesenteric glands, is as distinct and separate as any of the other animal poisons which produce specific results, such as small-pox, measles, scarlet fever, cholera". But sewer emanations do not always induce such effects in indi-

\* Professor Tyndall, *Proceedings of Royal Society*, No. 181, May 1877, p. 230.

† *Op. cit.*, p. 232.

‡ Dr. Burdon Sanderson, *Appendix to Sixth Report*, new series, by Medical Officer to Privy Council, p. 9.

viduals most constantly and directly exposed to them; precisely similar effects also result in cases of fever due to causes other than these. How, then, can specific results arise from different series of causes, the causes themselves non-specific?

Inoculation of rabbits with blood from typhoid fever patients has produced in these animals not specific typhoid fever, but typhoid septicæmia, precisely as results from inoculation with organic matter in a state of putrefaction.\* In this respect there is reason to believe that the Lepuridæ manifest a greater degree of susceptibility than occurs in man. Unfortunate rodents have been inoculated with hydrophobic saliva from the human subject; death has rapidly followed, but, whether or not by hydrophobia, was a point on which the three operators had as many opinions among themselves.† So much with regard to a known specific poison.

As further adverse to this theory of specific poison, time

\* M. Decroix, *Hygiene and Surgery of Franco-German War*, p. 226.

† Dr. Davaine (*Courier Méd.*) remarks that, according to the researches of M. Pasteur, we know that putrefaction is the fermentation produced by infusorial animals of the family of Bacteria or Vibrio. The presence of these infusoria is one of the signs which characterise this phenomenon, which, according to Dr. Davaine, may take place as well in a living animal as in the laboratory. But what are putrid diseases? It is in order to reply to this question that the eminent experimenter has made some new experiments, of which the following are a short résumé:—

Blood from several patients attacked with gangrene was injected into rabbits without any result. This blood contained neither bacteria nor vibrios. "But if the gangrene", says Dr. Davaine, "be not itself a septicæmic disease, it may become so by putrefaction of the gangrenous parts, and the introduction into the blood of the putrid elements." This is what took place in an experiment of Dr. Bouley, of which we have spoken.

Dr. Davaine has also made a particular study of typhoid fever. In all the cases the blood of a typhoid patient, inoculated on rabbits, has caused death in a shorter or longer time, sometimes in a few hours, sometimes after two or more weeks, and he never injected more than the thousandth part of a drop, so that the septic nature of typhoid fever cannot be doubted. "I would add", said Dr. Davaine, in closing his communication, "that in successive generations of poison obtained from the inoculation of rabbits, I have not met with any difference between typhoid septicæmia, and that produced by the inoculation of organic matter in a state of putrefaction, either in the phenomena, or progress, or termination of the disease. It is to be noticed, however, that the incubation is generally much longer in the first case than in the second; but in another communication he will show that there is nothing in this special to typhoid fever.

M. Pasteur inoculated two rabbits with saliva from a child just dead from hydrophobia, with the result that both these animals died in less than thirty-six hours afterwards. Their blood, after death, when examined microscopically, presented minute organisms, having the appearance of the figure 8; these occurring in masses. These organisms, when intro-



alone restricts the number of my references to recognised authorities on the subject; the names of those authorities appear in my printed reports and other documents. Thus, the *de novo* origin of fever—in other words, the evolution—finds support among the group of observers, names of four among whom are given in my first special report. One writer observes that “fever cannot be traced to any specific poison”; another that, “in ninety-nine cases out of every hundred, the disease is not from any specific germ”; another, that “all medical men are not agreed as to the cause of enteric fever”; another, that “causation is so little understood as to give us little help in the diagnosis of this disease”; several others, that “enteric fever may arise from fatigue and exposure”; a still more recent writer that, “under special and peculiar conditions, enteric fever may become instituted in the system without any external agencies other than such common causes as give rise to that lowered tone of vitality\* which favours the springing up within itself of the morbid phenomena in question”; yet another, that “specific causes are not in all cases required to produce an attack of fever—that changes may take place spontaneously in one or more of the functions, and proceed to give rise to the worst forms of fever”; and so on. In India, of the cases investigated by me, the reports by medical officers concerned indicate that in no instance among them was an attack of fever actually traced to the operation of a specific poison. Hence, as a general result of what has thus been adduced, I submit that I have good grounds for the opinion arrived at and expressed by me, that not only is the presence of a specific poison undemonstrated in fevers met with in that country, attended by intestinal complications and characterised by a low, typhoid, or adynamic condition of body, but that such cases of fever occur as the results of general conditions, climatic,

duced into a *bouillon* of veal propagated it rapidly, and when inoculated in other rabbits, induced death similarly as in those from which they had first been taken. But, it is asked, was the disease in either case *la rage*? M. Raynard says Yes. MM. Colin and Dujardin-Beaumetz say No. M. Pasteur says neither Yes nor No.—*Gazette Médicale de Paris*, 22nd January 1881.

\* For example, of 23,000 French prisoners confined at Stettin in 1870-71, 93 were attacked with typhoid fever. The outbreak on that occasion was attributed to the combined effects of hardships, defeat, and imprisonment, that is, to the ordinary causes of typhus in armies under circumstances more or less similar.

Dr. Lowe records the case of a man, dirty in habits, and subject to diarrhœa, becoming ill of typhoid fever, in the absence of possible communication with one affected, with water pure, no drains, but his cottage damp, dirty, and overcrowded.

endemic, epidemic, and others, acting upon particular conditions and diathesis of individuals.

This view, I submit, finds support, by analogy, in recent published reports of diphtheria and scarlatina in this country.\*

Certain diseases, which undoubtedly in the first instance have arisen without the intervention of a specific poison or poisons, have subsequently spread by means of specific contagion. Typhus fever in camps, dysentery in fleets, ophthalmia in barracks, pyæmia in war hospitals, are examples in point.† But sudden outbreaks at places far apart, of diseases such as we are now considering, seem to me to indicate that they also, although capable of becoming epidemic, and in particular instances of being propagated by contagion, yet, as in the instances before us, their first development occurs autochthonously and autogeneously. In India, cases of fever occur that no theory of specific contagion can explain.‡ The doctrine of specific poison is altogether inapplicable to the history of what is called enteric fever in that country.§ So say high authorities on these subjects.

\* See *Brit. Med. Journal*, 18th December 1880, p. 989:—

“DIPHTHERIA AT THE CHILDREN’S HOSPITAL.—A very remarkable, though unfortunately completely negative, report has been made by Mr. W. H. Power, into the circumstances attending the outbreak of diphtheria in the Great Ormond Street Hospital for Sick Children in March of this year. The outbreak in question was without parallel in the history of the hospital. . . . . In-patients, of four out of the five general wards of the hospital, were almost simultaneously attacked by diphtheria, or scarlatina, and this under circumstances that seemed to exclude, at least in the majority of cases, antecedent human infection. Mr. Power’s inquiry, though thorough and searching, has not succeeded in demonstrating a cause of the diphtheria. . . . . The five initiatory cases of throat-illness in the several wards invaded had all been resident in the hospital for thirteen days and upwards before attack; all of them but one for nineteen days or more before they fell sick, a circumstance that seems to indicate that the children did not themselves introduce infectious disease to their several wards. . . . . In Louisa ward scarlatina was followed, after intervals, varying from twelve to eighteen days, by scarlatina, measles, and diphtheria. In Alexandra ward diphtheria was, within three days, followed by cases of scarlatina, and by acute albuminuria. In Alice ward diphtheria was quickly followed by diphtheria and sore throat, and whooping-cough; and, after an interval of nearly three weeks, by an additional case of diphtheria. . . . Thus, Mr. Power finds it necessary to close his report without having arrived at any definite answer to the question how diphtheria was produced in the hospital—a disappointing, but apparently inevitable, result.”

† Dr. Low describes a case in which typhoid fever, originating from bad hygienic conditions, was itself propagated by infection. He thinks that, under progressive development, infectiveness may become elaborated from a succession of attacks of diarrhoea.

‡ Surgeon-Major Don.

§ Cunningham. See Macnamara, p. 90:—“As an example of the lengths to which the followers of the specific poison theory have to go in their search for explanation, according to that theory, for the cause of ‘enteric



*Contamination Theory.*—I apologise for giving expression to so simple and elementary a truth as that contamination by foul matters of air, earth, water, meat, or milk are, individually and collectively, causes of disease. But are they so of any one particular form of disease, specific in character, rather than of a generally deteriorated state of body, the result of which presents itself as increased susceptibility of, or liability to, disease generally, and especially to that, whatever its form, which occurs epidemically? Such conditions are seldom unconnected with crowding, personal dirt, hunger, insufficient food; too often, habits of dissipation, vice, crime, —moral, equally with physical, deterioration. Thus, as with the one set so with the other, insanitary conditions naturally lead to, as often they are themselves results of, degeneracy, both bodily and morally.\*

*Air.*—That air polluted by animal matters undergoing decomposition induces diarrhoea, dysentery, in extreme cases what is called putrid fever, and cholera, is within the experience of most observers and writers. That such results do not always necessarily arise from this cause is no less within their cognisance. Factories of preparations the most offensive have remained absolutely free from cholera. When in 1861 that disease more than decimated our troops at Mean Meer, so intense was the peculiar and characteristic cholera odour in hospital and vicinity, that it was perceptible from, and at a distance of, eighty yards; yet the propagation of the disease was not attributed to this circumstance.

If, on the one hand, instances are recorded of the occurrence of yellow fever in connection with emanations from decomposing matters on board ship in latitudes within the sphere of that disease, so instances are on record where, with a decomposing mass of hides on board for weeks together, the mal-odours arising therefrom have blackened the lead paint in the saloons and cabins; have produced such a de-

or typhoid' fever, the following extract, from a letter which recently appeared in a medical journal, sufficiently indicates, viz.:—'From time to time I have had cases of typhoid fever under my care when the local dispositions were anything but favourable for such, nor was I able to trace their origin to a typhoid source. What struck me as rather remarkable, in connection with these cases, was their occurring in houses where persons who were much about them prior to and during their illness had leucorrhœal discharges, and none of which persons got the typhoid. The idea has occurred to me frequently (and no work that I have looked into on the subject alludes to it as an origin of the disease) that perhaps the matter which produces typhoid fever may be, or reside in, some special kind of uterine, or vaginal secretion.'"

\* See p. 11, No. 2, *New Series of Reports of the Medical Officer of the Privy Council*, 1874.

gree of congestion of the mucous membrane of the nose and fauces as to persist for many months after landing: and yet, although measles and boils prevailed extensively on board, there was no specific fever among the troops or crew.\*

Here is an example of what all the large cities of China are more or less; † and in which, Reports state, “no epidemic of febrile disease came under observation”. “Density of population, poverty, filthy condition of houses and streets; it might have been presumed that enteric fever, at all events, would have come to light, seeing that the products, whence its organisms are supposed to be derived and nourished, abound in many directions”. “Latrines numerous; constructed without regard to cleanliness; their contents kept for months; the neighbourhood saturated with odours of the most intense description; and yet, in some private houses and restaurants in close vicinity, the people well and lively, carrying on active and prosperous business.”

Of Pekin, it is stated, “We are obliged to pass certain localities at all times with closed nostrils, while hundreds of people continually live in and around and above these open cesspools, and yet manage to look well and healthy.” ‡

According to an eminent writer § on fever in England, “it has never been demonstrated that any particular gaseous body can induce the lesions found after death from enteric fever” ||

*b. Earth.*—There is no question as to the general fact that, in India, the prevalence, and frequently, also, the occurrence, of cholera, has a distinct relation to locality, including soil and other special conditions. Localities, the soil of which is impregnated with cholera discharges, are thereby rendered absolutely dangerous as camping grounds. But the relation between cholera and the state of the soil as regards

\* Such conditions existed on board the *Marlborough*, homeward bound, in 1856.

† *Customs Reports*, No. 13, part 6, January–March 1872, p. 41. Also No. 5, to 31st March 1873, p. 41.

‡ *Customs Reports*, July–September 1872, p. 41. § Dr. Harley.

|| The following is taken from the *Globe* newspaper, and refers to Paris, viz. :—“The *Havas Agency* has published a reply to the articles which have been written in the different newspapers respecting the dreadful smells that poison the air of the city. Those who suffer from the pestilential miasma are informed that, notwithstanding the manner in which their olfactory nerves are offended, the death-rate in the city has considerably diminished during the past month.” The object of these remarks is to show that offensive odours are of themselves not necessarily a cause of sickness. The circumstance also is suggestive that plumbers and other persons whose work is in connection with drain-pipes, sewers, etc., do not suffer in an especial degree from fever, or from any particular form or type of fever.



conservancy is by no means constant. From 1854 to 1867, cholera was absent from Hurdwar, the state of conservancy meantime the same; in the latter year, the first regular attempt was made to improve the place in that respect, and then the disease recurred with great violence. Filthy places at Lucknow, Morar, Constantinople, Rome, etc., in 1864-5, and similarly in Central India in 1875, escaped; while others, clean, and in better general condition, suffered.

Of Peking, it is said, "with all our filth, dirt, and smells—and people in the west can form no notion of what they are, for they almost defy description—there is a wonderful immunity even from fevers. The police and scavengers are among the healthiest and most robust of our population. The beggars, a numerous class, sleep in the streets nearly all the year round—to some extent they contest with dogs for refuse of the dunghills—still they survive and flourish, and most of them look fat and sleek".\* Similarly, to my personal knowledge in Tientsin, *Hwo-luan* or sporadic, *Wan-yih* or epidemic† cholera, known in China since B.C. 2500, occurred severely in Peking as an epidemic in 1821 and 1862, and on other occasions. In the intervals, local conditions were precisely as they were during the prevalence of the disease.‡

In India, the term "filth disease" has of late years been theoretically applied§ to fevers of an adynamic type, or with intestinal complication, in a sense intended to explain their etiology, and preventive measures have been applied accordingly. But so far have those measures of conservancy and scavenging, applied to stations, been from reducing the fatality of fevers returned synonymously typhoid or enteric, that, as already detailed before this Society,|| proportionate mortality has increased very notably. Of yellow fever in New Orleans, it is stated that the city was not in a worse condition as regards dirt in 1878, while the epidemic raged, than it was in 1877, or 1876, or 1875, when there was no epidemic; and inferences were drawn on the spot which, if justified, militate against sanitation, according to the simple theory of which the nasty word filth is the expression.

With regard to fever, my printed reports and published articles on the subject contain somewhat lengthy details, in which, by the evidence of capable observers and recorders, outbreaks of fever, presenting characters such as are held to

\* *Customs Reports*, July–September 1873, p. 49.

† *Customs Reports*, July–September 1872, p. 41.

‡ See p. 39.

§ *Med. Reports, Privy Council*, No. 5, for 1873, p. 9.

|| *Notes on Fevers*, p. 1.

distinguish typhoid or enteric, have occurred on virgin soil, where contamination by filth or other organic matter was simply impossible. Among such places are enumerated Natal, New Zealand, Cyprus, Ascension, etc. Even in localities, and on occasions when either or all the diseases named co-exist with "insanitary" conditions, it is well to demarcate between such coincidences and the relation necessarily connecting effect with cause.

On this subject of local contamination, a well-known professor and writer\* on Public Health observes that "all who are deeply interested in sanitary reform seem to imbibe an unconscious predilection for the doctrine that all diseases which prevail epidemically are the offspring of filth and overcrowding. This extreme doctrine is rejected by all the best authorities." He then discusses the subjects of contagion and epidemic influences on constitution, furnishing the explanation of phenomena which the theory of local contamination alone fails to demonstrate. A still later writer† takes up the latter subject, and I should have wished to present their views. They can now, however, be no more than thus alluded to. My limits altogether preclude me from following them.‡

c. *Water*.—The capacity of water to convey the disease cholera, under certain circumstances, is acknowledged. Not so the precise manner in which this takes place, nor the precise nature of the things conveyed, whether germ,§ poison, or morbid influence. According to the International Commissioners, doubts are expressed as to water thus contaminated being rendered innocuous by either filtration or boiling.|| Chemistry also fails to detect the existence of contaminating material of specific kind. But there are many instances on record where cholera has spread in localities where contamination of water was impossible; also of two sets of troops using water from the same source, the one set

\* Mr. James Ball writes thus in the *Journal of the Society of Arts*, January 21st 1881:—"Professors of sanitary matters are so utterly at variance upon what they individually consider to be vital questions, that the public could not place anything like implicit reliance upon the reports furnished them."

† Dr. Guy, *Public Health*, p. 38.

‡ J. Parkin; see *Journal of Science*, November 1880, p. 715.

§ In 1870 Professor Cohn described a peculiar microphyte, *Crenothrix Polypora*, which he found in the well-water of a certain district in Breslau, famous for the frequent occurrence of enteric fever among its inhabitants.

|| Dr. Parkes stated that "it is uncertain how far boiling will destroy the poison of specific diseases. Purification of river water for drinking by means of boiling was practised in the armies of ancient Persia B.C. 550."



being attacked by cholera, the other set remaining absolutely exempt. Contaminated water induces also other diseases than cholera, more especially diarrhoea and dysentery. It does not of necessity induce cholera, even in places where that disease is endemic, epidemic, or both. In those where it is neither endemic nor epidemic at the time, water, however contaminated, does not induce it.\* Many German authorities are opposed to the theory of choleraic water poisoning, on the grounds that it failed to account for the diffusion of the epidemic of Munich, Bavaria, Saxony, Baden, and villages around Vienna.†

To quote one of the most recent writers on this subject‡—“Did we find outbreaks of cholera uniformly occurring at those seasons of the year when the drinking water of the community is most foul we should with reason connect the phenomena. But it is not so. Thus, in Bengal, cholera is on the increase in October and November, when the drinking water is about its best; and the spring outbreaks occur towards the end of February or the beginning of March, at a time when the water of rivers, tanks, and wells is as yet unpolluted by the rain washings of accumulated dirt from the surrounding surface.”

With regard to fever in India, there is a concurrence of opinion that in malarial localities attacks of malarial fever may be, and are, induced by means of water in such places, contaminated with decomposing vegetable matters. As explained at considerable length in my Reports and printed Articles on the subject, cases of malarial fever become in their progress complicated with infiltration or ulceration of the glands of the ileum, as with other forms of organic lesion; the phenomena of the disease in particular individuals and stages of attack assume a low, adynamic, typhous, or typhoid character. In this sense, there appears to be no doubt as to the influence of contaminated water in the causation of fever. But, as a matter of fact, of 175 cases,

\* On this subject Dr. Parkes said, “although the origin of typhoid merely from putrefying non-typhoid sewage is not at present considered to be probable it is not disproved.”

† At Newcastle in 1854, and in reference to the now famous Broad Street pump case, it was not until cholera had become epidemic in England that contaminated water induced an attack of the disease.

Dr. Somerville observes in his *Report on the Health State of Foochow*, for the half-year ending 30th September 1875—“I think there is a growing opinion in the profession, especially entertained by those who have had much experience in tropical and sub-tropical countries, that water containing organic matter has been too heavily blamed as a cause of disease.”—See *Customs Reports*, No. 27, July–September 1875, p. 43.

‡ Macnamara, *Himalayan India*, p. 118.

details of which are given in my first special report, and 10 additional contained in my second, in not one instance was a connection established between an attack of fever and the water made use of by the subject of attack.

Here is an illustrative instance of what is looked upon as water causation recently adduced in India. At a particular station\* twenty-eight cases of fever occurred among soldiers; of these, twenty-four in a body of teetotallers, who were quartered in various localities in that station. The men of abstinence were wont to assemble at their place of meeting; and there, in the words of the reporter, make merry on their beverage drawn from a pump hard by, the pump unused by other men in the cantonment. And so, at the risk of causing alarm to the class referred to, the cause of illness was assigned to the cause of water only, all other circumstances and conditions affecting the men in question being passed over silently. But what of the cases to which this cause could not be assigned? What of other men of the class alluded to, their number left unstated, who had no fever? That persons whose social condition, habits, and mode of life present similarity should be subject to prevailing diseases of allied or similar type is but in accordance with analogy. That the class here indicated is more likely to suffer from fever, asthenic in type, than from ardent or inflammatory, is in accordance with observation.† But as a development of the theory of single, and it water, causation here alluded to, I remark that trustworthy statistics are wanting as to comparative coincidences between cases of fever and particular sources of water supply in affected localities, and coincidences between fever attacks and supplies from butchers, bakers, grocers, or other establishments in the same localities. In India, all these sources of supply are equally under strict supervision. Also, has the oxidising power of water upon the decomposing organic matters, recognised only a few years ago, been now clean forgotten? Do any of my contemporaries recollect their experiences of outward bound voyages in sailing ships ere the first half of this century had yet been reckoned with the past? Do they recollect how the water casks in those days had the reputation of being filled from the Thames at Blackwall while the tide was low; that afterwards, while the process of what was called "settling itself" was in progress, foul odours of sulphuretted hydrogen rose with violence from the casks; then after an interval this

\* Kamptee.

† Compare this with the remarks already quoted from Surgeon-Major Don regarding the classes most liable to asthenic fevers in Bermuda.



“settled” water became sweet and palatable? And do they also recollect the wonderful measure of health enjoyed on board such vessels, no fever, no bowel disease of any consequence, no deaths among a strength numbering close upon 200, during a voyage ranging in length from four to six months, their numbers greater when disembarked than when embarked, by reason of births on board?

This is the state of the water-supply at Canton, as described not long since.\* “The creek San-t’sung is not far from the foreign settlement; it is narrow, and covered with boats; on either side of it are innumerable houses, chiefly brothels; the alvine dejections, and other impurities of thousands of inhabitants along it, are daily discharged into the stream; yet the water, too dirty even for washing, is daily used for culinary purposes without being filtered or precipitated with alum, as is done in Shanghai.”† Here we should expect the prevalence of such diseases as typhoid fever and diarrhœa

\* *Chinese Customs Reports*, No. 13, part 6, January–March, 1872, p. 21.

† “At Shanghai, the creeks receive drainage from the manured fields, and in them the natives regularly scour their ordure buckets. From such a source is the water-supply for foreigners obtained.”—*Customs Reports*, July–September 1873, p. 55. It is true that the Chinese, as a class, drink only water that has been boiled, or in which tea has been infused, and that their relative exemption from cholera has been attributed to this circumstance. See references already made to the assumed resistance of theoretical specific poisons to the process of boiling. In all shapes such causes of pythogenic fever, as are usually assigned, exist abundantly in Chinese towns, yet only isolated and rare cases presenting characters of that disease are reported among the dense population, nor has this form, apparently as yet, spread as an epidemic. It were strange if among the many characters assumed by the general disease fever, particular lesions in the intestines, as of other organs, did not occasionally happen. There is, however, nothing in that circumstance to indicate that in their nature or causation they differed from those, the complications of which affected other organs and tissues.”—Dr. Gardener, quoted in first special report, p. 11. At p. 21 of the *Chinese Customs Gazette*, January–March 1872, the following occurs in reference to typhoid fever: “Since the sewage question has been so much in agitation in connection with this fever, it may be well to mention that in Canton large numbers of the native population are daily using water, and inhaling air charged with the impurities of human excreta, apparently with utter impunity. River water is greatly used, but that used by the crowded boat population along the different jetties is extremely filthy. The Sampan people prefer to get it by the side of their own boats, simply because they receive no harm by the practice.” Nothing appears to indicate other than that among the boat population of Canton, water is used in the ordinary way, that is, boiled for culinary purposes, unboiled for other purposes. This significant remark occurs, however, at the place quoted: “The natives have no faith in the skill of foreign physicians in the cure of fever, and when taken with it they do not send for them, nor do they come to the hospital to be treated as in-door patients. From native books and physicians we can gather no distinct idea of such a disease as typhoid fever among the Chinese.”

occurring often enough to attract attention ; but, according to the observer\* from whom I quote, the people who use this water are not more subject to fevers and other diseases than their neighbours, and this impunity is one of the reasons for their continuance in the use of such water. The writer quoted remarks in reference to this circumstance: "A detailed examination of this creek, and the disgusting habits of the inhabitants, would almost unsettle one's idea of the connection between typhoid fever and polluted water." At Foochow,† conditions are described as equally bad in this respect as at Canton, and the same may be said of many other Chinese towns and cities, and yet there is no enteric fever in them, and, for the most part, cholera, when it does occur, is, by accounts, less fatal than it is in India or in Europe.‡

As a contrast, I quote thus with regard to cases, said to have been of enteric fever, at Ascension.§ "The water-supply, rain water, spring water, to which all contamination is prevented, and condensed water ; all three waters kept stored in stone and iron tanks, and cannot by any possibility be exposed to sewage contamination ; and yet nine cases of 'enteric' fever are said to have occurred on that island ; the characteristic symptoms of that disease present in all its varying degrees. No material impurity in the water or tanks ; no fault with the hygienic state of the garrison, or of the farm establishment at Green Mountain."

*Food and Milk.*—In certain Eastern nations, particular articles of food are, by means of religious and other enactments, declared unwholesome ; in other countries, those articles are in common use without evil result. In India, the use of milk is general, many sects of natives consuming it in great quantities. These classes are careful, however, that the milk so used by them is in the first instance boiled, coagulated, and otherwise prepared. Experience on their part, and on that of Europeans in that country, indicates that in an unprepared state, but particularly in places where cholera is endemic, or where it is epidemic, there is considerable danger attending the free use of this product.

\* Dr. F. Wong.

† *Customs Reports*, January-March 1873, p. 41.

‡ A similar state of things is described as existing in Japan. "There, as in China, the fields and growing vegetables are at short intervals of time drenched with liquid human filth ; the canals and watercourses are contaminated by water which escapes from the fields, and yet no special disease among the population is assigned to this cause."—See *Journal d'Hygiène*, No. 228, of 3rd February 1881.

§ *Health Report of Navy*, 1879, p. 54.



But there is no apparent reason to assume that the actual source of such danger is anything exterior to the changes which spontaneously take place in the fluid as a result of general conditions prevailing in that particular place. In China, milk is looked upon as an excretion, and abhorred as unclean. No doubt there are sanitary reasons for its being so. In India, instances have occurred in which there could be no reasonable doubt that cholera had been induced by the use of milk containing water contaminated by cholera dejections. But, on the other hand, infants fed at the breast by nurses ill with cholera, if in some instances they have been themselves attacked, they have escaped in others. As a general result, milk contaminated by cholera matters is most dangerous to individuals partaking of it.

With regard to fever, only such as is attended by ulceration of the small intestines has been attributed to contaminated articles of food, including milk. How stand the facts in reference to this point? In no single instance of the somewhat numerous cases investigated by me in India was a connection traced between the occurrence of fever said to be enteric or typhoid, and the use of contaminated or deteriorated meat. Indeed, no such meat was made use of either by soldiers or their families. As to instances in which elsewhere the occurrence of typhoid fever has been attributed to this cause, the disease thus induced has subsequently been referred to trichinosis, and then to sausage poisoning. On this point, I refer to remarks already made in this paper under the head of *Specific Origin Theory*.

I am aware that cases, said to have been of enteric fever, have by competent writers\* been attributed to eating tainted tinned meat, the circumstance assigned theoretically to the development of an assumed poison, putrogen. Also that there are those who believe that eating the flesh of an animal affected with typhoid fever can bring on the disease in the person who eats it. Compare these remarks with those already made, and then with the following:—

At Shanghai, in 1872, rinderpest prevailed extensively among the cattle. Beef of animals thus affected was extensively eaten by the sick inhabitants; no evil result followed. But, as expressed by the reporter, "it is absurd to recommend people not to be alarmed, when the meat which supplies their tables may have been cut from animals dead of a disease which from *post mortem* appearances might be described as a combination of diphtheria, typhoid fever, and dysentery."† In India, the Kotahs, a Dravidian tribe inha-

\* Dr. Lowe.

† *Customs Reports*, January–March 1872, p. 79.

biting the Neilgherie hills, habitually eat carrion, and in Bengal, certain wandering mendicants devour dead matters of the most horrible kind,\* in both cases without any such result as might be looked for to accrue. I purposely refrain from prosecuting this part of my subject, as it refers to England. It is on record† that in Paris people have inoculated themselves from animals suffering from cattle plague, have eaten the flesh of those affected with that form of disease, and even of those affected with carbuncle, without evil result. It is, moreover, stated on authority that the cooked flesh of those suffering from typhus is not unfit for food. According to a paper submitted to the Paris Academy of Science, although milk from cows suffering from typhus is unwholesome, in other respects "neither it nor meat are capable of transmitting typhus to man or any animal except a ruminant.‡ As to the generally pernicious and most objectionable qualities of contaminated meat and milk, there is no question. But we are dealing with specific diseases, and them only.§

10. *Youth and Recent Arrival.*—As a principle, all ages are equally liable to attack by cholera during epidemics of that disease. As a second principle, the recently-arrived European, of whatever nationality, is more liable to be attacked than those of longer residence. Exceptions to this occur, however; notably in the outbreak of cholera among the cavalry at Secunderabad in 1871. On that occasion, the men first attacked were those of longest residence in India, and there are other instances of the same kind. But these exceptions are not sufficient to affect the general rule as expressed.

With regard to fever in India and the tropics generally, circumstances are somewhat different. In all, sickness, especially by the several forms of fever, but particularly such as affect the intestinal canal, attacks the young and recent arrival to an extent proportionally greater than it does the man of more mature years and longer residence. Inasmuch as in temperate climates seasonal conditions which prevail in autumn induce bowel complaints in various forms, so in the

\* *Medical Jurisprudence for India.* By Dr. Chevers.

† *Hygiene and Surgery of Franco-Prussian War*, p. 225.

‡ *Id.* p. 226.

§ Dr. R. B. Lowe has been told that rabbits and cats suffer from a disease in all respects like typhoid. He says it is just possible that some case may have originated from eating the diseased rabbit flesh, and that rabbits may have become infected by contagion from the discharges of a typhoid patient. Beaugrand gives the case of typhoid fever caused by eating the flesh of a wild kid caught in a snare. He has ascribed diarrhoea, and other illnesses, to eating rabbits.



tropics corresponding seasonal conditions produce similar results, whether as independent affections or as complications of others. Youth and adolescence are the periods during which deposits in, and other affections of, glands and gland-like tissues are of most frequent occurrence. Hence, doubtless, the occurrence of infiltration, and in some cases of ulceration, in the glands of Peyer in other diseases than fever, and in some instances where during life there was no apparent illness whatever. This circumstance has in India presented itself in cases where death by heat apoplexy occurred within a couple of days after attack. Such a state of glands appears to me, like scrofula, to be properly indicated as a condition. But where the condition exists, there constitutional disease, however induced, will naturally affect tissues thus impaired, nor is the introduction of a specific poison required to bring about that result. Young soldiers are more impressionable to all forms of endemic disease than old. They are also more indiscreet and inexperienced as regards exposure to well-known causes of illness.

11. *Races*.—In some epidemics of cholera the natives of India suffer more severely by that disease than do foreign residents; in others, they suffer less. Aborigines of the hilly districts of Nagpore are said to be exempt from cholera so long as they remain in their own native localities, but to be peculiarly prone to that disease when they enter the plains. A similar circumstance has been observed in reference to Ghoorkas from Nepaul; and it is further on record that during the epidemic of 1869 in Persia scarcely a negro escaped. In that of 1877-8 in Southern India the disease affected Europeans to a small extent compared to what it did the natives. And yet, with a very few exceptions, cholera has in turn affected all nations and nationalities. This remark applies also to small-pox.\*

On the coast of Guinea the native African is to a great degree exempt from fever, of which the European visitor is nearly certain, sooner or later, to be the subject, and very

\* In China a large proportion of European mothers are unable to suckle children. Small-pox and syphilis, when attacking races for the first time, are characterised by a virulence and deadliness seldom met with in their subsequent history. An extension of the same principle will help to explain the decay of epidemics, or the complete extinction of some diseases.—*Chinese Customs Reports*, July-September 1873, p. 31. "The acquisition of a high degree of civilisation, humanity, and science, tends to the fostering and propagation of forms less able to resist disease on account of its endeavouring to preserve, and its success in fostering the weak and susceptible. This is a drawback to civilisation."—*Op. cit.*, p. 32. This picture can scarcely be said to be complimentary to modern hygiene.

often the victim. The native races are altogether exempt from those outbreaks of fatal epidemics which, from time to time, have made havoc in ships' crews in the estuaries of those great rivers which occur along the West Coast from the Gambia to the Gaboon. In India it is stated that Non-Aryan races in Assam suffer to a comparatively greater extent from "malarial" disease than do Aryans in the same provinces. On the other hand, a race of people, viz., the Tharoos, Aryans by race, withstand the pestilential climate of the Oude *terai*, which is deadly to all others.\* In China, the native of the country and the European appear to suffer equally from malarial fever, and from that form designated typho-malarial.†

Natives of India and Europeans of various nationalities suffer from altogether different diseases, and variously from the same diseases. This rule holds good to such an extent as affecting the very existence of the British as permanent settlers in, and colonists of, that country, that so far as I am aware the assertion of a very eminent medical officer has never yet been controverted, viz., that a third generation is wanting of pure Europeans, resident continuously in India, and without admixture of new or imported "blood".‡ Thus, by analogy, we are led to what is demonstrated by actualities, viz., that the phenomena of disease differ according to race. This is so to a marked degree in the case of fever. But of this again, under the head of climate.

12. *Individual Conditions*.—Although delicate physique and ill-health predispose to cholera, and persons sick in hospital manifest a great liability to attack and death by that disease when epidemic, yet exceptions are so frequent that a rule on this subject is far from absolute.

With regard to tropical fevers, circumstances are more defined. Thus, according to a recognised authority§ on this subject "the severe, or ardent fever, called also climatic, or

\* *Tharoos*, believed to have been originally from Chittore, whence they escaped on the capture of that place by Akbar about A.D. 1560. They claim to have been originally Rajpoots; that their ancestors lost their caste by drinking intoxicating liquors, and rearing fowls. The present descendants are much given to the vice of drunkenness. They keep their houses scrupulously clean. They drink water from wells only.—Sir John Elliott's *Races of India*, vol. i, pp. 317-18.

† From the *Customs' Reports*, July-September, 1872, p. 59.

‡ This question of relation of race and disease presents considerable difficulties. While in China the native Chinese suffer from malarial fevers to quite an equal extent as Europeans (*Customs Reports*, July-September 1872, p. 35), the natives of India in many instances, similarly, suffer more than Europeans. On the other hand, there is reason to believe that the Jews in England are more healthy and long-lived than the English people are.

§ Copland.



seasoning fever, occurs among the recently arrived,—and more especially among the young, the intemperate, the robust and plethoric, and among those exposed to the sun in very high temperatures.” According to the views formerly held in India, fever occurring in such subjects, sthenic in its earlier stages, in its later became complicated with visceral derangement, intestinal and otherwise, attended by a low, typhoid, or adynamic state, in persons of weakly frame, asthenic from the first. Of fever in Bermuda, a similar observation occurs, viz., that “pathological changes depend upon contingent circumstances, personal and otherwise, that enteric fever (that is, fever with intestinal complication?) invariably occurred in persons of feeble muscular development; while it was observed that the simple continued fevers without bowel lesion, were generally in persons of more robust frame.” On the other hand, physical conditions, manner of life and habits, whether natural or acquired, may be modified as to predispose to adynamic forms of disease, and to determination to particular viscera.

13. *Climatic and Seasonal Influences.*—Under the operation of the sum of conditions briefly expressed as climatic, differences, specific and generic, occur in all branches of the great organic kingdom met with in the several zones; often, also, in different parts of the same zone. That a few, extremely few exceptions which occur, but tend to prove this rule is doubtless true; but the rule is as stated. And so, also, with disease. As with growth and development, so with decay, and, often, the manner in which this takes place: all of these are affected by conditions, geographical and climatorial. Hence, arises the general question of geographical distribution of disease.\*

As in temperate climates, the process of growth, development, and subsequent disintegration are, for the most part, in progress slow, so in tropical are they rapid. If, in some instances, animals and plants undergo, more or less completely,

\* In what may be called the Western tropics, the modifications of fever are thus noticed by a very distinguished member of this Society. “Cases commence as remittent, and continued as such from the sixth to the tenth day, on the same afternoon the fever recurred, rapidly took on the character of yellow fever, and proved fatal on the fourth or fifth day of that form. In other cases, which commenced as intermittent, diarrhoea ensued, after three or more tertian periods the fever became continued, assumed the character of typhoid, ultimately presented the affection of the kidneys and urine seen in yellow fever, then terminated in death. The intermixture of morbid appearances, peculiar to yellow and typhoid fevers, was detected in variable proportions.” Inspector-General Lawson, *Medico-Chirurg. Review*, July 1869, p. 225, printed in *Chinese Customs Reports*, part 6, July–September 1872, p. 59.

a process of acclimatisation when introduced from one climate to one nearly similar, the great majority refuse to do so; while of those introduced from a climate of particular character to one altogether different, many perish; and those that continue become modified in various ways, lose the power of reproduction, or their descendants rapidly degenerate. And so with regard to manifestations of disease, the nature of attack, the organs most liable to suffer, differ under one set of climatorial conditions from what they are in another.

On this section of my subject, I summarise conclusions expressed by a competent and recognised authority.\* “The primary effect of great changes of climate is on the circulation; the blood drawn surface-ward by heat, driven in by cold. The secondary effect is increased external vascularity during heat, internal during cold. In the tropics the vascularity of adult lungs is reduced, so also are their spirometric measurement, their functions, the nephritic vascularity and secretion; those of the skin are increased, the circulation becomes more languid, the pulse less frequent, and less forcible; the organs and functions of animal, like those of vegetable life, are affected by great changes of climate, heat impairing the weight, strength, and health at all ages, and retarding growth in youth.” The balance of conditions and functions, here indicated, being more or less completely and suddenly deranged, disease becomes a natural result. It so occurs; its type and incidence, as regards organs and tissues, influenced by conditions already stated.

Those who, depressed, worn out by endemic disease, or by simple exhaustion incidental to a tropical climate, say of Bengal, as an example, speedily realise the benefits of a trip to sea, or to the bracing atmosphere of the Himalayas. So do they alas! and very often conversely, when scarcely half recovered, duty forces their return to localities in which their health gave way. To such, and they are many, the expression “climate” indicates a very stern reality.†

A very eminent authority‡ writes on the same subject

\* Dr. Rattray. Paper before Royal Society.

† “It is a common observation with men, when discussing the unhealthiness of these climates (China), that their evil reputation is not deserved; that they are as healthy as our native lands, and that we should find them so, did we only assimilate our diet and habits to those of the natives.” “There is a sophistry about this which deceives some, and others like it, because they belong to a morbid class, who have a natural tendency to do anything entailing a self-denial, who think that whatever is pleasant must be bad, and whatever is unpleasant, and involving self-denial, must be good.”—*Chinese Customs Reports*, July-September 1873, p. 32.

‡ Dr. Guy, *Public Health*, p. 31.



thus: "Every year we have some atmospheric element, which neither thermometer nor barometer, neither rain nor wind-gauge, nor measure of moisture, nor test of ozone, can reveal to us, but only our records of sickness and death. One year it is such as favours small-pox; the next, perhaps, it will promote scarlet fever or measles, or whooping-cough; or it will, so to speak, select from several forms of fever that one which shall fill the beds of our fever hospitals. The condition of air, which disease itself is the only test and measure, was once called pestilence, but is now known as its epidemic constitution — *la disposition atmosphérique génératrice*."

14. *Contagion* plays relatively an inconsiderable part in regard to cholera and fever in the tropics. With regard to the former disease, while there are circumstances which support the theory of transmission by this means in respect to individuals and communities, there are other, and equally numerous, which point to an opposite direction; the result being, that in one set of instances it is beyond question that the disease was thus transmitted; in other instances, it is equally indubitable that it was not so communicated.

It has been pointed out\* with regard to a succession of outbreaks of cholera in India, that in places where the epidemic was most intense, the disease was often confined to very circumscribed localities, and points of immunity are mixed up with those which suffered all over the country to a varying extent in different districts; also that in the affected and non-affected localities the conditions of the people were alike, and free communication went on among them.†

As a matter of fact, it is within the experience of many observers in India that in times of cholera a general tendency to bowel affections prevails; that in other respects the health standard of masses is impaired, and that during the continuance of such conditions, depressants of all kinds, medical, physical, or moral, are to be avoided. Exceptions which occur do not alter the rule as it stands. The recurrence of cholera periods is familiarly recognised as a cholera wave. There are also fever years, unhealthy years, during

\* In the last report by the sanitary commissioner with the Government of India, viz., for 1879, Dr. Cunningham expresses strongly his views that neither propagation by men, that is, contagion, nor fouling of water by cholera discharges, can account for the diffusion of cholera, *Medical Times and Gazette*, February 5th, 1881. It is desirable to bear in mind the difference between the communication of cholera in isolated cases, and the general diffusion of that disease as an epidemic.

† Paper by Inspector-General Lawson. See *Transactions of the Epidemiological Society*, 1879, p. 91.

which diseases, of whatever nature, external or internal, assume severe or peculiar types. All these phenomena pointing to the operation of a cause above and beyond a specific undiscoverable entity, transcending, but it may be, including the latter.

The theory of pandemic waves merits careful attention, for the reason, on the one hand, that it appears to be but another expression for epidemic influence; on the other, on account of the high position as an investigator, enjoyed by its leading advocate. According to him, its nature and mode of action are difficult to define; it may act by rendering the system more susceptible of the ordinary causes of disease, or it may act upon those causes themselves, giving origin to a more virulent, or new form of disease.

The existence of contagious fevers\* in India is placed beyond doubt. Such a fever has been described in 1815 and 1820 in Kattywar, Kutch, and Guzerat;† more recently the occurrence of malarial fevers as epidemics has been recorded as happening at intervals of ten years,‡ the circumstance of the disease on such occasions being contagious or not, being much debated. Then comes the Pali plague, the Maha-Murree, the great sickness§ in 1834-5, 1849, 1851-2, 1860, 1876-7, its contagiousness apparently limited to race. But with regard to the ordinary fevers of India, such as came under my notice, out of 175 cases investigated, not one was traced to either contagion or infection.

15. *Summary.*—In summarising the remarks now made, the following points present themselves when viewed from the aspect from which I consider the data thus examined. The distribution of the diseases named in different portions of India, on the occasions described, is to be accounted for neither by the theory of specific poisoning alone, nor by that of contagion alone. There is every reason for believing that, although no actual relationship exists between the diseases, cholera and small-pox, the same, or a similar law applies to

\* With regard to what is called enteric or typhoid fever, Dr. Murchison says that hospital experience lends little support to the doctrine of contagion. Dr. Wilks had never seen a case where it was contagious among the nurses of Guy's Hospital, nor had Dr. Peacock in those of St. Thomas's Hospital. Messrs. Bristowe and Holmes had seen two cases in which it was contagious in the Royal Free Hospital. Dr. Collie is of opinion that it is contagious. Dr. Sharkey believes contagion to be more frequent as a cause than is supposed.

Dr. Chevers gives, *Transactions of the Epidemiological Society*, vol. iv, part iii, p. 338, particulars of an epidemic of relapsing fever in Yusufzye in 1852-3, of violent remittent in Upper Provinces in 1816; in other parts of India in 1836-7, 1855, 1860, 1864.

† *First Special Report*, p. 8.

‡ Macnamara, p. 301.

§ See p. 320.



the manner of their prevalence as epidemics. Between cholera and malarial fevers a relationship is indicated as existing, alike in respect to causation and phenomena. Both these diseases in India present a general relation to season. Both in India and England a relation appears to exist between the type of prevailing fever and locality. Bowel affections generally, in India and elsewhere, present a relation to season and locality; this relation as defined as that of vegetation to the same circumstances. In endemic fevers intestinal lesions, and those of the abdominal tissues, occur as complications in protracted cases. Cholera in India occurs under a variety of circumstances, and in different manners, but neither furnish a specific name applied to particular cases, as indicating one particular manner of causation. Fevers vary in phenomena and intensity, according to conditions, geographical, climatic, and individual. Among our soldiers in India fevers in the mass, and in individual cases, are less sthenic in type than they formerly were. Reasons for this circumstance are assigned. Specific poisons are of two categories, as described. Innocuous liquids can, by artificial means, become converted into poisons; hence, analogy indicates the likelihood of corresponding changes being effected by means of vital action. But diseased liquids do not necessarily communicate their particular disease, either when inoculated, or when swallowed. Certain diseases named, which are propagated by infection or contagion, are induced by particular combinations of conditions. Fever, in some of its types and forms is of this class; so is cholera. Between these diseases themselves, and with regard to several others named as occurring epidemically, an affinity is indicated. The expression malaria is but another term for climatic influences. The existence of organisms peculiar to malaria has yet to be confirmed. No specific poison is necessary to account for the phenomena of Indian fevers. The theory of specific poison does not explain those in "typhoid" or "enteric" fever. It is opposed as insufficient by a number of authorities. General insanitary conditions predispose to disease, but do they to any one specific disease more than another? It is not established that such is the case. Polluted air induces certain diseases, but not necessarily a specific form of fever. In China air intensely polluted is compatible with health and activity. The theory of local pollution, if sufficient to account for the occurrence of some epidemics, is altogether insufficient in respect to others. Although contaminated water may induce cholera, the occurrence of that disease is not always thus accounted for. Water induces cholera after it has become epidemic, not be-

fore. The relation of water-supply to cholera in India is not established by recent observations. Very striking instances are adduced where the use of extremely foul water has not resulted in fever, enteric or other; while instances are recorded, particularly in places where cholera is endemic or epidemic, of cases of that disease following the use of contaminated milk; instances are related of infants suckled by women ill of cholera, and yet not becoming affected by it. Cases said to have been typhoid fever, due to the use of diseased meat, were subsequently stated to have been cases of trichinosis and sausage-poisoning. Although specific typhoid, like several other forms of fever, may be conveyed by means of milk, this circumstance by itself fails to explain the epidemic diffusion of that disease. As a rule, cholera has no relation to age. In India and the tropics generally the young and the lately-arrived suffer more by endemic diseases than the older in age and residence. Race appears to affect liability to certain special diseases in particular countries; not so in others. Infant mortality of Europeans in India is excessive. Individual conditions and habits predispose to particular forms of disease and complications. Climate influences the geographical distribution of disease, and determines its type and incidence. Although cholera has undoubtedly been propagated by means of masses of persons and individuals in numerous instances, there are others equally numerous in which it has not been so.\* Fevers of particular kinds in India may be propagated by means of infection, but of the cases investigated by me not one was thus accounted for.†

Thus, by the light I possess, have I endeavoured to pass in review, some out of many points which, to me, appear most important in reference to the occurrence and prevalence of the diseases named. I am aware that I have the great misfortune to entertain an interpretation of phenomena and evidence before me, different, in several respects, from that of some very eminent authorities. I am also aware that in my manner of interpreting those phenomena, I am in accord with

\* *Hygiene of Cholera*, par. 11, p. 99; also pp. 150-159.

† As expressed by the older authors, so now—"Neither infection, nor terrestrial malaria, nor mineral vapours, nor exhalations from dead animal matter, nor intemperature of season or weather, nor famine, scarcity, or unwholesome food, nor crowding of the living—the healthy or sick—nor filth, nor stillness, humidity, warmth, or other conditions of the air, nor depressing emotions and passions, nor any physical, social, or moral vicissitude, will singly account for epidemics; but that the association of several of these causes in various grades of predominance is necessary to their occurrence, diffusion, and continuance."—*Copland's Dictionary of Medicine*, 1858, p. 773.



other eminent authorities and most careful observers; the numbers of both decidedly on the increase, not alone in this country, but more especially in India, China, and elsewhere, among our vast foreign possessions and settlements.

I have restricted my remarks to opinions only. I, however, give references in the shape of foot-notes, the better to facilitate access to the sources of these opinions. I trust that in the paper now read I have, to some extent, at least, succeeded in my endeavour to indicate the grounds upon which views expressed by me have been formed, as also the process by which I have myself been led to consider from the data before me, that the theories of specific poison and contagion are, of themselves, insufficient to account for the phenomena of the diseases to which I have had the honour to solicit your attention, and that of the Epidemiological Society.

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