On the origin, habits and diffusion of cholera, and what may be done to prevent or arrest its progress, and to mitigate its ravages / [by J. Fayrer].

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Fayrer, Joseph, Sir, 1824-1907.

Publication/Creation

[Place of publication not identified] : [publisher not identified], [1886.]

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ON

THE ORIGIN, HABITS AND DIFFUSION OF CHOLERA, AND WHAT MAY BE DONE TO PREVENT OR ARREST ITS PROGRESS, AND TO MITIGATE ITS RAVAGES.*

WHEN the Committee of your Association did me the honour of inviting me to address you on the subject of cholera, I hesitated to comply with the request, because it appeared to me at first sight unsuited to a general audience. On reflection, however, I thought that in a topic of such universal interest, which has been, nay is, so prominently before men's minds, I might find matter which would give effect to the wishes of the Committee and also be of service in conveying information which all should possess, with regard to the opinions they should form, the attitude they should assume, and the action they should take in behalf of the public weal, whenever cholera menaces or has actually invaded this or any neighbouring country. I propose therefore to give you some account of a disease which has extended its ravages over much of the earth's surface, and has destroyed so many of the human race; which is uncertain and apparently capricious in its incidence, terrible in the force and rapidity with which it often strikes, and obstinate in its resistance to therapeutic measures.

The true cause of cholera is still unknown, but the laws which affect its origin, propagation and diffusion have been so far ascertained by observation that, happily, the measures by which its progress may be stayed and its fatality mitigated are now well known to be within the scope of sanitary preventive operations. Moreover we are encouraged to believe that not only may it be disarmed of much of its present terrors, but that, in the future, we may anticipate a great diminution of its intensity, or, it may be, as in the case of such great epidemics as the "Black Death," and "Sweating Sickness," and others which desolated Europe

* A Lecture addressed to the Young Men's Christian Association, at Exeter Hall, 2nd March, 1886. Col. the Lord Wantage, K.C.B., V.C., presiding.

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in the middle ages, that it will take its place among the records of the past.

The subject of my lecture, then, will be the Natural History of a pestilence which is becoming yearly of greater interest, and I hope to tell you something which I trust may modify erroneous notions as to its character and attributes, and to shew you how you may help in preserving yourselves and others from its evil effects.

I have to tell you of a pestilence which sweeps over vast areas, leaving desolation in its track; whose origin, nay, even pathology, is still involved in obscurity; whose breath is fatal as the shade of the fabled Upas tree; whose mission is like that of the destroying angel of the Apocalypse. But I have also to tell you how its fatality may be diminished, and how a country—when duly prepared—may regard its approach with confidence, if not with indifference, not trusting in quarantine or other oppressive and restrictive measures, which are as noxious as they are futile, but placing firm reliance on the efficacy of Sanitary Science to cope with and overcome the evil, if only its practical teaching be attended to, for on that alone can any reliance be placed.

It may be well to make a few preliminary remarks for the benefit of those who do not already possess the knowledge, on what is meant by the terms epidemic, endemic, sporadic and zymotic.

The term *epidemic* is of Greek origin and signifies "upon the people"; it is applied to disease either when it is diffused far and wide, ranging over extensive countries and often leaping as it were by bounds to others, or when it spreads among more limited communities, following a definite track, dying out rapidly, or after one or more revivals or recrudescences, in the localities in which it had previously prevailed.

The term *endemic*, on the other hand, is applied to disease which is peculiar to certain localities, is always present, and depends on local causes; it may, under some conditions, assume the epidemic character, when it passes its ordinary limits and is diffused far and wide in varying degrees of intensity.

Sporadic, (from σπειρω, I sow) is applied to isolated cases which may occur anywhere, from causes peculiar to each case; such often herald the approach of the same disease in an epidemic form.

Cholera assumes all these forms; it occurs sporadically in

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many places, is endemic in Bengal and other localities, and rages from time to time over various parts of the world in an epidemic form. The same may be said of the plague, small-pox, scarlet fever, and some other diseases. I use the term epidemic in its simple technical sense, as applied to disease prevailing and spreading among the people. As to what else may be implied hypothetically in the term, I have only to say that I understand it to mean something superadded, whether of atmospheric or cosmic origin, without which disease would not be generally diffused. This has been called (by Dunglison) "the epidemic constitution," whilst Léon Colin describes it as "a something isolated, impersonal, detached from the disease itself, the epidemic genius [constitution, influence], a certain creative force of the different epidemic affections, compelling, directing, extinguishing them."

These definitions, however, define nothing; the fact is we do not know the real nature of that which is implied in the term "epidemic influence or intensity"; but we do know that it means a potent—often the most potent—factor in diffusing disease. It may be, I suppose, referable to certain meteorological conditions, taking that expression in its widest sense; something either propagated in great telluric or aerial currents, or prevailing in cyclical periods simultaneously in various regions of the earth's surface; co-operating with local causes in conferring on the disease its quality of epidemicity, in some cases, perhaps, the combination itself acting as a cause.

Whatever this influence really be, epidemic prevalence does not occur without it, and this is so not only in such diseases as influenza or cholera (where the question of contagion is at least doubtful), but in the most contagious, such as scarlatina and small-pox; for it seems pretty certain, that whatever part contagion may play in the etiology of disease, it is of small importance relatively to this influence in diffusing the disease.

Dr. Southwood Smith has pointed out that there is much in common in the nature of epidemics, however they may vary in their special characters; that, in their propagation, development and diffusion they are subject to this influence. That in some, such as scarlatina and small-pox, there is a special exciting cause such as has conferred on them the term zymotic, cannot be questioned; but in others such as influenza or cholera, this is not so certainly made out, and

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it is still a question to be solved, whether these may not owe their origin, as well as their diffusion, to more general causes.

Epidemics are fevers; "cholera is a fever which appears in its true character when not immediately fatal, and when time is allowed for the development of its successive stages." They resemble each other in the extent of their range and the manner of their diffusion. They sometimes give warnings of their approach by the outbreak of some milder epidemic, and, it has been said, "by the modification of the type of existing diseases, or by the transmutation of ordinary diseases into something more or less resembling that which is at hand." It would appear that they are occasionally preceded by influenza; this was the case in the visitations of cholera in 1831 and 1848.

They are sometimes actually in operation in a place before they assume their distinct form; *e.g.* diarrhœa may prevail before cholera breaks out. "They resemble each other in their migration;" advancing by leaps they come to their height, decline and disappear in one locality, attack another, pass through the same process, proceed to another and so on to a fourth, fifth, and sixth; the same resemblance is seen in the periodicity of their return.

The predisposing causes are external and internal.

External are vitiated air or water, overcrowding, sewer gases, stagnant subsoil moisture, and other insanitary conditions; such are also called "localizing causes." Internal causes are such as render the blood impure.

The atmosphere, without being vitiated by such causes, undergoes natural changes which predispose to the spread of epidemics. It is quite certain (says Dr. S. Smith) that there is an epidemic meteorology. Mr. Glaisher took the first steps towards bringing this matter within the purview of science, having studied it during three cholera epidemics. This department of Epidemiology is making progress and promises to yield important results. I may say it is now the subject of careful investigation by a well-organized Meteorological Department in India.

Variation in atmospheric pressure, extraordinary stillness of the atmosphere, deficiency in the tension of positive electricity or of rainfall, absence of ozone, fogs, blights, low forms of life in the air, all have been regarded as possible predisposing causes. Attention has been called more than once to the disappearance of birds from cholera-affected

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districts at the beginning of the outbreak. The dreadful outbreak of cholera at Kurrachee in 1846 was (it is said) preceded by days of intense stagnation of atmosphere, and others have been preceded or attended by similar phenomena.

Some believe that the predisposing causes may themselves become efficient primary causes, and that the outbreak of epidemics may be prevented by placing the population under favourable sanitary conditions; that the prevalence of certain local causes in addition to certain general conditions of the atmosphere may bring about the changes in the person which are required to engender widespread disease; that the existence of a distinct primary cause is not necessary to account for the phenomena. The general opinion is, however, that joined to the predisposing causes there is a primary cause, a distinct entity, which may travel from one part of the globe to another, capable of spreading over space however large, or of confining itself to any space however small; such is the supposed cholera germ or particulate poison, said to be capable of increasing to any extent under favourable circumstances.

The advocates of this belief have been most energetic of late in their researches among bacterial life for the primary cause, and a therapeutic application of it has recently been witnessed in inoculation experiments for cholera in Spain, of the futility of which—by the way—there can be little doubt.

The specific germ or poison, from its analogy to ordinary ferments has been called "zyme," and hence the term *zymotic* given to epidemic diseases.

It is remarkable that while some epidemics spare the natives of the country and affect foreigners, others—such as cholera—affect all.

History of Cholera.—The epidemic which concerns us this evening is Cholera; let me give you a brief sketch of its history.

First as to the word itself:—Hippocrates uses the word "χολερη," this being the Ionic form of "χολερα."

The chief opinions as to its derivation are:—

1. From χολη = bile and ῥοια = flux;
2. From χολερα = the gutter of a house.
3. From χολας = an intestine.
4. From χολος = the old form of χολη, χολερη being 'η χολερη = the bilious disease.*

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* Macpherson. Annals of Cholera.

The Hindostanee and Arabic names are "murree" and "taoun" and "wubba," but these really mean "deadly pestilence," and the Chinese "ho-louan" and French "trousse-galant" come under the same head. It is doubtful, however, if the latter were really cholera..

The specific names for cholera are generally derived from its most important symptom, *i.e.*, derangement of the alimentary canal. The oldest and most widely spread name is "haiza," a term common now in India where Hindostanee is spoken, used by Rhazes (900 A.D.), by Avicenna a century later, and by Averrhoës in the 12th century.*

The term found by the Portuguese in use at Goa was "mordeshee," and Europeans continued to use that term for some time under the forms "mordshi," "morshi," "morexi," "morexin," "mordexin," "mordeshin," and "mort de chien."*

The local names employed in the East are most of them descriptive of the characteristic symptoms, *e.g.*

Bengalee = Oola-oota.
Mahratta = Morshi, Tural.
Chittagong = Mou-pet.
Cashmeree = Dakee.
Malay = Moontaan.
Deccanee = Dank lunga.*

Let me now give a brief outline of the general characters of the disease itself; a clinical or pathological account would be out of place here, but enough must be said to render what follows intelligible.

There are certain erroneous notions about cholera, and one assigns that name to the disease in its most fully developed condition alone; now this is a mistaken conception, and one which gives an incorrect impression of its extent and fatality. The fact is that it presents many phases and symptoms, varying in gravity from simple malaise to profound collapse or the comatose condition of the worst forms of fever. Sporadic cholera is often spoken of as though it were a different disease to the epidemic, malignant, or so-called Asiatic cholera. I cannot stay to discuss this; for my own part, I believe cholera is cholera wherever it occurs, and its epidemic prevalence and intensity are phases or accidents in its history.

Cholera manifests itself in several stages or degrees, the

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* Macpherson. Annals of Cholera.

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earliest being merely malaise and general uneasiness; this is followed by the more serious symptom of bowel derangement, which soon passes into incessant catharsis and emesis of clear rice-watery fluid; this—very rapidly in some cases—causes a state of collapse which frequently proves fatal, or, if reaction occur, fever follows, with a variety of complications not less dangerous.

The mortality of cholera is great when it has advanced to the condition of collapse or secondary fever. In an epidemic, perhaps half die. Death is generally due to exhaustion from depression of vital energy and the loss of the serous part of the blood, from uræmic poisoning or from pulmonary or cardiac embolism, or from the complications attending consecutive fever. In some severe outbreaks death occurs very rapidly, as if from shock, in a few hours. The fatality appears to vary in different outbreaks, which are influenced in intensity by local causes as well as by epidemic force. The part played by meteorological conditions, no doubt, is important, and the effects of season and locality are marked, as I shall have to tell you later.

The suddenness and violence of some attacks are so remarkable as to make it obvious that some factor—apart from contagion or insanitary conditions—is at work. It has generally been observed that the cases at the outset of an epidemic are more numerous and fatal than later on, and as it gradually declines in intensity, the cases become less severe in character, next less numerous and severe, and finally cease altogether. This is not peculiar to cholera; it occurs in other epidemics, and was specially noted by Defoe in his account of the plague in London in the 17th century.

The patient's appearance and condition are strikingly significant when the disease has assumed its developed stage. The pinched, shrunken, livid face, hollow eyes with darkened areolæ, the cold clammy skin, the corrugated fingers, the cold breath, the sunken, hollow, husky voice, the incessant discharges, the raging thirst, the cramped extremities, the failing pulse,—all eloquently and sadly proclaim the true state and extreme danger of the sufferer. I shall give you some illustrations of the extent of this danger.

Now to proceed to the history of cholera. In the pre-Christian era cholera is described by Hindoos, Chinese, and Greeks.

Ancient writers on Hindoo medicine do not give a very

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definite account of the disease, nor do they describe it in an epidemic form. The Ajurveda of Suçruta has a description of "Visuchika," generally supposed to be cholera, but later Sanscrit works say little on the subject.*

Records of Chinese medicine are usually considered to be contemporaneous with, or much earlier than Hippocrates (5th century B.C.). Ho-louan is the Chinese name for cholera; there is no evidence, however, of its having been known in China in an epidemic form.

Hippocrates describes cases of cholera: *e.g.*, those of Eutychides, Bias the pugilist, &c.;* but though affirming it to be more frequent at certain seasons, he describes no epidemic. Both he and the Chinese mention two forms—the damp and the dry.

The idea that cholera was known to the Hebrews proceeded from a wrong translation of the words "choli-ra," adopted in the Septuagint and Vulgate; this was rectified by Luther in his translation, and the idea is now abandoned.*

After the Christian era, cholera is frequently mentioned by Roman writers, Celsus, Aurelianus, and Aretaeus of Cappadocia; by later Greek writers, Alexander of Tralles, Paulus Ægineta; by Arab writers, Rhazes (A.D. 900), Avicenna, Averrhöes, Ali Ben Hossein of Bokhara (1364), &c.* The 13th, 14th, and 15th centuries are very barren concerning annals of medicine, but from Bernard Gordon, Raphael of Volterra, and others, we learn that cholera was a well known disease in Europe.*

In India it was not observed by Europeans before 1503, though an instance is given by Mr. Dowson in his edition of Sir Henry Elliot's "History of India," of what may have been cholera in 1325.*

In Europe, from the beginning of the 16th century, there are notices of epidemics of bowel affections and of a disease called "trousse-galant," which appeared in England and France in 1545. The earliest epidemic of cholera described by name occurred at Nismes in 1564. An outbreak at Ghent, in 1643, is described by Van der Heyden, and another occurred there again in 1665.† The epidemic that raged in London from 1669-82 is called by Sydenham

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* Macpherson. Annals of Cholera.

† Macpherson, Op. cit., and Scoutetten, Histoire chronologique, topographique et etymologique du choléra.

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cholera,* but by Wills only an aggravated form of dysentery.

According to Dr. Macpherson, cholera was present in various parts of Europe in a mild epidemic form during the 18th century, dying away towards the end, and remaining quiet during the first years of the present century. Previous to the 19th century, outbreaks in Europe seem to have been less severe and less widely diffused than those in India, but it must be borne in mind that the records of disease were very imperfect in those times.

In the East, cholera was first observed by the Portugese in 1503.† The first epidemic outbreak occurred at Goa in 1543; it was observed by Gaspar Correa, and the following is his description of it:—

"In the spring of this year there appeared a mortal throe, which those of the country call moryxy, common in all classes of people, no less to the child at the breast than to the octogenarian—to the stalled beast and the domestic fowls also, for it was common to all things living; nor could any reason be assigned for this agonizing infliction. The sound as well as the sick fell victims to it, and nothing did it respect. This dolour struck on the stomach; so grievous was the throe, and of so bad a sort, that the very worst kind of poison seemed to be taking effect, as proved by vomiting, with excessive thirst for water accompanying it, as if the stomach were parched up, and by cramps that were fixed in the sinews of the joints and in the soles of the feet, with pain so extreme that the sufferer seemed at the point of death. The eyes were dimmed to the sense, and the nails of the hands and of the feet black and curved. For this disease none of our physicians found a cure. The patient barely lived the day, or at the most the night through, in such sort that of 100 attacked scarcely 10 escaped, and they used native remedies. So great was the mortality that the bells tolled all day long. There were 12, 15, or 20 burials daily. At last the Governor ordered that the bells should be tolled no more, as their tolling increased the alarm. The Governor ordered the physicians to examine a dead body; but they found nothing in the body, but the stomach shrivelled up like a piece of leather."†

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* Sydenham's Works, translated by Swan. Page 133.

† Macpherson. Annals of Cholera.

Compare this with epidemics of cholera that occur now and the identity will be apparent; the outbreak at Kurrachee, for instance, which will be described later.

In the 17th century a full account of the disease is given by Bontius, who describes it in Java in 1629; Zacutus Lusitanus notes its prevalence in Arabia; Baldaeus, a Dutch clergyman, refers to fatal cramps in his accounts of the coasts of India (1641); Cleyer noticed cholera in China in 1669; Thevenot was attacked by it near Surat in 1666, and Then Rhyne, a Dutch Professor, who wrote towards the end of the 17th century, mentioned a remedy employed against it in Japan.* Cholera appeared in an epidemic form in Mewar in 1661, in Marwar in 1681-82, in Goa in 1683-84.*

During the 18th century cholera visited in an epidemic form Pondicherry and the coast in 1768-69, and Ganjam and Calcutta in 1781; it appeared also in Java, China, and the Mauritius, and is reported to have occurred in an epidemic form at Tinnevelly in 1757, on the Malabar coast in 1782, at Hurdwar and Madras in 1783, at Travancore in 1792, and in Mewar and the Mahratta country in 1794.*

Of these epidemics the most widely extending was the outbreak at Ganjam in 1781; it branched off in a northerly direction, but was not traced further than Calcutta; it appeared in Central India and Hurdwar in 1783, in Madras in 1782, and extended as far south as Trincomalee. After this outbreak notices of the disease become rarer until the great epidemic of 1817.

I shall continue the history of cholera in a brief summary of its great epidemic movements since 1817 up to the date of that which is now hovering over Europe, and has recently manifested itself with great intensity in France, Spain, and Italy. These are, according to Hirsch, arranged in series called Pandemics.

The pandemic of 1817-23 was almost confined to Asia, Astrakhan being the only European locality attacked.

Cholera devastated India from end to end, attacked Ceylon, Mauritius, Réunion and the East coast of Africa (1820). It broke out in Burmah, Siam, several of the East Indian Islands, and finally in China and Japan in 1822. In 1821 the epidemic was at Muscat, in Mesopotamia and the North East provinces of Persia. In 1822 it appeared in

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* Macpherson. Annals of Cholera.

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the West of Persia, attacked the North of Syria, broke out in the following year in Palestine, in Antioch, in Damascus, in towns of the Transcaucasus, and in Astrakhan on September the 22nd.*

The second pandemic (1826-37) extended widely over Europe, Asia and North America, and appeared on the West coast of Africa.

In 1827 cholera was in Cabul, Balkh and Bokhara; in 1828 in Khiva and among the Kirghese hordes. East Russia was again the first European place attacked, cholera appearing in 1829 at Orenberg and Astrakhan: it became very widely diffused over Russia during 1830. During 1831 and 1832 the epidemic appeared in Turkey, and in all the Northern and Central countries of Europe—except Denmark—and attacked, for the first time, North America (Canada and the United States) in 1832.

In 1833 Spain and Portugal suffered and the epidemic was severely prevalent in the United States, and appeared on the Pacific coast and in Mexico.

At the end of 1834 cholera broke out in the South of France; appeared in South America for the first time in 1835, and in the same year in Italy, where it became widely diffused during 1836. During 1837 cholera was in Malta, Sicily, Austria, South West of Germany and Central America (for the first time). It died out, however, by the end of the autumn.

Besides the places already mentioned in Asia, cholera attacked China (1830), Japan (1831), Persia (1829), Mesopotamia, Arabia, Syria and Palestine.

In Africa, cholera appeared in Egypt (1831), Algiers, Abyssinia, Zanzibar, and some of the Soudan countries.*

The third pandemic (1846-63) extended over the whole of the Northern hemisphere to 25° South in the Old World and to 30° South in the New World.

It can be divided into two periods, 1846-50 and 1852-63.

During the first period (1846-50), in Asia, cholera was widely diffused over India, Turkestan, Afghanistan, Persia, Mesopotamia, the coast of Arabia, and Syria.

In Europe it appeared in Orenberg in 1847. With the exception of Spain and Portugal, the disease extended over the whole of Europe, but was not very widely prevalent in

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* Hirsch. Handbook of Geographical and Historical Pathology.

the South and East of Germany, in Norway, Denmark, and Ireland.

In America, cholera appeared in New York and New Orleans at the same time (1848), and over-ran all the states to the east of the Rocky Mountains, and attacked San Francisco, Mexico (1849), California, Panama and New Granada.

In Africa, cholera was in Egypt and countries of the Northern coast.

There was a general lull from 1850-2, isolated cases only being reported in the north and north east of Europe.

During the second period, of places in Asia, India suffered severely in 1852-58-60-61; there were epidemics also in China, Japan, the East Indian Islands, Persia, Afghanistan and Turkestan.

In Europe, the disease appeared again in East Russia, Prussia and Poland. The whole of Europe suffered, the Northern and Central countries being the first attacked; the epidemic had died out by 1856, but re-appeared in Hamburg and on the shores of the Gulf of Finland in 1859, and a few cases occurred in England during the same year.*

In America, the area of epidemic prevalence was almost co-extensive with the northern continent. The disease appeared in South America, attacking Brazil for the first time (1855), and Venezuela; it broke out also in Central America.

In Africa, cholera attacked Algiers and Morocco (1853), Egypt, Nubia, Abyssinia, West coast of Madagascar (for the first time), Cape Verde Islands, Madeira, Mauritius and Réunion.†

The fourth pandemic (1865-76), can—like the preceding one—be divided into two periods, *e.g.*, 1865-69 and 1871-75.

In Asia, during 1863-64 cholera was widely diffused over India, Ceylon, the East Indian Islands, China, Japan, West and South coasts of Arabia (1865), Persia, Mesopotamia and Syria.

In Europe, the epidemic appeared in the summer months of 1865 in Malta, France, Italy, Spain, Belgium and Russia. In the latter country cholera was heard of every year till 1874. It subsequently invaded every nation in

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* Cuningham. Cholera—What can the State do to prevent it?

† Hirsch. Handbook of Geographical and Historical Pathology.

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Europe except Greece,—Denmark, however, being very slightly affected.

In America, the West Indies was the first locality affected (1865). During 1866 the disease was widely diffused over the United States, appeared in Central America and attacked the River Plate States and the west coast of South America for the first time; it was also prevalent in Bolivia, Peru, Brazil (1867-68), and British Honduras.

In Africa the epidemic was very widely diffused, attacking Somali land (1865), Zanzibar (1869), Madagascar, the Mauritius (1867), Egypt, Nubia and Abyssinia (1865), Senegambia (for the first time), Algiers, Tunis and Morocco.

During 1869-70 there was a lull, cholera persisting at very few points of the globe outside India; Russia, however, being one of the points.*

During the second period (1871-75) the Asiatic countries attacked were Persia (in which cholera had been present since 1856), Mesopotamia, Arabia, Turkestan, Bokhara, Syria (1875).

In Europe during 1871, cholera was gradually diffused through Russia. During 1872 and 1873, Russia, Poland, Prussia, Austria, Turkey and Sweden suffered severely; other countries suffered less and Denmark again escaped entirely. By 1874 the disease had died out in most countries of Europe, except in Hungary and other central parts.*

In America in 1873, cholera broke out in New Orleans and attacked many states on the banks of the Mississippi and in the interior plains.

In Africa, cholera appears during this epidemic to have been limited to Egypt (1871 and 1872) and Nubia (1872).†

A fifth pandemic which still continues, first appeared in Egypt during the summer and autumn of 1883.

It began at Damietta—where a fair had recently been held—and subsequently attacked Cairo and other towns, affecting so many districts that they could not be quoted in official returns. There was also an outbreak among the British troops at Suez.

The epidemic of 1883 was restricted to Egypt. The entire number of deaths is not given, but up to the end of July the deaths notified to Sir G. Hunter were 12, 600—the

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* Cuningham. Cholera—What can the State do to prevent it?

† Hirsch. Handbook of Geographical and Historical Pathology.

real number being probably about twice that amount. The condition of the country is described as one of an extremely insanitary nature.

In 1884, cholera appeared at Toulon on June 18th, and a week afterwards it appeared at Marseilles, and subsequently attacked many towns—Arles, Aix, Perpignan, &c. —in the south east of France, where it continued till the middle or end of September.

During July it was gradually increasing in France, and appeared in a mild form at St. Petersburgh and Charkoff.*

In the beginning of August cholera was in Lombardy and by the end of the month was diffused over the greater part of northern Italy, raging most severely in Spezzia.

In September it appeared in Naples and was prevalent there in a virulent form throughout the month. In Italy, during the year there were 27,030 cases and 14,299 deaths.

In October cholera was dying out in all districts that it had yet attacked, but at the beginning of the month it broke out at Yport in Normandy, was reported in other parts of northern France, including Nantes, and finally appeared in Paris on November the 5th, where it was active till the end of the month, there being during that time in the city 971 cases and 866 deaths.

During 1884 cases occurred in two English ports,—Cardiff being one,—but failed to spread inland.

In 1885 cholera was prevalent in Spain from June to November, and during that time attacked nearly all the provinces of that country. It was first reported in the provinces of Valencia and Castellon during the last week of March; by the end of May it began to diffuse, attacking Madrid in June and spreading over many provinces, amongst them Saragossa, Toledo and Alicante. By the end of the month the mortality had reached 5,700.

During July many more provinces were involved, and the disease became much more severe in districts already attacked. The mortality for the month was not far short of 24,000.

At the beginning of August the epidemic was still increasing, but by the 7th it had reached its height and declined steadily during September. The mortality for August was 45,000 at least; for September rather more than 13,000. Twenty-four deaths took place within the British lines.

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The total number of recorded deaths from cholera in Spain was 79,490, but 100,000 is nearer the real number. Valencia (13,400) and Saragossa (10,954) registered the greatest number of deaths.

Cholera appeared in August at Marseilles and Toulon; in November in Brittany,—Brest, and the immediate neighbourhood being affected.

Meanwhile, in September it had appeared in Parma, where there were 313 cases and 202 deaths, in Ferrara, Reggio, Massa, Rovigo, Genoa, Modena and Venice; during this year, however, in Italy, the disease scarcely reached the height of an epidemic.

In Sicily, cholera was prevalent during September and October; in the whole island there were 6,397 cases and 3,409 deaths, of which 5,535 cases and 2,959 deaths took place in the town and province of Palermo.

In 1886 up to this time, the epidemic has been comparatively inactive; there was an outbreak, however, at Tarifa, in the Straits of Gibraltar, in the first week of February, and between 700 and 800 cases of cholera have occurred in the province of Finisterre since the beginning of December, 1885. There are also rumours of the disease at Venice and Trieste, and it is not improbable that a fresh recrudescence will take place later on in the year. Our own island has hitherto been almost exempt, but no vigour should be relaxed in the observance of sanitary measures, by which alone we can prevent its development.*

Etiology of Cholera.—It is not without reason that some have suggested that cholera, influenza, and malarial fevers are only different manifestations of a common disease. They frequently prevail at the same time, and have such community of symptoms that it is sometimes difficult to determine between them, more especially in time of epidemic prevalence and in certain stages. Cholera frequently simulates malarious fever, and in certain epidemics in India it has been difficult to say to which the disease should be assigned. For instance, Dr. Ross, referring to the outbreak at Amritsar in 1881, says: "Fever in the city did not appear in an epidemic form until September; it was preceded by cholera about the beginning of August, of an

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* The particulars of this epidemic are taken from various numbers of the *Lancet* for 1883-84-85, from the *Practitioner* for January, 1886, and from the *Morning Post* of Monday, February 8th, 1886.

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extremely fatal type, and later on, when masked by fever, there was some difficulty in recognising it. . . . The two diseases, cholera and fever, supposing them to be distinct, masked one another so effectually, that diagnosis was extremely difficult at times."

Then again with reference to another outbreak, he says: "I observed in Kohat, in 1869, an outbreak of fever very similar to the Amritsar epidemic, followed by cholera. It was then observed also that it was an impossibility to tell when the cholera commenced, the symptoms of many cases of the fever being so similar."

It is admitted that season plays a great part in the etiology of fevers and influenza, and with regard to cholera, it is conceded that the character of the epidemic season, depending on meteorological influences, is important in determining the type of the disease.

The malaise or general discomfort in cholera, the premonitory, and next, the colliquative diarrhœa, vomiting and collapse, correspond to febrile malaise, the intermittent or algid state, and the remittent or pernicious bilious forms with collapse, in fevers; in influenza to the premonitory chills or malaise, the catarrhal, bronchial, febrile symptoms, and the depression and complications which often make the disease so severe in epidemics, so fatal—in some cases quite as fatal as cholera.

For instance, in 1564 there was a very destructive epidemic of influenza in Spain, during which 10,000 people died at Barcelona alone. The epidemic of 1580 was very widely diffused in the East, in Africa, and in Europe—affecting Denmark, Sweden, Germany, Hungary, Turkey, France, the Netherlands, Spain, and Portugal. In Paris alone 40,000 died.* Sir Thomas Watson writes, "On a cold night, says Maertens, the thermometer rose 30° F. in St. Petersburg; the next morning 40,000 people were taken ill with influenza, but every epidemic is not preceded by similar changes in the temperature, for, as Dr. Hancock observes, there has not been any uniform connection between any one sensible quality of the atmosphere—as to heat or cold, rain or drought, wind or calm,—and the invasion of the epidemic. Irregularities and vicissitudes of weather have, however, gone before the disease in very many instances, but sometimes one condition of the atmos-

* Hirsch. Handbook of Geographical and Historical Pathology, and Haecker, Epidemics of the Middle Ages.

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phere, sometimes another has been its immediate forerunner, and the epidemic has frequently been observed to fall partially and capriciously, as a blight falls upon a field or a district. Petit informs us that in 1775 the disease in France was ushered in by thick noisome fogs, and I may here call to mind the dense fog which prevailed over this city in the raging of the distemper in 1857.

"Influenza travels or migrates from one place to another and holds for the most part to certain courses, in spite of opposite winds and variations of temperature. It has been noticed that it generally follows a westerly or north-westerly direction—in this resembling epidemic cholera. The body of the epidemic is preceded by dropping cases, like the droppings of a thunder shower, is most violent at its commencement, and is generally over in six weeks. Conjecture has not been idle as to its origin; one hypothesis assigns it to change in the electrical condition of the air, or to magnetic currents. Schönbein thought it was caused by abundance of ozone; all this is sheer hypothesis, but I have nothing better to offer you. That which commends itself to my own acceptance is the ozone hypothesis. The absolute mortality under the epidemic of 1857 has been immense, though the relative mortality was small. More persons have died in the present year (1857) than died of cholera when it raged in 1832." In these particulars there is a close analogy to cholera.

There are several theories of the causation of cholera; briefly expressed they are:—That a miasmatic poison is absorbed, either by the lungs or intestinal canal, which produces a primary disease of the blood, and that the virus multiplies and causes disturbance of the vital functions. What this virus is, or whence it comes, is not stated.

A second theory asserts that the diffusion of the disease is effected by human agency, by means of a poison in the persons or effects of those who have been exposed to it, this poison being inhaled, or swallowed in water or food.

The water theory assumes the propagation of cholera by means of drinking water which has been contaminated by the specific germ contained in cholera discharges; it has, universally, many advocates.

A modification of this theory assumes that, to produce cholera, the germ must be in a certain vibrionic stage of decomposition. This germ may be preserved in a dry state for years, but whether fresh or old, it undergoes rapid

changes in water. Oxidisation, acids, and certain degrees of temperature, both high and low, can render it harmless.

Pettenkofer believes that the cholera germ is developed in a damp, porous soil, impregnated with organic matter. The germ must remain in the soil some time before it acquires poisonous characters; it then rises into the air and effects an entry into the bodies of people by means of air, food, or water. The germs, further developed and multiplied, are expelled in an immature state, again get into the soil, and remain there till mature; in this way an epidemic is produced. In considering the effect of traffic on the transmission of cholera, he asserts that the dejecta are not the only means of spreading cholera, and that possibly, in that way, they are quite harmless. According to him, the above conditions, combined with personal susceptibility, must concur for the production of an epidemic.

In 1883, Dr. Koch investigated cholera in Egypt, and subsequently in Calcutta. The result of these researches led him to believe that he had discovered the germ in a comma-shaped bacillus. The doctrine of contagion was much emphasised thereby, and the dread of it enhanced; the fear was so great that Southern Europe became almost demoralised, and the necessity for quarantine seemed to be a logical result.

In May, 1884, the Secretary of State for India in Council instituted a special inquiry into the subject, and sent Drs. Klein and Gibbes to study the disease in India. In March, 1885, they sent in their report, and a committee was convened at the India Office to consider it.

This committee formulated the following conclusions:—that comma-shaped bacilli are usually found in the dejecta of persons suffering from cholera, but that there are no grounds for assuming that they are the cause of the disease, that they are, in fact, but epiphenomena, thus confirming the conclusions of Lewis and Cuningham, arrived at years before.

I may here say that most important and valuable researches into Bactereology are being prosecuted with great benefit to science generally and with infinite promise of good to that of medicine in particular; but I would ask the distinguished investigators to defer generalization until the data are more numerous and more certain, especially when such important issues as those attending the discovery of the primary cause of a disease like cholera are involved.

Another theory asserts the cause of cholera, to be an

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influence, the origin of which is of a dynamic nature. Goodeve says: "May it not be a mistake to consider the specific cause at all as a simple body, either generated from without, and air-wafted to a particular spot, and then multiplying itself indefinitely, or as a locally-generated agent, and spreading over certain areas? Might it not be more in accordance with facts to suppose that neither a miasm from without nor a miasm from within, exclusively contains the specific poison? Might it not be that two factors are needed, the one some air-borne material or some dynamic modification of atmospheric elements coming from without, the other some local element, neither being potent unless united? The peculiar atmosphere sweeps along hither and thither, and it is only when it meets with the other peculiar substance that the poison is generated."

Dr. Bryden, whose vast opportunities of studying the disease, give great weight to his views, maintains that cholera has a permanent abode in certain areas of India, and in other districts is renewed by invasion from this area; that the cholera miasm is earth-borne and aerially conveyed; that the disease has no power of continuous manifestation throughout the year. He says also that it can be transmitted by means of fomites, but that the aggregate of cases so transmitted, cannot produce an epidemic. He considers the presence of the cholera miasm, of a humid atmosphere and of prevailing winds to be essential to the manifestation of an epidemic, and that its length of duration is proportional to the natural degree of humidity of the district. Reappearance subsequent to invasion being—he believes—under the control of the normal meteorology of the district invaded, its date can be anticipated according to the geographical situation of the district. Outbreak, that is local manifestation, is governed by the same laws as invasion.

None of these theories satisfactorily explain all the phenomena, and the primary cause of cholera is still unknown; much, however, has been learnt of the laws and development of the disease, and as to what should be done to prevent the outbreak and spread of an epidemic.

Men whose opinions differ concerning etiology arrive at similar conclusions with regard to preventive measures. For instance: it is almost universally admitted that improvement in sanitation and purity of water-supply are efficacious means for the prevention of cholera. One, however, advocates this from the belief that a cholera germ develops in

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a soil impregnated with organic matter, and that the virus enters a man's system by means of the water he drinks, while another simply believes in good sanitation and purity of water as being essential for the preservation of that normal state of health in which people are not likely to become subject to cholera. So with quarantine. Those who do not believe in the contagion of cholera naturally consider it useless; while others reject it and because it cannot be efficiently carried out, whilst it brings with it many evils without preventing the spread of the disease.

In India where a sanitary service has now been established for twenty years, the policy of the government is to reject all theories of causation and propagation as a basis for practical sanitary work; guided by very large experience they have been taught, that in dealing with cholera, theories cannot be taken as a groundwork for any useful action on the part of the State; that by improvement in the condition of localities much good can be done, but that any attempt to carry the doctrine of contagion into practice has no good results, but is productive of much harm, not only because it involves oppression, but because it vastly aggravates all the evil it is intended to prevent. In India, accordingly, all cordons, quarantine, and even isolation of the sick have been discarded, reliance being placed on sanitary measures alone, and the result proves that the confidence is not misplaced; the following statistics taken from the reports of the Army Medical Department confirm this :—

DEATH-RATE PER 1,000 FROM CHOLERA.

English Army,	1860-69.	1870-79.	1880-83.
Bengal ...	9·24	4·18	2·49
Madras ...	2·56	1·68	0·90
Bombay ...	4·80	1·53	0·45
	Jail Population.		
1859-1867 ...	...	...	10·67
1868-1876 ...	...	...	3·28
1877-1883 ...	...	...	3·61

The belief in transmission by human intercourse is still firmly held by many of the highest authorities; few consider there is any danger of communication of the disease by mere contact or personal communication, but that the danger lies in the transmission of the germ, through water or other channel, from the internal economy of one person to that of another; hence contagionists insist on what all

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admit the importance of, *i.e.*, purity of drinking water. For my own part, I am unable to accept this theory as a sufficient explanation of all the facts and phenomena, and would seek the solution of the problem in causes of a wider and more general character, looking for prevention to sanitary measures, and rejecting all others—especially of a coercive or oppressive character. Nevertheless, until contagion is absolutely disproved, I think the authorities are justified in adopting measures, which avoiding all oppression and undue interference with personal liberty, take precautions against possible sources of infection, but at the same time give full effect to all known practical measures taught by the sanitary science of the present day.

The evil results of the contagion theory have been manifested not only in the rigours and hardships of quarantine, whereby great suffering, much disease and incalculable damage to commercial interests have been effected, but in the general state of panic and demoralization which has deranged and degraded society generally. The state of the South of Europe during the recent cholera was pitiable, and the measures of fumigation, isolation, and general interference with personal liberty would have been ridiculous had they not been so pernicious. The same feeling still prevails in some parts of the world, and I quote an absurd example from the *Times* of January, 22, 1886. "Two Japanese sailors died from cholera during the short journey from Kobe to Nagasaki. Their dead bodies were thrown overboard. The Japanese authorities immediately forbade fishing along the coast."—*Sanitary Record*. It would not be difficult to adduce others equally absurd.

It is satisfactory to see that a considerable modification of these proceedings took place in Southern Europe during the latest manifestations of cholera last year; whether this be due to the conviction, forced upon people by recent events, of the futility of such proceedings, or to the impression made by the British and Indian delegates at the Roman Conference, in their emphatic declarations on the subject, I do not venture to say; but we recognize the change with satisfaction, for it points to a more thorough reform still, and gives hope that in time, methods which are worthy of the dark ages will give place to those adopted here and in India.

With reference to the question of the occurrence of the disease in the lower animals, Correa observed it in animals

and birds in 1543, and there was an epidemic of so-called cholera among cats at Delhi in 1875, when 500 cats were said to have died; another at Ahmednagar in 1881, and a third at Sirur in 1883.* It has already been noticed that more than once birds have deserted cholera-affected districts. Experiments made with a view of ascertaining the inoculability of cholera have, with a few doubtful exceptions, failed to communicate the disease to animals. On the whole, I should regard their susceptibility as doubtful.

Habits and geographical distribution of Cholera.—The history of the great epidemics of cholera shews that it has extended widely over the earth's surface, yet that there are regions which have escaped. These regions, according to Hirsch and Cuningham, are:

The whole continent of Australia, except perhaps the northern part.

The Islands of the Pacific;

In Africa: the east coast south of Delagoa Bay; southern and central divisions of the interior up to the Soudan; the west coast up to the Rio Grande; the islands of St. Helena and Ascension; the Cape of Good Hope.

In North America; all the country north of the 50th parallel.

In South America; the South Polar lands, the Falkland Islands, Terra del Fuego, Patagonia, Chili.

In Europe; Iceland, the Faröe Islands, the Hebrides, the Shetland and Orkney Islands, Lapland, Russia, north of the 64th parallel

In Asia; the Northern governments of Siberia and Kamschatka; it is uncertain about Mongolia and Manchooria.†

Places in India that cholera has not visited are:—

The convict settlement on the Andaman Islands (it has occurred in men landed from Calcutta, but not as an epidemic, or but very slightly), Mussoorie, Montgomery, Mooltan, Muzzaffurgurh, Dera Ghazi Khan, Sialkot and Nowshera* (very slightly).

European towns that have hitherto escaped are:—Würtzburg, Frankfort-on-the-Main, Olmütz, Falun, Rouen, Versailles, Lyons (slight epidemic in 1854), Sedan, Cheltenham.†

In treating this section of the subject it is necessary to refer to India, so commonly regarded as the home and

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* Cuningham. Cholera—What can the State do to prevent it?

† Hirsch. Handbook of Geographical and Historical Pathology.

birth-place of cholera. In certain areas the disease is endemic; these areas are:—

Lower Bengal, including the deltas of the Ganges, Brahmaputra and Mahanuddy, bounded on the West by about 85°, on the East by about 91°, on the North by 27°, on the South by about 20° 10′; the interfluvial tracts of Behar; the deltas of the Irawaddy, Salwin, Godavery, Kistna and Kaveri; the Konkan and Malabar coasts; the southern half of the North West Provinces and Oudh; the Gurgaon, Delhi and Karnal districts between the Jumna and Sutlej; the Kangra, Gurdaspur and Amritsar districts between the Beas and Ravi; the Hoshiapur and Jullundur districts between the Beas and the Sutlej;* the cities of Madras and Bombay;† the valley of the Nerbudda and Tapti rivers.‡

Hunter's investigations shew that cholera is endemic in parts of Egypt;§ in parts of Russia and elsewhere in Europe there can be little doubt that it is so, and I cannot consider the chain of evidence which would trace it to India especially as being complete. It is continually present in England, as seen by the Registrar General's returns, and probably in many other countries, though the mortality is seldom so high as to attract notice, excepting when localizing causes and epidemic influence co-operate to develop an epidemic. It is customary to regard this cholera as another form of disease—Sporadic cholera or Cholera Nostras,—but there is probably no real distinction.

The influence of climate, rainfall and prevailing winds has been carefully considered, and its exact extent, though considerable, can hardly be estimated; roughly speaking, however, heat, moisture and a stagnant atmosphere combined are conditions favourable to the diffusion of cholera. Elevation has an influence, though less positive than relative, but cholera has occurred at Simla (7084 feet) and even higher.‖

The wide-spread distribution of the disease would indicate that the nature of the soil is not a very important factor, through some writers consider that cholera is less prevalent on sandy, porous ground and in deserts, on granite, metamorphic and trap rocks, on the laterite and

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* Bellew. The History of Cholera in India.
† Aitkin. The Science and Practice of Medicine.
‡ Macnamara. A history of Asiatic cholera.
§ Hunter. Report on Cholera in Egypt in 1883.
‖ Hirsch. Handbook of Geographical and Historical Pathology.

volcanic formations, and, in England, on the primary geological formations.

Season has a decided influence, as shewn by the steady wave-like fluctuations of cholera mortality during different months, but the minimum and maximum mortality vary very much according to district. In some parts of India, such as the chief endemic area and Madras, there is a double seasonal wave; in districts where there is only one, the minimum mortality, generally speaking, occurs during the three months of November, December and January, the maximum in June, July or August.*

Outside India the disease is most active during the summer and autumn months.†

Admitting that cholera is more prevalent, active, and ever present in certain endemic areas of India, I do not consider it proved that that country is responsible for all the cholera which has overrun the world; yet such is the prevailing belief.

With regard to the spread of the disease, the theories of contagion and diffusion by human intercourse do not explain the movements of epidemics, for the history of the last fifty years shews, that though means of communication have been enormously multiplied all over India, as everywhere else, epidemics have neither increased in frequency, nor become more rapid in their progress, nor altered as to their general direction; in fact, of places that lie on the main line of traffic, many suffer little, while those that are most inaccessible often suffer most.*

Since 1877 records have been kept of the attendants on cholera patients in military and jail hospitals throughout India; it is found that 5,696 cases occupied 10,599 attendants, and that only 201 of these attendants were attacked, or 1.9 per cent.* The same immunity of attendants is shown by the statistics of the London Hospitals, in 1866, and it has been noticed that in the general hospital of Calcutta, where cholera cases are admitted indiscriminately with others, the disease has never spread.

With reference to dissemination, it has been asserted that, cholera breaking out in such an assembly as the Hurdwar Fair, on the dispersion of the pilgrims the disease has been diffused in all directions over the country; but, on careful analysis of facts, it will be found that although the pilgrims

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* Cuningham. Cholera—What can the state do to prevent it?

† Hirsch. Handbook of Geographical and Historical Pathology.

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affected on the spot have died in all directions whither they have travelled, that cholera has appeared in others only in the direction in which the epidemic was moving. Further, it has been found in reported cases of importation of cholera from one station to another, that the disease had already manifested itself in the district, before the particular case which was supposed to have imported it, had arrived. Wherever thorough investigation has been possible, it has been found that explanation based on the theory of contagion fails to account for the facts.

Since the opening of the Red Sea route in 1842, and the Suez Canal in 1869, Europe has suffered no more from cholera than it did before, though traffic has increased very much; and, notwithstanding the daily communication by ships with India through the Canal and Red Sea, no instance of an epidemic being conveyed to Europe by this route has occurred.*

During epidemic prevalence cholera never attacks all the places in the area over which it is diffused, but breaks out in but few of the inhabited towns and villages, sometimes leaping over places in the direct line of its course, and returning to them later during the same epidemic. It is a remarkable fact also, that in Bengal an epidemic always moves upwards,* not necessarily along the great lines of traffic or with the rivers, but rather against them. Frequently places attacked at the same time are widely distant, and this is constantly observed in Indian epidemics, only a comparatively small proportion of villages and towns being attacked in any large area where an epidemic, however intense, prevails.

Greatest intensity is often reached at the same time over widely extending areas. In Northern India in 1879, it was manifested not only by the number of different places in which the disease showed itself, but also by the high mortality.

Cholera seems to have an affinity for certain districts,—even streets and houses,—and the same house has been known to be twice the site of the first outbreak of an epidemic; there were several in Calcutta when I was there. It is worthy of notice also that certain trades, such as the tanner's, seem to confer a prophylactic influence. Everything points to locality as the most important factor in the

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* Cuningham. Cholera—What can the State do to prevent it?

development of the disease, and to its being the most serious subject for consideration in dealing with an outbreak.

The apparent caprice and fluctuation of a cholera epidemic are shown by the following illustration from the "Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1884":—

The mortality from cholera in these districts varies greatly in different years, *e.g.*, 87 deaths in 1884 were preceded by 27,897 in 1883, and it will be seen on comparing the returns since 1869 that a sudden fall like the one mentioned has happened two or three times, and that in only two instances (1870-71 and 1881-82) have the returns for two consecutive years been almost equal. These variations in intensity occur everywhere in India, and are not to be explained by any of the theories generally advanced; we know, however, that bad sanitation invites cholera and increases its severity, while a good sanitary state tends to keep it off, or to lessen the intensity of the epidemic. This fact was shown in the case of Spain last year, where the great cholera outbreak was undoubtedly connected with sanitary negligence.

It cannot be supposed, however, that the local or personal conditions of the provinces under consideration varied so enormously from year to year. One explanation was, that in a year of severe epidemic intensity, more susceptible people were carried off, leaving fewer to be attacked in a following year; but this view is not confirmed by statistics, and, in the absence of any certain knowledge, we must attribute the variation of mortality to variation in the intensity of the epidemic influence. To produce an outbreak of cholera, local and personal predisposing causes, as well as the epidemic influence, must be present,—the latter, however, being the the chief factor.

A province or a body of men is sometimes struck by cholera, the whole community being affected. The outbreak starts from a definite time, and the greatest mortality is compressed into a few days, generally at the very beginning. This does not result from the length of the attack, but from the virulence of the disease, which generally dies out sooner than in the typical outbreak.

I here give a few examples of such sudden outbursts.

The great epidemic which broke out among the troops of the army of Lord Hastings began on November the 7th, 1817, was in all parts of the camp on the 9th, and reached its height on the 17th. During the week in which it raged

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most violently, 764 soldiers and 8000 camp followers died; the epidemic had ceased by the 22nd or 23rd of November.*

Another outbreak occurred in May, 1818, among the Nagpore subsidiary force. Between seventy and eighty cases were admitted the first day, and many were found dead and dying about the camp.*

Another instance is the great outbreak at Kurrachee in 1846. On Sunday evening, June 14th, there was a sudden change in the atmosphere, the wind veered from south-west to north-east, and a thick lurid cloud darkened the air. Later on in the evening cholera appeared in thirteen corps of the troops stationed there; it increased in violence till the 16th, when 277 cases were admitted, of which 186 died; after that date it gradually declined, 814 cases and 442 deaths having occurred between the 15th and 18th (inclusive).*

Without any premonitory symptoms, cholera appeared at Peshawur, at five o'clock on the morning of May 20th, 1867; from that day till the 23rd, the number of cases increased daily, and after that date decreased gradually, the last case being admitted to hospital on the 31st.*

A remarkably sudden outbreak occurred in an orphanage at Secundra, near Agra, on May 29th, 1867. The girls were caught in a sudden shower of rain, the elder ones being the most exposed to it. One of them was found dying at four o'clock the next morning, and subsequently 40 of them and 6 of the younger girls were attacked. Boys and girls were at once removed to different places; not one of the boys suffered. On May 30th, 16 cases were admitted; on the 31st, 15; between the 1st and 6th of June, 15; the disease then died out.

To turn to Europe. In an establishment for pauper children at Tooting, in 1849, there were crowded 1395 children, little more than 100 cubic feet of breathing space being allowed for each child. One night cholera attacked 64 of these children; 300 were attacked in all, and within a week 180 died.†

The epidemic of 1832, in Paris, commenced on the 26th of March, and increased so rapidly, that in eighteen days it had reached its climax, and had already extended to all

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* Quoted from Bryden. Cholera in the Bengal Presidency from 1817 to 1872.

† Southwood Smith. The Common Nature of Epidemics.

the quarters of the city, and had been fatal to 7,000 people.*

The following tables show the absolute mortality of cholera, and its relative mortality, compared with certain other prevalent diseases in India ; from these it will be seen, that, bad as cholera often is, it occupies by no means the highest place in the death rate.

MORTALITY FROM CHOLERA IN INDIA.†
(Including Army and Jail population.)

Year.	Total Mortality.	Rate per 1,000.
1874	18,455	· 887
1875	384,858	2· 434
1876	486,667	2· 628
1877	637,059	3· 203
1878	319,451	3·6002
1879	271,071	5· 335
1880	119,170	1·0949
1881	162,266	1· 745
1882	351,408	1·5435
1883	249,244	1· 551

MORTALITY AMONG THE GENERAL POPULATION IN INDIA.†

Year.	Rate per 1,000.			
	Fevers.	Bowel Complaints.	Cholera.	Small-pox.
1874	11·09	2· 27	· 08	1·26
1875	12·35	2· 71	2· 72	·78
1876	13·54	2· 35	2· 07	·66
1877	13·54	2· 54	2·809	1·15
1878	19·80	1·959	3· 53	1·49
1879	16·54	1· 67	1· 31	·96
1880	14·16	1· 58	·367	·45
1881	14·82	1· 70	· 78	·37
1882	13·95	1· 83	1· 44	·71
1883	14·62	1· 99	1· 96	1·13

* Baly and Gull. Reports on Epidemic Cholera.

† Reports of the Sanitary Commissioner with the Government of India.

Before leaving this subject, it is necessary to refer to outbreaks of cholera on board ship. Cholera has frequently broken out in vessels in the harbours of affected ports, but has disappeared soon after the ship has gone to sea. On the other hand, in passenger, emigrant and troop-ships, it has made and makes its appearance from time to time, within certain periods after leaving the port,—these periods varying from two or three days to as many weeks. But, as the people on board have all been exposed to the influence of cholera before they left, we must assume that cholera was latent in them when they left.

In some cases, where the port of embarkation was not affected though the passengers came from a cholera affected district, and the disease spread to the crew, it is to be remembered, that the ship started from a country in which the epidemic influence was present, though not ostensibly in the port of embarkation.

This ship-cholera seems to give some support to the doctrine of contagion, but the truth most probably will be found to lie in the fact that the individuals attacked were cholerised before they left the country, and that insanitary local causes on board the ship developed that which was dormant in the individuals.

Dr. Sutherland, with reference to this subject, writes :— "The ship or the men must have been in a cholera locality. The men are the chief agents. They become cholerised, so to speak, and whether the disease lies dormant or shows itself, depends on other conditions being superadded. It would be another thing if cases such as these introduced an epidemic into a perfectly uncholerised country. But this has never happened; the *aura* must be there before the ships. We cannot tell yet what cholerisation is. We are seeking to know. But we do know that it is set up indigenously and without external importation."

He adds :—1. "A ship lying in an epidemic port may become part of the epidemic port after it has sailed, provided there be men on board who have also been in the locality. 2. A ship sailing on the free open sea may encounter a travelling epidemic and be struck thereby. This has happened in the Bay of Bengal, in the face of the Monsoon. 3. An epidemic may outstrip a steam ship, as happened at Malta, in 1865. 4. No cholera-struck ship ever landed an epidemic. 5. What is called the incubation period of cholera is not fixed but variable, and may require nothing but change of temperature to develop it."

Precautionary measures, general and special, against cholera.—Up to the present date the belief is maintained by foreign powers that epidemic diseases, and among them especially cholera, can be arrested in their progress and debarred from entering into a country by quarantine. This, as its name implies, and as you are probably aware, originally meant seclusion and isolation for a period of forty days, of persons either affected by a disease, or coming from a locality where it prevailed. Quarantine is based upon the assumption that the disease is communicable from person to person, either by means of the individual himself or of his effects. This, however, has been modified considerably in its application of late years, and the period of isolation has been much diminished, even by those who hold the doctrine of contagion.

It is unnecessary to describe minutely the evils that resulted from this grave interference with personal liberty; suffice it to say that they consisted of discomforts and horrors arising from the accumulation of people in Lazarettes, whereby great inconvenience and personal suffering were inflicted, with hindrance to commerce and the creation of foci of intensified disease, forming an accumulation of evils much greater than that they were intended to avert.

Still, could it be shown that by such measures, the propagation and diffusion of disease from nation to nation can be averted, their adoption, under proper management, and with precautions as to the personal safety and comfort of those concerned, would be justified as the minor evil. But, if it be true that the diffusion of epidemic disease is dependent in a great measure on atmospheric or general causes, apart from contagion, then the futility of quarantine is obvious.

The British and Indian Governments, basing their measures for prevention and protection on well ascertained facts alone, and not upon theories of etiology, have discontinued all quarantine measures, whether by land or sea, relying upon sanitation, combined with medical inspection, as the only and sufficient means of safety.

The British Government, represented by its Local Board, recognising the truly contagious nature of some diseases and its probability in others, has adopted measures of inspection and isolation of the sick, together with disinfection, and purification of ships, effects and persons, insisting at the same time on all that conduces to the

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establishment of healthy conditions of living, but avoiding all undue interference with personal liberty. The following is an epitome of their measures as regards cholera :—

Ships known or suspected to have cholera on board, are to be detained by the Custom House Officers, until the Medical Officer of Health shall have inspected them.

Those on board suffering from cholera are, if possible, to be moved to a hospital, but if they remain on board they are to be isolated, and all that comes from them disinfected.

Those not suffering from cholera, but coming from an affected ship, are to be allowed to proceed to their destination, notice being given to the Health Officer of the district to which they go.

The ship itself and the effects of any on board, who have suffered from cholera, are to be disinfected and no further detention is to be imposed.

In India all quarantine, cordons and interference with personal liberty, including isolation of the sick, have been discarded as practically useless, attention being concentrated upon sanitary measures as the sole means of preventing the propagation and diffusion of the disease, as will be seen from the following summary of regulations for the army, which, as far as possible, are applied to the population generally.

In anticipation of an outbreak, personal cleanliness is especially enjoined, the utmost attention is to be given to the sanitary condition of the station, overcrowding is to be avoided and great care to be taken in watching and checking premonitory symptoms.

On the appearance of cholera, bodies of men are to be *at once removed from the affected locality ;* great attention is to be paid to the purity of the water supply, and to the nature of the camping ground, and all dejecta are to be buried in trenches dug for the purpose.

Purification and fumigation are to be resorted to, both for the room or building in which any case of cholera has occurred, and for the effects of the sufferers.

Temporary buildings are to be erected as hospitals, but, in the case of the general population, removal of the sick from their homes is not enforced. It should be clearly pointed out that no danger is incurred by attending on the sick.

With reference to the futility of quarantine, Dr. Southwood Smith says, "the object of quarantine is to prevent

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the introduction of epidemic disease from one country into another," and the whole machinery of it is based on the assumption that by an absolute interdiction of communication with the sick, or infected articles, the introduction of epidemic diseases into a country can be prevented.

This assumption however, overlooks the presence of an "epidemic atmosphere," without which it is now generally admitted that no disease will spread epidemically. "Allowing therefore to contagion all the influence which anyone supposes it to possess, and to quarantine all the control which it claims," there remains this primary and essential condition which it cannot reach.

Experience shews that "the influence of an epidemic atmosphere may exist over thousands of square miles, and yet affect only particular localities." The cases of cholera which have occurred in widely distant parts of England and Scotland, and notably in India, mark the presence of this influence; yet cholera has fixed itself and prevailed as an epidemic only in comparatively few places. Why has it so localized itself? Probably because it has there found certain local or personal conditions, or both. It follows that we should make diligent search for all localizing circumstances and remove them, "so as to render the locality untenantable for the epidemic." Quarantine however, leaves all these localizing conditions "untouched and unthought of."

"The question of contagion has no necessary connection with that of quarantine." The real question is, can it prevent the extension of epidemic diseases, whether contagious or not? "If it can it is valuable beyond price; if it cannot, it is a barbarous encumbrance, interrupting commerce, obstructing international intercourse, periling life and wasting public money." "Whether it can accomplish its object or not is a mere question of evidence," and everything in India and Britain affirms that it cannot do so.

With regard to the bearing of quarantine on the question of cholera, Professor Caldwell of America says: "Cholera, though a fatal scourge to the world, will, through the wise, beneficent dispensation under which we live, be productive of consequences favourable alike to science and humanity. Besides being instrumental in throwing much light on the practice of physic, it will prove highly influential in extinguishing the belief in pestilential contagion, and bringing into disrepute the quarantine establishments that have hitherto existed."

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Measures of prevention and quarantine have been the subject of many international conferences; the following is a brief summary of the conclusions of those held at Constantinople in 1866, Vienna in 1874, and Rome in 1885:—

The theories on which the measures recommended by these conferences are grounded have undergone little change since the conference at Constantinople in 1866; the basis on which all the conclusions with regard to preventive measures are built up is still, as it was then, the theory of contagion.

Quarantine has, however, gradually been reduced from ten days imposed at the Constantinople conference, to seven days at Vienna, and to five days suggested at Rome, and even the five days are not to be exacted unless the ship has had cholera on board, or has been gravely suspected, after leaving port. But great stress is still laid on quarantine in the Red Sea, as though that were the channel by which cholera entered Europe, of which there is really no evidence.

Great modifications were suggested at Rome with regard to pilgrim traffic to Mecca, 10 days' detention in the Red Sea being reduced to 5, and 24 hours only being imposed on ships with a clean bill of health.

Land Quarantine was declared useless at the Vienna Conference, and both that and cordons were abolished at the Roman Conference last year, on the ground that they were impracticable.

It will be observed, that though the idea of contagion still prevails, it has undergone great modifications, suggesting the hope that the time may not be very far distant when reliance will no longer be placed on such barbarous institutions as quarantine, but upon sanitary measures which alone offer any guarantee for protection.

The question arises, what does it behove each individual of the community to do, as regards himself, his household, his village, town, and country, when cholera menaces, or has actually made its appearance?

Attention should be directed to careful living, careful clothing, and moderation in habits and diet. Avoid depressing influences, fear, over-fatigue, chills, violent alternations of temperature, aperient medicines, especially those of a saline nature, indigestible food, impure water, unripe or over-ripe fruit, and be careful to observe and promptly check any tendency to diarrhœa.

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Pay due attention to ventilation, to perfect drainage, to purity of water-supply, to prevention of overcrowding, using all your personal influence to secure this throughout your village or town. Do not be afraid to attend upon the sick, for you will incur no danger thereby. Disinfection of excreta, effects, houses and rooms should be practised.

Protest against quarantine and all coercive measures which divert attention from the true sources of safety, summed up in the expression "complete sanitation."

There is good reason to believe that the measures recommended by our Government, if they are carried out by individuals and municipalities, are such as may imbue us with a feeling of confidence, that in the event of cholera appearing in this country, we shall be protected against any intensity of prevalence. The more we can perfect the measures now in force,—and you can do much towards this, for insanitary houses are still far too numerous everywhere —the more thoroughly we give them our individual and collective support, moral or material, the more complete we may anticipate, will be our immunity from the disease.

Experience on the Continent, during the recent epidemic, serves to show how futile coercive measures have been and must be, while the examples of Marseilles, Toulon, Valencia, Palermo, Naples, whose notoriously insanitary conditions have paid their natural penalty, will be, we may trust, a salutary warning as to how cholera may be intensified by local causes, and will give a lesson which, we hope, will not be disregarded.

We read in the *Times* of Monday, February the 22nd, that a most important memorial to the Lieutenant-Governor of Bengal, concerning sanitation is now before the Government of Bengal. This memorial states that since 1881, cholera has swept away more than 20,000 people in Calcutta and its suburbs; that in some suburban wards the death-rate has stood at 70 in the 1,000; that during the decade of 1875 to 1884, out of a population of 257,000 in the suburbs, no fewer than half have perished.

There is not the least doubt that the laws of sanitary science are thoroughly well understood in this country, and that the enactments of the Government would be most effective if properly carried out, but no Government can force good sanitation upon towns, villages, or houses, without the co-operation and hearty support of the resi-

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dents, and all their measures will be found useless, unless backed up by the personal efforts and exertions of individuals. Experience shows us that in the present day the best houses are often most defective, and that local causes of disease, which might easily be removed, abound. Why spend £50 on hospitals for cholera, when £5 laid out on sanitary measures might obviate their necessity?

I do not wish to frighten you, but cholera is in Europe, and may appear wherever it can find a fitting nidus, that is, the presence of bad local conditions, and then all the quarantine and inspection in the world will not keep it out; that such bad local conditions in towns, streets and houses, are still the rule rather than the exception, is proved by the reports of the Sanitary Associations and of sanitary engineers who deal with these matters in localities where Government officials can exercise no interference. I regard this as a great sanitary defect of the present day, and I urge you to see to it thoroughly; for upon this may depend whether a pestilence which has already invaded Europe and is threatening us, shall find footing, or shall leave us unscathed.

The measures are simple enough if only the public can be brought to believe in the unseen but easily removable dangers within, around and beneath their houses.

I will conclude by quoting from the writings of Drs. Southwood Smith and Ferguson, which I strongly recommend to your attention.

Dr. Ferguson, speaking of epidemics generally, says:— "Places, not persons, comprehend the whole history, the etiology of the disease. *Places, not persons!* Let the emphatic words be dinned into the ears of the Lords of the Treasury, until they acquire the force of a creed which will save them hereafter from the absurdity of forcing quarantine. . . . . Let them further be repeated in the Schools of Medicine, until the Professors become ashamed of imbuing the minds of the young with prejudice and false belief, which, should they ever visit warmer climates, may cause them to be eminently mischievous in vexing the commerce, and deeply and injuriously agitating the public mind of whatever community may have received them."

Dr. Southwood Smith, writing on the same subject, says:—"Epidemics are under our own control; we may promote their spread, we may prevent it. We

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may secure ourselves from them. We have done so We have banished the most formidable. Those that remain are not so difficult to be conquered as those that have been vanquished. . . . . We see that epidemics are not made by a divine law the necessary condition of a man's existence upon earth. The boon of life is not marred with this penalty. The great laws of nature, which are God's ordinances in their regular course and appointed operations, do form and give off around us, products which are injurious to us; but He has given us senses to perceive them, and reason to devise the means of avoiding them, and epidemics arise and spread because we will not regard the one nor use the other."