FAYRER NATURAL HISTORY AND EPIDEMIOLOGY OF CHOLERA

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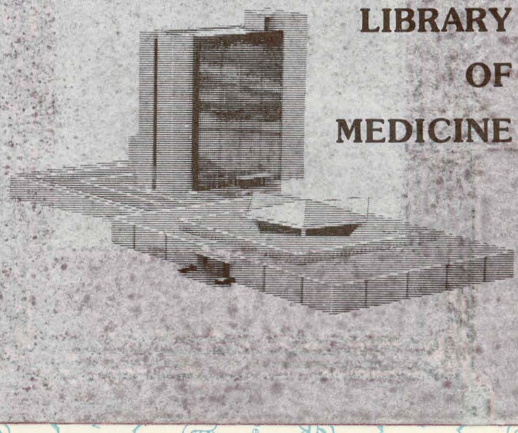

THE

NATURAL HISTORY AND EPIDEMIOLOGY

OF

CHOLERA

BEING THE ANNUAL ORATION OF THE MEDICAL SOCIETY OF LONDON, MAY 7, 1888

BY

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LONDON
J. & A. CHURCHILL
11 NEW BURLINGTON STREET
1888

TO

HUGHLINGS JACKSON,

LL.D., M.D., F.R.C.P., F.R.S.

LATE PRESIDENT OF THE MEDICAL SOCIETY OF LONDON,

THIS ORATION,

DELIVERED BY HIS DESIRE,

AND PRINTED IN OBEDIENCE TO THE WISH OF THE SOCIETY,

Is Dedicated,

WITH SINCERE REGARD AND RESPECT.

THE

NATURAL HISTORY AND EPIDEMIOLOGY OF CHOLERA.

Mr. President and Gentlemen,—It is in obedience, sir, to the behest of your predecessor that I am entrusted with the duty of commemorating the inauguration of the Medical Society of London by delivering an annual oration which shall deal with matter germane to the purposes for which the Society was founded.

I am as deeply impressed with a sense of the honour conferred on me in being selected for this duty, as with that of my inability to do it the justice it merits, and can only at once offer my grateful acknowledgments, and crave indulgence for the shortcomings from which I cannot hope to escape.

The subject I have selected to bring before you is "The Natural History and Epidemiology of Cholera." It appeared to me, after revolving in my mind other possible subjects for this address, that I could hardly select one of greater interest at any time, but especially now, that the dark shadow of this mysterous pestilence, which has so recently loomed over Europe, has passed away, after threatening, though

not invading, our own islands—thanks, no doubt in a great measure, to the protection afforded by a system of sanitary administration which, whilst preserving the general health of the people, has rendered them less susceptible to disease, the local causes of which it has contributed to diminish, if not to destroy.

I do not propose to dwell on the pathology or therapeutics of cholera, but to submit to you the views which, to me at least, seem most in accordance with other facts concerning it that have been ascertained. I purpose, in short, to give a brief review of its history, habits, method of diffusion, geographical distribution, relation to climate, season, meteorological conditions and locality, its etiology, its effects on the human race, and, finally, the methods which experience has taught us are most efficient in mitigating or preventing it. This involves so much, that I cannot hope to do more than indicate the most prominent points of each of these subjects; still I trust I may be able to interest the Fellows of the Society and the visitors who honour us with their presence this evening.

The subject has for many years interested me and occupied my attention; whether in the West Indies; the epidemic of 1849 in England; in India and Burmah during a varied experience of nearly a quarter of a century, or as a member of the Army Sanitary Committee for the past sixteen years, when the effects of cholera on the army, as well as on the vast civil population of India, have been constantly before me in the exhaustive reports which are regularly published by the Governments of India. On the ground, therefore, of personal experience, I venture to think I have

some claim to make cholera the subject of this address; and, as regards fitness in respect of time and place—bearing in mind the ever-increasing tendency of cholera to enlarge its range of geographical distribution; the fact that it has so recently been present in Europe, threatening, though happily not actually invading, our own islands; that it has been the subject of international conferences, which have resulted in little else than to leave England hopelessly at issue with other powers in respect of the methods of prevention or protection; and, further, considering that as in England and India the measures adopted are totally different to those of other nations, but, as we are confident, productive of the best results—I think that no more fitting occasion for a review of the whole question could be found than the annual oration of the Medical Society of London.

My subject, therefore, is the natural history of a pestilence which exhibits many characters in common with the plagues of the Middle Ages; like them traversing the earth in zones, spreading in tropical, temperate, and polar regions, attacking all sorts and conditions of men, uncertain and often apparently capricious in its incidence, terrible from the rapidity and intensity with which it strikes, and from the obstinacy with which it resists all therapeutic measures, yet at the same time obedient to certain laws which regulate its incidence, diffusion, and decline. Of its cause, if indeed we may assign it to any single cause, we are still ignorant, but experience and observation have made us so far familiar with its habits, and the manner of its propagation and diffusion, that we are able to say how its incidence may be evaded, its

course stayed, its rigour mitigated, and how it may be disarmed of much of its terror; nor are we without hope that in time to come it may, like the black death, the sweating sickness, and other pests, give way before the application of the laws of hygiene, and take its place among the records of the past.

Having much in common with other epidemics, cholera possesses well-marked features of its own, but there is some reason for believing that it may have close etiological affinities with other diseases which in many respects differ from it widely in their characters.

No disease better illustrates the peculiarities of an epidemic; diffused far and wide over extensive countries, often leaping from one to the other, as it were, by bounds, or spreading rapidly among more limited communities, following a definite track, modified by climate or geographical position, dying out gradually or rapidly, to become extinct for a time, or to remain in abeyance till revivified into activity by fresh influences. On the other hand, it may occur in the sporadic form, or prevail as an endemic in certain regions from which it is never absent (such as in what is called the endemic area of Bengal), whence it may spread epidemically to regions beyond.

History of Cholera.—Cholera is an ancient disease; as far back as the records of medicine extend, descriptions of it are to be found. It has been said that it first appeared as an epidemic at Jessore in Bengal in 1817, but, as I need hardly say, this is not the case. It is described by Hindoos, Chinese, Greeks, and other ancient writers of the pre-Christian era;

by Romans, Greeks, Arabs, and a long succession of other authors up to the present day. The Ayurveda of Susçruta describes it as Visuchika;[1] Chinese writers, contemporaneous with Hippocrates (5th century before Christ), mention it under the name of Ho-louan; Hippocrates speaks of it as χολερη, Ionic form of χολερα, from χολη, bile, and ῥοια, flux, or perhaps χολερα, the gutter of a house.[1] He gives descriptions of certain cases and alludes to seasonal prevalence, but does not refer to it as an epidemic. Like the Chinese he speaks of two forms, the wet and the dry. The Arabic names, "Wubba" and "Taoun," though applied to cholera, also mean pestilence, whilst "Haiza," the term used by Rhazes, Avicenna, and Averrhoës,[1] is that in common use in India at the present day. There are various names for cholera in the East, most of them significant of the characteristic symptoms.

Cholera is mentioned by Celsus, Cœlius Aurelianus, Aretaeus of Cappadocia, Paulus Aegineta, Alexander of Tralles; by Arab writers, Rhazes, Avicenna, Averrhoës, by Ali Ben Hossein of Bokhara (1364), and Mahmud Ishah.[1] Bernard Gorden, John of Gaddesden, Raphael of Volterra, and others mention cholera as a well-known disease in Europe, but the 13th, 14th, and 15th centuries furnish little information on the subject.[1]

In Elliott's "History of India," a disease which may have been cholera is mentioned as occurring in 1325, but there is no other notice of it in India by Europeans before 1503.[1] In Europe, from early in the sixteenth century there are notices of epidemics

[1] Macpherson, "Annals of Cholera."

of bowel affections and of what is called "trousse-galant," which appeared in England and France in 1545. In 1564 an epidemic of cholera occurred at Nismes; in 1643 and 1665 in Ghent, as described by Van der Heyden.[1] Piso says that cholera was severe in Brazil in 1658;[1] Sydenham writes of an epidemic of cholera in London in 1669–62.[2] Dr. Macpherson, the learned historian of cholera, says it was present in various parts of Europe in a mild epidemic form during the eighteenth century, dying away towards the end and remaining quiet during the first years of the present century.[1] Outbreaks seem then to have been less severe, but the records of disease were very imperfect in those days. Sir J. Pringle describes it as prevailing in the Low Countries, about Ghent, towards the end of the eighteenth century. Dr. Short speaks of an epidemic in England in 1726. In 1722–23–24 it was in North Germany; in 1736 at Nimeguen; in 1742–50 in Minorca (Dr. Cleghorn); in 1751 Malouin describes an epidemic in Paris; in 1767 Dr. Short mentions cholera making havoc among men. Dr. Holmes, President of this Society, in 1777, in an address to the Society, said that it came round every year as regularly as autumn, and I might give many other references about this period and later, bringing up a continuous history of cholera in Europe to the present time.

In Asia in the sixteenth century cholera was described by the Portuguese; it ravaged the troops of the Zamorin; and an epidemic which occurred in Goa in 1543 was described by Gaspar Correa,[1] who

[1] Macpherson, "Annals of Cholera."

[2] Sydenham's Works, translated by Swan, p. 133.

says the name given by the Portuguese was Mordeshee, which continued to be used under the forms Mordshi, Morshi, Mordeshin, Mort de Chien. Garcia d'Orta and Bontius give a full account of the disease in 1629 in Goa and Java; Linschott and others also mention it. Zacutus Lusitanus speaks of its prevalence in Arabia; Baldaeus, a Dutch clergyman, refers to fatal cramps in his account of the coasts of India in 1641; Cleyer noticed cholera in China in 1669; Thevenot in Surat in 1666. Then Rhyne refers to a remedy for it in Japan. In India it was epidemic in Mewar in 1661, in Marwar in 1681–82, in Goa in 1683–84.[1] In 1757 cholera occurred at Tinnevelly; in 1768–9 there was an epidemic in Pondicherry and on the coast, and in Ganjam and Calcutta in 1781. It appeared also in Java, China, and the Mauritius, on the Malabar coast in 1782, as far south as Trincomalee; in Hurdwar and Central India in 1783, at Travancore in 1792, in Mewar and the Mahratta country in 1794.[1] After the last mentioned epidemics, notices of the disease become rarer until the great epidemic of 1817. There is abundant evidence to show that the disease has been well known and described since the very earliest periods of history, nor is there anything in this record to prove that its origin is to be traced to India alone.

The history of the distribution subsequent to this may be summarized according to Hirsch in a series called by him Pandemics.[2]

The first pandemic (1817–23), notably intense about Jessore in Bengal, extended over the whole of

[1] Macpherson, "Annals of Cholera."

[2] Hirsch, "Handbook of Geographical and Historical Pathology."

India. Taking a southerly direction it appeared in Ceylon (1819), and Bourbon and the east coast of Africa (1820). Its progress in an easterly direction began with Nepaul, thence to Arracan, Burmah, Siam, the peninsula of Malacca and the East Indies (all in 1819), the Moluccas, Philippines and Chinese Empire (1820) and Japan (1822). The first place to the west of India in which cholera appeared was the east coast of Arabia (1821), then Mesopotamia, Persia, along the coast to the Euphrates and Tigris, and thence to Bagdad and Syria (all in 1821). In 1822 it extended along the Tigris to Kurdistan, thence to Syria, Palestine, and Damascus (1823), and from Persia to Russia in 1822.

In the second pandemic (1826–37) cholera advanced from Bengal, along the Ganges, through the North-West Provinces, and westwards in two directions; through Cabul, Balkh, and Bokhara, to Orenberg, where it died out the next year; through Mesopotamia, Arabia, Syria, Palestine and by Suez to Egypt, the north coast of Africa, the east coast, Abyssinia, and some of the Soudan countries; and, in the other direction, through Persia and Transcaucasia to Astrakhan, and thence over Russia. It reached Germany through Poland and Danzig; Austria, through Galicia, Turkey, and Asia Minor. It appeared in Great Britain, France, and the Netherlands almost at the same time (1832); the next year it was in Spain and Portugal; in 1835 it attacked the south of France and Italy, and in 1837 was in Switzerland, Austria, and Germany, attacking districts in the two latter countries which had escaped before. Norway and Sweden were attacked in 1834.

Cholera appeared in Canada in 1832, extended up the St. Lawrence River and through Detroit to the United States, along the east coast and down the Ohio. From New Orleans it extended through the southern, central, and western States to the shores of the Pacific (1833), Mexico and the West Indies (1833); appeared in South America (Guiana) in 1835 and Central America in 1837. Manifesting itself in an easterly direction it appeared in China and Japan.

During the third pandemic (1846–63) cholera was widely prevalent in India, and had appeared in Further India, the Philippines, China, and Persia before the date mentioned. From Persia it extended by its former route to Orenberg, through Siberia, to the shores of the Black Sea and Constantinople; it spread over a great part of Turkey, the Danubian Principalities, Hungary, Asia Minor, Syria, and Egypt, and reached ultimately the north coast of Africa (1848–49–50). At the same time it re-appeared in India, Further India, and the Malay Archipelago, and attacked Greece and Malta. Meanwhile cholera had reached European Russia through Astrakhan, extending up the Don, thence over the whole country on to Germany (1848). It was in England, the Netherlands, and Belgium in 1848–49, Sweden, Austria, France, and Italy in 1849 and '50. It appeared in North America in 1848, breaking out in New York and New Orleans simultaneously, extending over all the States east of the Rocky Mountains, and reaching Canada in 1849 and the west coast in 1850. Panama and Mexico were attacked in 1849, then South America (New Granada), and finally the West Indies (1850–54).

There was a remission from 1850–52, and after that date, in Europe, cholera appeared in all the countries it had visited before, with the addition of Spain and Denmark. In Asia it extended over the East Indies, China and Japan, Persia, and thence to Syria. In 1853 it appeared in Algiers, in 1855 in Egypt, and subsequently Nubia and the northern coast of Africa, Samoli Land, Madagascar, Mauritius (for the first time), and the Comoro Islands.

In North America it was not severe, but in Central America its area was widely extended, and in South America, Granada, Guiana, Venezuela, and Brazil were invaded.

The fourth pandemic (1865–75), unlike the others, took a westward course through Arabia and Suez; Malta, the South of France, Spain, and Italy being the first places attacked. From Turkey, attacked in 1865, cholera invaded the countries of the north and east of Europe, attacking them almost simultaneously, appearing in England and Belgium in 1865, and subsequently breaking out in Switzerland, the Netherlands, Norway, and Sweden.

In the Western Hemisphere it appeared first in the West Indies (1865), and in North America in 1866. In a northerly direction it extended over the United States from New Orleans to Nova Scotia, and in a southerly direction to Central America. In South America it first appeared in Paraguay, extended down the Uruguay to Buenos Ayres and in a northerly direction to Brazil; the Argentine Republic, Bolivia, and Peru were invaded.

Meanwhile cholera had reached Persia, Mesopotamia, and Syria, and in the other direction Egypt,

the northern coast of Africa, and Senegambia. After ravaging Somali Land, it appeared in the interior, and, later, on the Mozambique coast and in Mauritius. In an easterly direction it attacked the East Indies, China, and Japan at an early period of this pandemic.

There was a remission during the years 1869 and '70, except in Russia and Persia; the Danubian Principalities, Austria, Turkey, and Prussia were again attacked, but the south and west and the Scandinavian kingdoms suffered little during the second period. Cholera appeared in New Orleans in 1873, and extended over the central plain of North America; South America was entirely free.

In Asia cholera attacked Arabia and extended to Nubia, and, following the course of the Tigris and Euphrates, appeared in Mesopotamia. It broke out in Turkestan and Bokhara in 1872, and in Syria in 1875.

The pandemic which began in 1883 is so recent that I give its history in fuller detail. During 1883 cholera was restricted to Egypt. The entire mortality is not given, but up to the end of July the deaths notified to Sir G. Hunter were 12,600—the real number being probably about twice that amount. The condition of the country is described as extremely insanitary.

In 1884 cholera appeared at Toulon on June 18, and a week afterwards at Marseilles, subsequently attacking 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 Russia in a mild form at St. Petersburg and Charkoff.[1]

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

In September it appeared in Naples, and was present 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 the districts 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 5, 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 cholera appeared in two English ports, Cardiff being one, but failed to spread.

In 1885 cholera was prevalent in Spain from June to November, and extended over nearly the whole 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 to the provinces of 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 serious in districts already attacked. The mortality for the month was not far short of 24,000.

[1] Cuningham, "Cholera—What can the State do to prevent it?"

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 at Gibraltar.

The recorded deaths from cholera in Spain were 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 Europe during 1886 cholera was prevalent in Italy, in the Austro-Hungarian Empire, and to a slight extent in Spain and France.

At the beginning of the year there were a few deaths reported from Venice and the south of Spain, but cholera as an epidemic did not take any hold on Europe till the middle of April, when it first appeared at Brindisi, and almost at the same time in the Venetian province and to a slight extent in Brittany, while there was a recrudescence in Bilbao.

In Italy the province of Naples was slightly affected, but the greatest severity was felt in the north-east, in the provinces round Venice, as Ferrara, Padua, Bologna, Vicenza, and Ravenna, and in the neighbourhood of Brindisi — Bari, Barletta, San Marco, Acquaviva suffering severely. The epidemic gradually increased in severity and in the range attacked till about the middle of August, the deaths up to that time being about 5,465. It then began to diminish in severity, but in September there were a few cases in Rome, and Sardinia was invaded. The epidemic may be said to have ceased in Italy by the middle of October, 21,000 cases and 8,650 deaths having been recorded.

The most striking feature of this epidemic was a severe outbreak at Francavilla Fontana in July, which suffered more severely than almost any other town in Italy since 1884.

In the Austro-Hungarian Empire cholera appeared at Trieste in June, and afterwards attacked places in Istria, Carniola, Dalmatia, Croatia, Bosnia, and Servia. It appeared at Raab in September, and shortly afterwards at Buda-Pesth, where it had caused nearly 500 deaths by the end of November. It then began to abate, but cases were still heard of up to the very end of the year, and there was a slight outbreak in Bulgaria (Tirnova) in December.

In Spain cholera was comparatively inactive. During the first three months of the year there were cases at Tarifa, near Gibraltar, and then cholera died down again till October, when there was a recrudescence in Malaga.

In France cholera was limited to the province of

Finisterre, where several deaths occurred during the first four months of the year.

In Japan it is reported that there were 50,000 cases and 35,000 deaths; the Corea is said to have been decimated.

In South America cholera appeared in Buenos Ayres in November.

In India there was no exceptional prevalence.

At the beginning of 1887 Europe was free from cholera; in March it was reported in Sicily, but did not acquire serious proportions till July. In that month it attacked Rocella on the Calabrian coast, and increased in Sicily and on the mainland.

In Sicily its range was limited to the provinces of Palermo, Messina, Caltanesetta, and Catania; its severity fluctuated slightly, but there was no distinct abatement in the island generally till the beginning of October.

In August there were cases at Malta; cholera began to increase in range in the south of Italy, and attacked Naples, Resina, and other places along the Bay of Naples. It increased in range along the Bay and in the extreme south till about the middle of September, and then Naples, Reggio, and their surroundings became its chief seat. From that time it ceased to increase, and by the middle of October there were no further returns from Italy.

The greatest severity of the epidemic was at Malta; it was there steadily maintained during September and October, but then the decline began, and after the middle of November there were no further returns.

The total number of deaths in Italy (including Sicily) was 2,200; in Malta 429.

In South America, the epidemic, which began in November 1886 at Buenos Ayres and Monte Video, attacked the provinces of Uruguay, the Argentine Republic, and Paraguay, and in the west Chili (for the first time), where it was limited to Santiago. By the middle of May it had ceased as an epidemic, but Santiago was again attacked in the middle of November, and Valparaiso became infected.

In India there was a severe epidemic in the north-west, and 70,000 deaths are reported in the North-West Provinces during June and July = 1 per cent. In Peshawar city there were 280 deaths during the month ending in the middle of August.

From this period cholera seems to have been dormant in Europe. Whether there may be a recrudescence in the spring, time will show.

Cholera has visited our islands several times as an epidemic, with the following results :—

Date.		Deaths.
1831–32		52,547
1848–49		53,293
1853–54		20,057
1859	In an epidemic form cholera was limited to Wick in Caithness, Glass Houghton, near Pontefract, and Netley.	
1866		14,378[1]

Geographical Distribution, Habits, Conditions, and Epidemic Movement.—The foregoing account of its movements shows how widely cholera has extended over the earth's surface, but there are geographical areas which have not yet felt its malign influences.

[1] *Pall Mall Gazette*, extra, August 8, 1883; Macnamara, "History of Asiatic Cholera;" Lawson, "Lecture on Cholera."

In some it has never appeared; in others, its incidence has been so slight as to amount practically to exemption. These regions (according to Hirsch and Cuningham) are—

The whole of Oceania, except perhaps the north-eastern part of Australia, Tasmania, New Zealand, Fiji, and the Malay Archipelago.

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; Ascension.

In North America, all the country north of the fiftieth parallel; in the West Indies, Martinique.

In South America, the South Polar Lands, the Falkland Islands, Terra del Fuego, Patagonia.

In Europe, Iceland, the Faroë 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.[1]

In India cholera has either not visited, or but very slightly:—

The Andaman Islands, Mussoorie, Montgomery, Mooltan, Muzzafargurh, Dera Ghazi Khan, Sialkot, and Nowshera.[2]

European towns that have hitherto practically escaped are:—

Wurtzburg, Frankfort-on-Main, Olmutz, Falun, Rouen, Versailles, Lyons, Sedan, Cheltenham.

On the other hand, there are places from which

[1] Hirsch, "Handbook of Geographical and Historical Pathology."

[2] Cuningham, "Cholera—What can the State do to prevent it?"

cholera is never absent, and these endemic areas (according to Corre[1]) comprise India, Indo-China, and perhaps a part of the islands of the Malay Archipelago, a vast assemblage of countries to which one might give the name of Indo-Malayan, and which corresponds to one of the hottest and dampest zones of the world; its limits would be on one hand the Tropic of Cancer and the 10th degree of south latitude, on the other hand the 65th and 125th degrees of east longitude.

In India itself, which is regarded by many as the sole birth-place and home of cholera, it is not by any means confined to Lower Bengal and the delta of the Ganges as is sometimes stated, but is endemic in several other and widely distributed areas; the deltas of the Brahmaputra and Mahanuddy; the interfluvial tracts of Behar; the deltas of the Irawaddy, Salwin, Godavery, Kistna, and Cavery; 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;[2] the cities of Madras and Bombay,[3] the valley of the Nerbudda and Tapti rivers.[4]

Hunter's investigations show that cholera is endemic in Egypt;[5] in parts of Russia there can be little doubt that it is so. It is continually

[1] Corre, "Traité Clinique des Maladies des Pays Chauds."
[2] Bellew, "The History of Cholera in Egypt."
[3] Aitken, "The Science and Practice of Medicine."
[4] Macnamara, "A History of Asiatic Cholera."
[5] Hunter, "Report on Cholera in Egypt, 1883."

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, except when localizing causes and epidemic influence co-operate to develop an epidemic.

Cholera, then, occurs in the sporadic, endemic, or epidemic form; in the former it may appear anywhere; it is endemic in Bengal and other localities, whilst under certain conditions it rages from time to time over various parts of the world, like fever, plague, dengue, small-pox, and others, including the great epidemics of the Middle Ages, some of which are now all but, if not quite, extinct.

The term epidemic influence is, I fear, but an expression of ignorance; we understand it to mean those causes external to the individual or the locality, whether of atmospheric or telluric origin, by which disease is diffused generally. Dunglison called it the epidemic constitution; Chevers says he believes "that the essentials to its occurrence (*i.e.*, epidemic cholera) are an atmospheric or telluric condition due, it may be, to some undetected abnormality in the air or in the earth—electric, volcanic, or other—or to the presence of some undetected microzyme or germ which predisposes those who are within the area of its occupation to cholera.[1]

Leon 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 epidemics, compelling, directing, extinguishing them."

[1] Chevers, "Cholera Asiatica Maligna."

Dr. Lawson speaks of pandemic waves in relation to the operation of this influence over the earth's surface in certain directions of a definite character, these directions being northwards. From further observation he concludes that the character of the waves is telluric (magnetic) rather than aërial; that they correspond for fever and cholera with this difference, that the minimum curve of one coincides with the maximum of the other.[1] He further remarks, "It may be said we do not know the intricate nature of gravitation, but we recognize its existence, and have become acquainted with the conditions under which it operates."[2] So it is with regard to epidemic influence.

Dr. Austin Flint says: "The morbific agents must be transported through the atmosphere or brought in some way from situations more or less distant. The causes of epidemic disease are migratory. In some instances they traverse almost every portion of the habitable globe. This is true of epidemic bronchitis or influenza, as of epidemic cholera. It is altogether improbable that the special causes in these and other epidemics originate in the different sections of country over which their prevalence extends."[3] Dr. Flint clearly thinks that the epidemic influence is an entity of some minutely particulate form, though he does not say what.

Aitken says: "There must be some distempered condition of the circumstances around us—some secret power that is operating injuriously upon our system

[1] Lawson, "Pandemic Waves."

[2] Lawson, "The Sanitary Lessons of Indian Epidemics:" *Medical Times and Gazette*, August 4, 1883.

[3] Flint, "Practice of Medicine."

—and to this we give the name of *epidemic influence or constitution*, which is believed to predispose towards the receptivity of specific disease poisons."[1]

These definitions, however, help us but little. The fact is we do not know the real nature of epidemic influence; we only know that there is a potent factor in the diffusion of disease, whether it be a dynamic agency, an altered constitution of the atmosphere, or a widely diffused miasm of particulate form spreading far and wide over the earth's surface, as did the volcanic dust from Kratakoa, which but recently girdled the earth. It may depend on certain states of the atmosphere, deficiency or excess of electrical or magnetic tension, different degrees of moisture, of ozone, or other modification of its physical properties; something propagated in aërial or telluric currents, recurring at intervals, co-operating with local and personal causes, and conferring on the disease its quality of epidemicity; in some cases, perhaps, not only acting as the propagating agent, but as the cause itself.

Mr. Glaisher took the first steps in bringing to notice meteorology in its relation to epidemics, by his observations during three cholera epidemics in this country. This department of science is progressing, and data are likely to be furnished by well-organized meteorological establishments both at home and in India. We know but little, after all, of what goes on around us, or of effects produced by modifications of cosmical conditions. Whatever this influence may be, epidemic prevalence does not take place without it. This is so not only in regard to cholera, influenza, dengue, and other fevers, where contagion may be

[1] Aitken, "The Science and Practice of Medicine."

questionable, but in the most contagious diseases, such as small-pox and scarlatina, for it is tolerably certain that, whatever part contagion may play in etiology, it is of small importance relatively in diffusing disease.

Variation in the atmospheric pressure or moisture, extraordinary stillness of the atmosphere, deficiency in the tension of positive electricity, absence of ozone, fogs, blights, and low forms of life in the air, have all been regarded as predisposing causes. Attention has been called more than once to the disappearance of birds from cholera-affected districts at the outset of an outbreak. The dreadful visitation of cholera at Kurrachee in 1846 was preceded by days of intense stagnation of atmosphere, and other outbreaks have been preceded or attended by similar phenomena.

It is believed by some that local causes, in addition to certain atmospheric conditions, may determine autogenetic changes in the body which engender disease, and that the existence of a specific primary cause is not always necessary. The general opinion, however, is that an external primary cause, a distinct entity is required; in the case of cholera this is the so-called germ, said to be capable, under favouring conditions, of multiplying to any extent. The advocates of this theory have been energetic in their researches for it among micro-organisms, and have thought that they discovered it in a bacillus. A singular expression of this creed, therapeutically, was witnessed recently in Spain in inoculation for the prevention of cholera; the results, I believe, have not been satisfactory.

There are certain erroneous notions about cholera;

e.g., one gives that name to the disease in its fully developed condition alone; but the fact is, that it presents many phases, varing in gravity from simple malaise to collapse, and the coma of the worst forms of fever. Sporadic cholera, or cholera nostras, as it is called, when it occurs in this country, is regarded as a different disease from Asiatic cholera, or cholera maligna; but the cholera of our country is undistinguishable at certain stages from that of India. I believe that the difference in intensity or epidemic prevalence depends on climate, locality, and the unknown conditions already alluded to. I saw as malignant a case of Algide cholera in the Lambeth Infirmary three years ago, as I have ever seen in Calcutta.

On July 31, 1884, at the Lambeth Infirmary, I saw a case of cholera with Dr. Lloyd. The man had been an English soldier, formerly in India, æt. thirty-four, well built, but rather slight, an inmate of the workhouse. He was attacked, on the night of the 29th of July, with vomiting and purging. He had not been away from the workhouse, and the task-master said he had done nothing, nor could he have eaten anything unusual. I found him at 1 P.M., on the 31st, with husky voice, leaden hue of face and hands, corrugated fingers, cramps in the legs, sighing, eyes half opened, dull, all the symptoms of collapse of cholera, tongue coated and cold, body cold and clammy, temperature 96°; no urine since admission on the 30th, when he was vomiting and purging frequently; stools were rice-water with flakes; some of the vomit had been kept—it was clear like rice-water, with a sediment like bran. The pulse was faint and quick, the skin not so cold, it is said, as it had been,

and the vomiting and purging had ceased for some hours; there was great thirst. Dr. Lloyd's notes of the case are given in a note. No better marked case of cholera than this one could have been seen in Calcutta.

On July 29, 1884, William Jackson, æt. thirty-five, a porter, who had been an inmate of the Lambeth Workhouse for six weeks previously, and had not gone out of the building during that period, was seized about 3 A.M. with vomiting and purging, accompanied with severe cramp in the legs and abdomen.

About 7.30 was transferred to the adjacent infirmary, and I found him in a state of collapse: surface very cold and clammy, skin over chest and legs blue, voice (naturally strong) reduced to a whisper, pulse almost imperceptible and very rapid, face pinched, skin over hands wrinkled, and complaining of cramps in abdomen and legs, and intense thirst; feels sick, tongue and breath cold. Temperature 97.

Has been purged about three times within an hour after admission, and about 6 P.M. vomited twice a quantity of dark fluid; no urine.

July 30, 10 A.M.—Vomited twice during the night, no purging. Temperature 97.4.

6 P.M.—Has vomited several times, purged frequently, very offensive stools, with light-coloured flakes; great thirst and restlessness. Temperature 97.6. No urine.

July 31, 10 A.M.—Quiet night, no vomiting or purging. Temperature 96; no urine passed, thirst not quite so intense.

6 P.M.—Profuse sweating, delirium, no vomiting, purging, or urine. Temperature 96.7.

August 1, 7 A.M.—No purging, vomiting, or urine. Temperature 97.6.

9 A.M.—Temperature 98, thirst not so intense; sudden change took place about 4 P.M., and death ensued at 6 P.M.

The treatment consisted in giving small pieces of ice to suck, and the administration of warm milk and brandy, and an aromatic mixture with opium to soothe the pain.

Post-mortem, August 4, 1884.

Previous History.—The patient had been an inmate of the Lambeth Workhouse since June 24, 1884, and had not left the building even for an hour during that time. He occupied a ward, in which the other occupants had also been for over a month, and the closest examination failed to detect any of them having been anywhere near the docks, or any possible source of infection. He had been a soldier, and had served in India, where he had suffered from dysentery, but

since his return to England, several years ago, had enjoyed good health, and whilst in the workhouse had never required medical treatment, or in any way come under the notice of the medical officer.

Subsequent History.—Two other cases of severe diarrhœa, terminating favourably, broke out in the workhouse, but not from the ward where the deceased came from, and for some time before and after this case of cholera, there appeared to be what usually arises every summer: a number of cases of ordinary diarrhœa, which are successfully treated without removal to the infirmary.

"There is no such thing," says Dr. Hutchinson, of the Bengal Medical Service, "as Asiatic cholera, if we mean by Asiatic that the disease is prevalent in India alone, or any given part of the eastern continent. British cholera, Asiatic cholera, Damietta cholera are all essentially the same disease, though, it may be, differing in degree and virulence;" and he remarks that cases of cholera appear every year in England in the Registrar-General's returns, which under conditions which appear from time to time would produce an epidemic, as is the case, only more frequently and with more activity, in India, China, Egypt, and elsewhere.

Hutchinson also says that the law under which cholera originates, disseminates, and declines is as rigid as any known law, and shows that, in 105 outbreaks among European troops in India and in gaols, it was found that the percentage of deaths, which had reached eighty per cent. in the first fourteen days, rapidly diminished. He further remarks that, "while three to five days represent the period of incubation of a typical invading cholera, fourteen days mark the limit of an advance of a typical epidemic. This is true of epidemic cholera wherever it appears, whether in Europe or Asia, whether in a city,

amongst troops, or in a jail,"[1] and adds that the period of incubation with regard to individuals is forty-eight hours, deduced from certain well-known cases; but this, I think, is not to be relied on; it may be longer or shorter.

The suddenness and virulence of certain outbreaks are remarkable, and point to some factor apart from contagion or local insanitary conditions. I append the case of Kurrachee, and one or two others that illustrate this :—

"At Kurrachee, in 1846, on Sunday evening, June 14, 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 297 cases were admitted, of which 186 died, many with frightful rapidity; after that date it gradually declined, 814 cases and 442 deaths having occurred between the 15th and 18th inclusive.[2]

"While proceeding up the China Sea, in one of the late East India Company's ships, we were suddenly attacked by cholera, men falling on deck as if struck by lightning. This continued for three days, when the visitation as suddenly ceased. As we were then using the same water that we had been drinking for three months previously, and from the time of leaving England, there could have been no contamination of the water in this instance, independently of the fact that it was contained in tanks into which extraneous matter could not possibly have entered.

[1] Hutchinson, "Cholera, its Cause and Mode of Dissemination."

[2] Bryden, "Cholera in the Bengal Presidency from 1817 to 1872."

A precisely similar outbreak occurred on board H.M.S. *Undaunted*, while proceeding down the China Sea. As the cases continued to increase, the surgeon at the end of three days recommended the captain to change the course of the vessel. This was no sooner done than the attacks ceased; not a case occurred afterwards."[1]

Fabre and Chailan relate the following:—"The first case of cholera took place at Aix on June 19, 1835; the second case did not occur till July 15. The 16th and the 12th regiments of the line, numbering 536 men, who occupied the Italian barracks, returned from their exercise at half-past seven in the morning. The soldiers at once went into the various rooms, opened the windows, took off their coats. A gust of burning wind having suddenly penetrated into the barracks, many of these men fell on to their beds as if asphyxiated. The colonel and lieutenant-colonel, acting on the advice of the surgeon-major, mounted to the second floor, and felt themselves the influence which was having such an effect on the soldiers; one of these superior officers died from cholera within twenty-four hours; the other and the surgeon-major were very ill for several days. On this very morning twenty-one men of the twelfth regiment of the line were taken to the hospital, and ten others in the after-part of the day. Fourteen died in the first twenty-four hours."[2]

"On June 20, 1845, Dr. Darby wrote from Cawnpore to the Medical Board of Bengal, that during the four preceding days the station had been

[1] Parkin, "Are Epidemics Contagious?"

[2] *Journal d'Hygiène*, November 3 and 17, 1887.

struck by cholera in its most malignant form. Amongst 2,212 Europeans, there were ninety-four cases and sixty-four deaths, whilst among 16,000 natives there were only ten deaths. This epidemic only raged some days and disappeared completely."[1]

"In 1854 in London, in the district of Savoy, there were in a few days 537 deaths from cholera; the suddenness of the outbreak was very remarkable. The greatest local diffusion seems to have been reached on the second day, if not on the first. During two days it prevailed with the same intensity, and in the two following days it showed a diminution of fifty per cent." (Dr. Snow).[2]

The suddenness of an outbreak may be followed by an equally rapid decline, and the remarkable alternations, whether for better or worse, caused by changes of weather, fall of rain, depression of temperature, thunderstorms, and gales of wind are very suggestive of the influence exerted by meteorology on its progress. Sudden outbreak followed by rapid decline was well illustrated when cholera attacked our troops and ships in the Crimea. It often occurs in India. Let me give you examples, one from my own experience.

After its arrival in the Levant, the French army had suffered a great deal of sickness, but the British army had been comparatively free up to the 19th of July, when cholera appeared among our regiments in Bulgaria, and by August 19 had killed 532 men. Before appearing in our army it had attacked French ships of war in the Mediterranean and their army in

[1] Bryden, "Cholera in the Bengal Presidency from 1817 to 1872."
[2] *Journal d'Hygiène, loc. cit.*

Bulgaria, making great ravages among the three divisions marched into the Dobrudja and in the ships. In a day's march, sometimes within the space of a few hours, hundreds of men dropped down in the sudden agonies of cholera; out of these three divisions no less than 10,000 lay dead or struck down by sickness.

The disease appeared in the British fleet, and on the 11th and 12th of August the admirals put out from their anchorage, hoping thus to arrest its progress. It nevertheless raged with a violence rare in Europe; the *Britannia* alone lost 105 men, and the number of sick was so great as to render the usual duties impracticable. "The waywardness of the disease on board the British ships was extraordinary; it spared the officers, who, partly by kindness and sympathy, partly by remedies, seemed often able to fight the disease, or make the men think they did so."

Almost suddenly the cholera ceased on board ship, the survivors returned to their duties, all mention of the terrible tragedy was dropped, and in a few days from the time when cholera had been at its height the crews were ready to embark the troops and land them in the Crimea.[1]

The Adjutant-General had been seized by cholera on Thursday, the 21st of June; he lay in a critical state, though the medical officer entertained strong hope that the remedies would bring on the reaction desired. "Then (on Saturday), however, there broke from a summer sky, not observed to be angered before, the extraordinary thunderstorm of the 23rd of June,

[1] Kinglake, "Invasion of the Crimea," vol. viii.

carrying with it great torrents of rain; and the swift atmospheric change implied by an outburst so violent extinguished at once every hope of bringing about a reaction." Estcourt died the next morning.[1]

In 1851 I was ordered to Dacca to take medical charge of the 74th Native Infantry, which was suffering from fever. I found the regiment—all except two companies, which were away on detachment—prostrated. The regimental and other extempore hospitals were full, and there were not enough men left to carry on the routine duties of the station. The fever was malarial, intermittent, remittent, and typhoid. In a short time I was directed to embark all, invalids and convalescents, on board a fleet of native boats, and take them up the river for change of air. I do not remember the exact numbers, but there could not have been less than from 400 to 500 men. The boats were decked with bamboo and covered with thatch, and held from fifteen to twenty men each, and there were thirty to forty of them. Our orders were to move up the stream a few miles every day, and make fast to the bank at night. Our mode of progress when there was no wind was that of tracking. There was no cholera in the regiment or in the station, that I know of, when we started. The men were prostrated with fever, many still suffering from it, and some had splenic or other visceral complications.

We got on well for three or four days. It was the cold season; the change appeared to be doing good, and some of the men seemed to brighten up, but none of them liked the move. We made fast to the

[1] Kinglake, "Invasion of the Crimea," vol. viii.

banks every night, when the men who were able to do so landed to cook their food; they were chiefly Hindoos of high caste. The river flowed through a flat alluvial country; the banks, which were but a few feet above the river, were of sand, and the land beyond was covered with light vegetation. There were no inhabitants near at hand, and I do not remember seeing any but an occasional villager, except a few who passed connected with other boats.

We had been out a few days, moving daily up the river, when one morning it was reported that a boatman had died of cholera very rapidly in the night. That day more cases occurred, the sepoys became affected, and cholera at once invaded the whole fleet with great virulence. It was most distressing to see the poor creatures in the last tortures of cramp, vomiting and purging. We did all we could, but it was of little avail. We moved on daily, as our orders to do so were stringent, but nevertheless the disease continued. We were in the open country, on a magnificent river; the weather was fine, the temperature pleasant, and, but for our floating plague-boats, all looked bright and cheerful. The men were in agonies of despair, and entreated to be taken back to head-quarters, as this, they said, was killing them. Each day produced its fresh list of cases and deaths; these soon became so numerous that the bodies were committed to the river without ceremony. It was remarkable how the days differed; on some the disease appeared to be aggravated, those who were ill got rapidly worse and died, and more fresh cases occurred, often fatal

in a few hours; whilst on others the very reverse would take place.

I repeatedly urged the officer in command to return, but he could not do so without orders. After some days, when it appeared that we were going to lose all our men, we held a council and determined to return. We did so, and, be the explanation what it may, the disease ceased, and by the time we got back to Dacca it had disappeared. A large proportion of those we brought back had to be invalided. I may add that I made careful inquiry day by day if cholera had occurred anywhere in our proximity, but heard of none. It was not a cholera season. I had discussed this aspect of the question and a possible outbreak with the P.M.O. before we started.

There is room for speculation as regards the causation of the sudden outbreak of the disease, its varying intensity on different days under apparently similar circumstances, and its rapid decline and cessation as we returned. The landing in the evening and lying by the bank all night were indicated as being mainly concerned, but this was done by other boats, and we heard of no cholera in them. The state of health of the men—all suffering from malarial fever—must be borne in mind, and the question of this as a cause may fairly be entertained. The country we passed through was open and healthy; the food and water were such as Hindoos approve, and I may say the disease was not confined to the Hindoos, for there were Mahomedans among the sepoys as well as among the boatmen. However, it is not with the view of offering any explanation of the etiology of

this outbreak that I have detailed it, but merely as an example of the varying phenomena which may be met with in a cholera outbreak, and the rapidity with which it may cease.

The following is an example of the benefit of change of locality in an outbreak of cholera. In 1855 H.M. 52nd Foot were stationed at Lucknow, in a set of large buildings which had formerly been used as the royal stables. A sudden and severe outbreak of cholera took place amongst them, which, causing great mortality, produced much depression amongst the men. A committee of medical officers was assembled, which recommended immediate removal to camp outside the city on the Cawnpore Road. Notwithstanding the great heat and the consequent danger of sunstroke, of which there were indeed a few cases, the cholera entirely ceased and the regiment was restored to its original state of health.

Locality, apart from insanitary conditions, its position and physical characters are to be taken account of. Elevation has an influence, though less positive than relative, but cholera has occurred at Simla and other hill stations in India over 7000 ft. above the sea.

The nature of the soil and the geological characters of a district have probably something to say in the localization of cholera. Some have thought that it is less prevalent on sandy, porous ground, on granite, metamorphic, and trap rocks, on laterite and volcanic formations, and on the primary geological deposits, but the widespread distribution of the disease does not point to this as a very important factor. Cholera prevails in deltas, but that it may occur with great viru-

lence even in a desert we know from Indian experience, and Sir Thomas Seaton's account of his march across the desert of Pat in Sind, proves not only that it may occur, but suggests its relation to fever and insolation, a point I shall have to notice later.

On May 3, 1839, a convoy of over 4,000 camels, escorted by two troops of irregular cavalry, a wing of the 23rd Bombay Native Infantry, a wing of the 42nd Bengal Native Infantry, a company of one of the Shah's regiments, and a troop of irregular cavalry, started from Shikarpur to join the army in Afghanistan. There were also a number of convalescents and a multitude of camp followers. Their road lay across the desert of Pat in Sind, which begins thirty miles west of Shikarpur, and stretches to the foot of the Bolan Pass. They reached Rojhan on the borders of the desert on May 28, after encountering many difficulties. On May 29 they started across the desert, and from the very beginning suffered severely from want of water. Deaths occurred during the 31st, but it was not till the evening of that day that cholera appeared. They were obliged to make a détour to search for water, and the extra fatigue added much to the sufferings caused by absence of water, by the extreme heat, which rose in the tents to 119°, by the fierce desert wind and the myriads of flies. Their route was marked by scores of men ill and dying from fever, cholera, and sheer exhaustion. "Some of the sufferers were fast sinking from fever, and were delirious; others appeared to be just seized with cholera; many, exhausted by thirst and overcome with fatigue, were bitterly bewailing their sad fate." Cholera, fever, and sunstroke worked

great devastation, and on June 3 the desert wind began to blow with increased violence. "Some of the men sank at once as if struck by some poisonous air, others were brought in alive, but dying fast—quite shrivelled in appearance, as if the hot wind had dried up all the juices in the body." Officers, as well as men, suffered severely. "The scene in Major L——'s tent I shall never forget; it was appalling. B——, suffering all the agonies of cholera, was the colour of lead; H—— was raving; S—— and M——, both of them speechless and helpless from utter exhaustion, appeared likewise as if struck with cholera."

The march across the desert occupied between seven and eight days, and these sufferings continued the whole time, disease not beginning to diminish till they reached Baugh on the morning of June 6.[1]

The greatest intensity of cholera incidence is not always found to be in the most populous places. "It was among the wandering tribes of the desert of Arabia, and among the scattered population of the mountainous region of the Caucasus, that cholera, on its first invasion of these countries, prevailed in its greatest intensity, and committed its greatest ravages. In Arabia, a third of the inhabitants, according to Moreau de Jonnès, perished, while in the Caucasus 16,000, or two-thirds of the population, were attacked, and 10,000, or nearly half, died. During the outbreak of cholera in Jamaica in 1850, at Kingston with a population of 40,000, not more than a sixth, or sixteen per cent., of the inhabitants were cut off. But at Falmouth, a small town, the deaths amounted

[1] Major-General Sir T. Seaton, K.C.B., "From Cadet to Colonel."

to a third. In Port Maria, a still smaller town, two-thirds of the population, or 600 out of 900, perished. 'At first,' writes the Rev. T. Simpson, 'the epidemic was mild in its type, and yielded readily, in most cases, to the treatment of our medical men. But on the 1st of December it burst on the town like a flood, carrying off 400, nearly half the population, in the short space of ten days.' In the small towns and villages the mortality was much greater."[1]

Bryden says: "The geographical distribution of an invading cholera is purely a phenomenon of meteorological significance. Epidemic cholera is never in any case spread *over a definite geographical area* by human intercourse alone; nor can human agency cause the boundaries of a natural province which has been occupied by cholera to be transgressed, so that a cholera *epidemic from such a source* shall appear in the province immediately adjoining and become generally diffused among its inhabitants."[2]

Seasonal prevalence in India varies according to the district. Generally speaking, the minimum intensity is in the winter months, while the maximum varies, falling sometimes in the summer, sometimes in the spring. In the endemic area and Madras there are two maximums, in the former in the spring and winter months, in the latter in the summer and winter months. Outside India the maximum is generally in the autumn and winter months, and we have Pettenkofer's authority for stating that in Prussia the minimum is in March and April, the maximum in September, the rise from July being

[1] Parkin, "Are Epidemics Contagious?"
[2] Bryden, "A Report on the Cholera of 1866–68."

rather rapid. This question, as well as many others, such as the caprice of an epidemic shown by its passing over many places in an area attacked, and its varying intensity in different years, is as yet unexplained.

Statistics given by Dr. H. W. Bellew, C.S.I., in his "History of Cholera in India," show that a definite and fixed relation exists between cholera prevalence and seasonal distribution of rainfall and the condition of the soil which receives it; drought followed by irregular scanty rainfall, scanty falls followed by heavier ones, and *vice versa*, are all favourable to cholera prevalence; that intensity of rainfall phenomena and cholera activity have a marked tendency to run in three years' cycles, greatest intensity being in the first year, followed by gradual diminution; dear food or famine distress influences the severity of an epidemic. Statistics are given for the years 1862–81, and in each cycle cholera followed the course laid down—except in that of 1875–77, when, instead of abating, it increased: in each year of that cycle there was drought in the previous year, followed by excessive monsoon rains, aided by famine.[1]

The conditions of the subsoil water, its fluctuating level and its stagnation, are no doubt concerned in the development of cholera, as beyond a doubt they are in that of fever, of which it is a potent factor; for it is certain that a water-logged subsoil and undrained ground materially affect the public health and add to the mortality from fever, and probably also from cholera.

[1] W. H. Bellew, "History of Cholera in India."

With regard to epidemicity in the endemic area, Cuningham says:—"In all parts of the country there is a most marked difference between the results of different years. In some years the disease is in abeyance, in others it is epidemic, and between these extremes there are many gradations. Even in the endemic districts, the difference between an epidemic and a non-epidemic year is very striking. In Nuddea, for example, in 1871, only 528 deaths from cholera were registered; in 1882 the number was 11,020. In Backergunge, in 1871, the number was 291; in 1877 it was 19,177. Similar results are to be seen in the districts outside the endemic area." . . . . "It is not to be supposed from the above remarks that the periods of cholera abeyance and cholera prevalence occur simultaneously all over the country. The case is rather the reverse. In a year when one province is suffering another may be enjoying remarkable immunity. It does, however, usually happen that marked cholera abeyance or cholera prevalence is observable over large areas—areas which often include many districts. In some years, as notably in 1874, there was a marked abeyance of cholera over the greater part of India. In the endemic area, and in the districts lying around this area, cholera, as a rule, occurs rather in a larger number of individual cases here and there than in epidemic outbursts."[1]

Since 1877 records have been kept of the attendants on cholera patients in military and gaol hospitals throughout India. It is found that 5,696 cases occupied 10,599 attendants, and that only 201

[1] Cuningham, "Cholera—What can the State do to prevent it?"

of these were attacked, or 1.9 per cent. The same immunity of attendants is shown by the statistics of London hospitals in 1866; and in the General and Medical College Hospitals of Calcutta, where cholera cases are admitted indiscriminately with others, the disease has never spread; but this, indeed, has been the experience in India generally.

With regard to the spread of cholera, theories of contagion and diffusion by human intercourse do not explain the movements of epidemics, for the history of the last fifty years shows that, though means of communication have greatly multiplied in India, as everywhere else, epidemics have neither increased in frequency, progressed more rapidly, nor altered as to their general direction. In fact, of places that lie on the main line of traffic, some suffer least, while others, more inaccessible, suffer most.[1]

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 on the spot have died in all directions whither they have travelled, 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 im-

[1] Cuningham, "Cholera—What can the State do to prevent it?"

ported 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 facts.

It is certain that the most frequented routes of human traffic or the most direct lines of intercourse are not always marked by frequency or intensity of cholera, and it seems especially remarkable, if cholera be spread by human intercourse, that since the opening of the Red Sea route in 1842, and the Suez Canal in 1869, the disease should not have been conveyed to Europe by the stream of vessels which are daily sailing from Calcutta and other cholera localities.

Cholera seems to have an affinity for certain districts—even streets and houses. I remember several houses, or groups of houses, in Calcutta, which were known to be liable to suffer from cholera, and it is so still in a marked degree, as shown by the last report of Dr. Simpson, the very able health officer of Calcutta. One side of a street may suffer, while another escapes; a small stream may divide a cholera affected district from one perfectly free. It is worthy of notice, also, that certain trades, such as the tanner's, are said to confer a prophylactic influence.

During epidemic prevalence cholera never attacks all the places in the area over which it is diffused, 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,[1]

[1] Cuningham, "Cholera—What can the State do to prevent it?"

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.

The apparent caprice and fluctuation of a cholera epidemic are shown by the following extract 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."

The following table shows how cholera varies in its incidence from year to year, and relates to the time when I was with the Prince of Wales in India:—

	Cholera Deaths.		
	1875.		1874.
Bengal Proper and Assam . . .	116,606	...	73,354
North-West Provinces . . .	41,106	...	6,396
Oudh	23,321	...	68
Punjab	6,246	...	78
Central Provinces	14,643	...	14
Berar	22,465	...	2
British Burmah	761	...	960
Madras and Mysore	97,051	...	313
Bombay	47,573	...	37
Rajpootana, Hyderabad, and Central India	14,649	...	4

These variations in intensity occur everywhere in

India, and can hardly be explained by the theory of contagion; we know this much, however, that bad sanitation, especially impure water, invites cholera and increases its severity, while a good sanitary state tends to prevent it, or to lessen the intensity of the epidemic. This was shown in the case of Spain in 1885, where the great cholera outbreak was undoubtedly connected with sanitary negligence.

Etiology.—There is much in the symptoms and general conditions of cholera to support the view which has been advanced by several observers, that it is only another form of fever, and that it owes its origin to analogous causes. Certainly fever and cholera frequently prevail at the same time, and have so much in common that it is difficult to differentiate between them, especially during epidemic prevalence.

In an outbreak at Umritsar, in 1881, Dr. Ross says:—"Fever in the city did not appear in an epidemic form until September. It was preceded by cholera early in August of an extremely fatal type. This later on, when masked by fever, was difficult to recognize." Of another outbreak he says:—"In Kohat, in 1869, an outbreak of fever very similar to the Umritsar epidemic, followed by cholera, occurred. It was then observed that it was often impossible to differentiate them."

Dr. Chevers expresses similar views, and refers to a series of illustrative cases which show how closely cholera and malarial fever are etiologically allied. Some, indeed, extend the community of origin to other diseases, such as insolation, dysentery, influenza.

The following is a remarkable instance of the community of origin, if not identity of cause which occurred under my own observation during the Burmese war in 1852. A party of European troops had been encamped for certain strategic purposes on some ground which had been recently cleared of dense jungle. They were rapidly attacked by fever and dysentery of the worst type, and, I believe, by cholera too. Many cases of fever and dysentery were sent to the Field Hospital at Rangoon under my charge. The fevers were remittent, of the most fatal type. The dysentery was equally fatal, the symptoms most severe, rapidly passing into a state of collapse, and after death the large intestine found to be gangrenous almost from end to end. There were other cases of less severity, but the intensity of the morbific agency, and its power of inducing different pathological conditions, was well illustrated in the cases referred to.

The sweating sickness of Mahwar, described by Dr. Murray in 1840, was probably only another manifestation of pathological conditions originating in the same cause to which cholera may be referred, and abundant illustration of this might be advanced did time permit. The different forms in which the morbific agency, whatever it be, manifests itself are the result presumably of an evolutionary process determined by constitutional predisposition and on certain conditions of the surroundings, of which we know but little.

The type of cholera varies considerably in different epidemics; vomiting, purging, cramps, early and late appearance of collapse, consecutive fever,

&c., present great difference in the modes in which they occur; whilst the fatality, also, of some epidemics is much less than that of others; there can be little doubt that these characters of an outbreak are influenced by meteorological and local causes.

Aitken says:—"It is desirable if possible to get rid of the term *cause* as applicable to any particular disease. . . . . There is no disease I know of which acknowledges any single cause." But rather, says he, "ought it to be our business to find out the many and ever-varying factors or conditions which as antecedents combine to produce disease, and, while we must acknowledge the influence of many agents in aiding and abetting these factors, we must mainly look to the physiological agencies within our own bodies during life as competent to bring about many forms of disease;"[1] and this may be applied to the question of the causation of cholera.

Chevers says: "The discovery of the cause of cholera will probably never be vouchsafed to a man of narrow and one-sided views. I believe that nothing valid will be revealed to us, unless we grasp and correlate all facts."[2] We may not know the cause, but it is assumed by some that, though we have never seen it, there is a specific organic germ, which, being introduced from without, gives rise to the disease. I venture to think that even this is not yet proved.

Chevers says: "I have never seen or heard anything which, upon close investigation, shakes my firm impression that a specific poison is not contained in the stools."[2]

[1] Aitken, "Animal Alkaloids."
[2] Chevers, "Cholera Asiatica Maligna."

There are several theories of the causation of cholera; briefly they are as follows:—

That it is due to a miasmatic poison, which, being absorbed by the lungs or alimentary canal, produces a primary disease of the blood, where it is rapidly multiplied, and causes disturbance of vital functions; that the diffusion of the disease is effected by human agency, the specific poison being carried by the persons and effects of those who have been exposed to it.

That it is due to a specific poison or germ which passes from the bowels of one person to those of another, chiefly by water, the poison being contained in the dejecta.

A modification of this theory assumes that to produce cholera the organic 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. Oxidization, acids, and certain degrees of temperature, it is inferred, can render it harmless.

According to Pettenkofer, a germ is developed in a damp porous soil with fluctuating subsoil water level, impregnated with organic matter—it is, in short, earth-born. The germ must remain in the soil some time and ferment before it acquires poisonous characters; it then rises into the air as a miasm, and thence effects entry into the body by means of air, food, or water. The germs, further developed and multiplied, are again expelled. In considering the effects of traffic on the transmission of cholera, he says: "The dejecta are not the only means of spreading cholera, and possibly in that way they are harmless." The conditions above stated, combined

with personal susceptibility, must concur for the production of an epidemic.

In 1883, Professor Koch, after investigating cholera in Egypt and later in India, discovered a bacillus in the alvine discharges of cholera patients, which was announced to be the germ which caused the disease. The doctrine of contagion received thereby an impulse by which the dread of it became enhanced, and southern Europe for a time was almost demoralized by fear, whilst the old measures of coercion and quarantine threatened to be reimposed with greater severity than ever.

In May 1884, the Secretary of State for India, at my instance, despatched a commission (Drs. Klein and Gibbs) to investigate the subject in India. In March 1885 they submitted their report, and a committee of physicians and pathologists was convened to consider it. The following conclusion was arrived at:—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, after a long and careful microscopic study of the disease in India.

Aitken, in his work on "Evolution in its Application to Pathology," remarks:—"Perhaps the brilliant success which has been achieved by the recent studies of disease-producing organisms or other materials acting on us from without—a success not equalled in any other field of medical inquiry—has made some think too little of those changes within ourselves,

which occur in such ordinary conditions of life that they may be called spontaneous ; yet these are not less important in the production of diseases, and must be studied, just as in agriculture, soil must be studied as well as the seeds."[1] I venture to think the above suggests the danger of too hasty generalization, and of reasoning on insufficient data.

Whilst fully recognizing the great value of these bacteriological researches and their bearing upon etiology, the full importance of which cannot yet be estimated, I demur to a microbe being accepted as the solution of such a problem as the cause of cholera.

Dr. Bryden, whose unrivalled opportunities of studying cholera in the most exhaustive manner give great weight to his opinion, maintained that cholera is due to a miasm, and has a perennial abode in certain areas of India, and in other districts is renewed by invasion from these areas. That the cholera germ or miasm is earth-born and aërially conveyed, and that the disease has no power of continuous manifestation throughout the year. He thought it could be transmitted by fomites, but that the aggregate of cases so transmitted would not produce an epidemic. He thought the presence of the cholera miasm, a humid atmosphere, and certain prevailing winds essential to the production of an epidemic, and that its duration bears some relation to the humidity of the locality. Reappearance after invasion and outbreaks are governed by the same laws as invasion.

Another theory assigns to cholera a cause inde-

[1] Aitken, "Evolution in its Application to Pathology."

pendent of a specific germ. Dr. E. Goodeve says: "May it not be a mistake to consider this 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 hither, and it is only when it meets with the other peculiar substance that the poison is generated or the effect produced."[1]

For my own part I am unable to convince myself that any of these theories satisfactorily or conclusively explain all the phenomena exhibited by a cholera epidemic, or that one view can be accepted to the absolute exclusion of all others, for there is much to support each. Whether this ultimate cause be a bacillus, a chemical molecule, or the outcome of forces surrounding us, of external influences acting on cerebro-spinal centres and producing certain perturbations of physiological processes, or perhaps developing an autogenetic poison, is a question still demanding solution, and I agree with Chevers that the cause will probably not be revealed to any one who searches with narrowed views. There is a great tendency in these days to trace all disease to a specific exterior cause, but we must not lose sight of

[1] Reynolds, "System of Medicine." Article on Cholera, by E. Goodeve.

the possibility of poisons autogenetically developed, with which the researches of Gautier, Peter, Brown, Lauder Brunton, and others are making us familiar, or of altered conditions of innervation, deranged natural physiological processes of vaso-motor action caused by forces acting from without, giving rise to disease. The primary cause, *i.e.*, the factor or group of factors which cause cholera, is still unknown, but so much, however, has been learnt of its habits, that in Europe and India we have come to know that action based on any theory of contagion is as useless as it is unprofitable. As to the local conditions which foster and develop, if they do not cause cholera, the most potent and protective safeguards against them are cleanliness, pure air, pure water, good food, clothing, lodging, and healthy conditions of living ; and with reference to water, as Dr. Simpson of Calcutta remarks, "A study of the distribution, progress, and seasonal changes indicates that the chief factor is a want of pure water." [1]

Happily, however much we in England and India may happen to differ as to certain points in the etiology, we are in accord as to the principles on which preventive sanitary measures should be conducted. As regards coercive measures, such as cordons and quarantine, they are rejected as useless, bringing many evils without preventing the spread of disease.

We have been charged by other nations with maintaining these views in accordance with the commercial interests of our country, but on what grounds it is difficult to understand, for, as Chevers says,

[1] W. J. Simpson, M.D. (Aberd.), D.P.H., Camb., "The Progress and Distribution of Cholera Mortality in Calcutta."

"Being quite unaware what that interest is, save that it appears to me that if I were a Bristol merchant it would not be to my interest to see that port impested with cholera. . . . . I remain absolutely unconvinced of the protective efficiency of sanitary cordons and quarantine in cutting off the approach of that which does not travel, and in arresting the propagation of that which is never propagated."[1]

The belief in transmission by human intercourse is still firmly held by the highest authorities; few consider that there is danger from mere contact or personal communication, but that the danger lies in the transmission of the germ through water or other channel from the bowel of one person to that of another; hence they properly insist on what others equally admit—the importance of the purity of drinking water; who do so not because it contains a germ, but because impurity tends to develop the pathological conditions which result in cholera. For my part I am unable to accept the water theory as a sufficient explanation of all cholera outbreaks, especially in those which occur where the water is beyond suspicion of cholera contamination, and my agnosticism leads me to seek the explanation in causes of a wider and more general character, though I desire to speak as one who is still waiting for further information, and who, though strongly impressed with the incommunicability of cholera by the ordinary modes of contagion, is still not prepared to assert dogmatically that under certain conditions it may not become communicable by some miasm engendered in localities such as quarantine lazarettes, where disease

[1] Chevers, "Cholera Asiatica Maligna."

is intensified by crowding. I hold, moreover, that until contagion in any form be entirely disproved, authorities are justified in adopting measures which, like those in force in our own country, whilst avoiding all oppressive or coercive interference with personal liberty, take reasonable precautions against possible sources of infection and give full effect to all known practical measures against the importation or diffusion of disease.

Coercive Measures and their Results.—The evil results of the contagion theory, as interpreted in other countries, have been shown, not only in the rigours and hardships of quarantine, whereby great suffering and incalculable damage to commercial interests have been effected, but in the general panic and demoralization which have degraded and deranged society generally.

The state of Southern Europe during the recent cholera was pitiable, and the measures for fumigation, isolation, and interference with personal liberty would have been ridiculous had they not been so mischievous. The following notice, extracted from a daily paper of the 27th of August 1887 (*Scottish News*), reminds one of the state of feeling in the Middle Ages, when the Jews were victimized as the supposed originators of the plague :—

"*The Cholera in Sicily—Sanguinary Scenes.*—A letter from Palermo, published in Vienna, reveals a startling state of things in Sicily, consequent upon the reappearance of the cholera. The ignorant population attribute the outbreak of the terrible epidemic to the evil disposition of the Government. Assassination, incendiarism, and sanguinary encounters with

the gendarmes and troops are reported from different parts of the island. The measures taken by the authorities since the last visitation of cholera, such as the disinfection of certain villages, suppressing unwholesome wells, and reinforcing the medical staffs, have been misconstrued and taken by the people as a sure indication that the Government wanted to send them the disease. Special precautions were taken at certain places, and shortly afterwards a case of cholera occurred at one of them, the patient being transferred to the cholera hospital recently erected. The same night a band of villagers armed to the teeth set fire to the building, and murdered the sick man, whom they accused of being paid by the Government to spread the malady amongst them. They then repaired to the high road, and, taking up a position behind the bushes on either side, they there awaited the arrival of the gendarmes, whom the mayor had sent for when the first alarm reached him. When the gendarmes came up with the miscreants they were greeted by a deadly fusillade that cost the life of their brigadier. The aggressors fled to the neighbouring woods, where they were attacked the next day by the troops. Half of them were shot and the others taken prisoners, but not before many soldiers had fallen. At Leonforte the armed inhabitants had a formal encounter with the carabineers. Dispersed after a savage combat, the bulk of them fled to the monastery of San Vincenzo, where they barricaded themselves and underwent a regular siege. The carabineers, reinforced by infantry, burst open the doors, and forced their way into the monastery. After a desperate resistance the besieged were over-

powered, and the survivors were marched off to prison under a strong escort. A state of siege has been proclaimed in the town. Similar events have taken place at Caltagirone. Seventy-eight peasants have been arrested at Catania. The island seems to be in a complete state of revolution."

A similar feeling exists in other parts of the world. Take the following absurd instance from the *Times* of the 22nd of January 1886: "Two Japanese sailors died from cholera during the short journey from Kobe to Nagasaki. Their bodies were thrown overboard. The Japanese authorities immediately forbade fishing all along the coast.—*Sanitary Record.*"

It is satisfactory to know that a modification of coercive measures has taken place in Southern Europe during the recent manifestations of cholera. Whether this be the result of the conviction, forced upon the people by events, of the futility of such proceedings, or whether it may be in some measure the result of the emphatic declarations made against quarantine by the British and Indian delegates at the Roman Conference, I cannot say; but we hail even this much as an augury of better things to come, and regard it as an indication that methods worthy of the dark ages will be discarded as they have been in Britain and India—I wish I could say in our colonies!

In Britain we have the moderate but more effective system of prevention laid down by our Local Board. In India, where a sanitary service has been organized for more than a quarter of a century, the policy of the Government, taught by experience, rejects all theories of causation and propagation as a basis for sanitary work, for they have learnt that any attempt

to carry the doctrine of contagion into practice has no good results, but is productive of harm, for it involves oppression, and aggravates the evils it is intended to prevent. Coercive measures have been discarded, reliance being placed on sanitary measures alone, and the results seem to be satisfactory, judging from the following statistics, which are taken from the 21st and 22nd Annual Reports of the Sanitary Commissioner with the Government of India :—

DEATH-RATE PER 1,000 FROM CHOLERA.

British Army :—	1860–69.	1870–79.	1880–83.	1884.	1885.
Bengal . . .	9.24	4.18	2.49	1.34	1.17
Madras . . .	2.56	1.68	0.90	0.93	0.19
Bombay . .	4.80	1.53	0.45	4.85	6.92
	1859–67.	1868–76.	1877–83.	1884.	1885.
Gaol population .	10.67	3.28	3.61	1.43	3.44

The mortality of cholera is high when it has reached the condition of collapse, or consecutive fever. At the outset of an epidemic probably half or more than half of those affected die. The fatality decreases as time goes on, and this has led the inexperienced to think that they have found some more effective mode of treatment than hitherto known. This diminution in intensity and fatality as an epidemic progresses is not peculiar to cholera epidemics ; it occurs in others, and was observed by Defoe in regard to the plague in London, during the seventeenth century. In an outbreak of cholera at Kurrachee, of the first 100 admitted 79 died ; of the second, 66 ; of the third, 50 ; of the fourth, 40 ; at a later period the mortality diminished and the cases were less severe.

The following tables show the mortality from cholera in India during a series of years, and it will

be seen that it is a trifle compared with that of fevers:—

MORTALITY FROM CHOLERA IN INDIA.[1 2]

(Including Army and Gaol population.)

Year.	Total Mortality.	Rate per 1000.
1876	486,704	2.470
1877	637,096	3.490
1878	319,503	1.704
1879	271,094	1.450
1880	119,182	.630
1881	162,290	.850
1882	351,422	1.760
1883	249,248	1.240
1884	287,926	1.450
1885	386,546	1.950

MORTALITY AMONG THE GENERAL POPULATION IN INDIA.[2]

Year.	Rate per 1000.			
	Fevers.	Bowel Complaints.	Cholera.	Small-pox.
1876	11.49	1.520	2.470	.530
1877	13.85	2.150	3.490	1.009
1878	17.35	2.220	1.703	1.640
1879	19.04	1.350	1.430	1.040
1880	14.68	1.250	.630	.370
1881	16.83	1.370	.850	.390
1882	15.75	1.410	1.760	.420
1883	14.37	1.306	1.240	1.160
1884	16.72	1.390	1.450	1.680
1885	17.18	1.480	1.950	.408

It may be well here to refer to cholera on board ship. It has frequently broken out in vessels in the harbours of affected ports, but has disappeared soon after the ship has gone to sea; in passenger, emigrant, and troop ships it makes its appearance from time to time, within certain periods after leaving the

[1] Excluding Calcutta.

[2] Reports of the Sanitary Commissioner with the Government of India.

port—varying from two or three days to as many weeks. But, as the people on board have been exposed to the influence of cholera before they left, we may 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 attacked the crew also, it is to be remembered that the ship started from a country in which the epidemic influence was present, though not ostensibly so in the port of embarkation.

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 cholerized before they left the country, and that insanitary local causes on board the ship developed that which was dormant in the individuals, or that the ship passed through a zone of epidemic influence.

Dr. Sutherland writes: "The ship or the men must have been in a cholera locality. The men become cholerized, 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 uncholerized country. But this has never happened; the *aura* must be there before the ships. We cannot tell yet what cholerization 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 and elsewhere, in the face of the Monsoon." For example, in November 1848, two ships, the *Swanton* and the *New York*, were struck with cholera in the Atlantic Ocean, the former twenty-six days after leaving port, the latter sixteen days. Both these vessels sailed from Havre at a time when cholera was prevalent in Germany, but had not reached the west of France. "3. An epidemic may outstrip a steamship, 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.—The belief is maintained by foreign Powers that epidemic diseases, and especially cholera, can be arrested in their progress and debarred from entering into a country by quarantine. This once meant seclusion and isolation, for a period of forty days, of persons either affected by disease, or coming from a locality where it prevailed, and 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. Of late years the period of isolation has been diminished, even by those who hold the doctrine of contagion.

It is needless to dilate minutely on the evils that

resulted from this grave interference with personal liberty; suffice it to say, that they comprised 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 disease, forming an accumulation of evils 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 for 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, then the futility of quarantine is obvious.

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

The British Government Local Board, recognizing the 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 establishment of healthy conditions of living, but avoiding 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, though 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 proceed.

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

In India, 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 best means of preventing the diffusion of the disease.

The following is a 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 enjoined, the utmost attention is to be given to the sanitary condition of the station; over-crowding is 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;

all dejecta are to be buried in trenches dug for the purpose.

Purification and fumigation are to be resorted to, both of the room or building in which any case of cholera has occurred, and of 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 is pointed out that no danger is incurred by attending on the sick.

Dr. Southwood Smith says: "The object of quarantine is to prevent the introduction of epidemic disease from one country to 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 by many contended that no disease will spread epidemically. "Allowing, therefore, to contagion all the influence which any one 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 shows that "the influence of an epidemic atmosphere may exist over thousands of square miles, and yet affect only particular localities." Why does it so localize itself? Probably because it finds there 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 leaves all such conditions "untouched and unthought of."

The real question, however, 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, perilling life, and wasting public money." Whether it can do this or not is a mere question of evidence, and everything in India and Britain affirms that it cannot do so.

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."

Measures of prevention and quarantine have been the subject of International Conferences, 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 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 in the unfinished conference at Rome; and even 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, ten days' detention in the Red Sea being reduced to five, and twenty-four hours only being imposed on ships with a clean bill of health.

Land quarantine was declared to be useless at the Vienna Conference, and both that and cordons were condemned at the Roman Conference on the ground that they were impracticable.

It will be observed that, though the theory of contagion still prevails, it has undergone great modifications, suggesting the hope that the time may not be far distant when reliance will be placed upon sanitary measures, which alone offer any guarantee for protection, rather than on such barbarous institutions as quarantine.

The question arises, What does it behove each individual of a 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.

Pay attention to ventilation, to perfect drainage, to absolute purity of water supply, and to prevention of over-crowding, using all influence to secure this throughout village or town. Do not be afraid to attend upon the sick, for no danger is incurred thereby. Disinfect excreta, and thoroughly cleanse effects, houses, and rooms.

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

Although much remains to be known about the causation of cholera and its apparent caprices of incidence and diffusion, yet, from what experience and observation have taught us, we seem to be warranted in stating the following to be facts with reference to the disease :—

1. That cholera has been present in India and other countries from the earliest times, and that isolated cases occur in almost all countries.

2. That cholera is always present, not only in certain parts of India, but elsewhere, and that in India outside these areas its prevalence varies in different years and according to the season of the year.

3. That cholera does not attack all the places within an epidemic area.

4. Meteorological changes produce sudden alterations in the activity and intensity of an outbreak.

5. That the rate and direction of an epidemic are not influenced by facilities of communication or by the greatest streams of human traffic; the opening of the Red Sea route, *e.g.*, not having increased its diffusion.

6. That the cases are more frequent and more severe at the commencement than in the continuance of an outbreak.

7. That hygienic measures afford the greatest security, although they are not an all-powerful safeguard against cholera, whilst local insanitary conditions and impure water favour its incidence and increase its intensity, and that it is important to check diarrhœa in times of cholera prevalence.

8. That cordons and quarantine have not only utterly failed to prevent the spread of cholera, but, on the contrary, have done harm.

9. That to enter an area in which cholera is present, or to travel within that area, is especially dangerous to new-comers, while residents, whose circumstances of living are favourable, have a better chance of escape.

10. That removal is the best course when cholera attacks a regiment or other body of men.

11. That attendants on the sick have not suffered more than others.

12. That impure water, irritating articles of diet, unripe fruit, saline aperients are liable, during epidemic prevalence, to bring on diarrhœa and cholera.

13. That fatigue, exhaustion, fear, and anxiety are powerful predisposing causes.

14. Some circumstances attending an outbreak of cholera, and the pathological conditions then deve-

loped, seem opposed to a specific poison as being the cause of the disease.

15. Having suffered previously from cholera gives no immunity from recurrence of the disease.

The sanitary measures recommended by Government, if carried out, are such as may imbue us with confidence that, if cholera appear, we shall be protected against any intensity of prevalence. The more we can perfect the measures now in force—and much can be done towards this, for insanitary houses are still far too numerous everywhere—the more thoroughly our individual and collective support, moral or material, be accorded, the more complete, we may anticipate, will be our immunity from the disease.

Experience in Europe during the recent epidemic shows how futile coercive measures have been, while the examples of Marseilles, Toulon, Valencia, Palermo, Naples, whose notoriously insanitary conditions have paid their natural penalty, will be a salutary warning as to how cholera may be intensified by local causes, and give a lesson which, it is to be hoped, will not be disregarded.

In the *Times* of Monday, February 22, 1886, it was recorded that a memorial to the Lieutenant-Governor of Bengal, concerning sanitation, was laid 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 1000; that during the decade of 1875 to 1884, out of a population of 257,000 in the suburbs, no fewer than half had perished.

The laws of sanitary science are understood both here and in India, and the enactments of the Government would be effective if fully carried out, but no Government can force sanitation upon towns, villages, or houses, without the co-operation and support of the residents, and all measures will be found useless unless backed by the personal efforts and exertions of individuals. Experience shows that in this country in the present day the best houses are often most defective, and that local causes of disease, which might be removed, abound, notwithstanding all that is done by the Government Local Board. In India, the reports of the Health Officer of Calcutta show that much is still wanted in that centre of cholera in the way of municipal aid, towards giving full effect to the sanitary measures necessary to control the disease. Let us hope that his advice will be attended to, for surely it would have the best results.

The cholera, which has been in Europe for the last five years, has now apparently died out, or at all events is dormant; but it may appear again, and wherever it can find a fitting nidus—*i.e.*, the presence of bad local conditions—all the quarantine and inspection in the world will not keep it out; that such bad local conditions in towns, streets, and houses exist, 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. The measures for their removal are simple enough if only the public can be brought to believe in the unseen but removable dangers which exist within, around, and beneath their houses.

This is a great sanitary defect of the present day, and cries loudly for reform; upon this it may depend whether pestilence shall find footing, or shall leave the locality unscathed.

But I must now bring these remarks to a close. Imperfect and incomplete as the account has been, I trust it may not have altogether failed in showing how much epidemic cholera is under our own control; that, whatever may be its origin—its incidence, its prevalence, and its dissemination are subject to physical laws which, if duly observed and enforced, will protect us from disease which, if uncontrolled by the exercise of the sense God has given us, may prove like the destroying angel of the Apocalypse. Happily we have acquired some knowledge of these laws, and it depends on ourselves, and how we apply it, as to what the results may be. Epidemics are not a necessary, though a constant, condition of man's existence on earth. They are amenable to the laws of hygiene and of common sense. "Let us," as says Dr. Dallinger in a recent address respecting small-pox, "do our duty and act up to our knowledge, and, as surely as disease comes among a people by physical laws broken, so it will depart from them if they see to it that physical laws are obeyed."

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