A treatise on the epidemic cholera : containing its history, symptoms, autopsy, etiology, causes, and treatment / by Alexander Turnbull Christie.

To Professor Graham
with the Compliments of
The late Authors Brother
George Turnbull.

George Ricko
Edinburgh.

A TREATISE

ON THE

EPIDEMIC CHOLERA;

CONTAINING

ITS HISTORY, SYMPTOMS, AUTOPSY, ETIOLOGY,
CAUSES, AND TREATMENT.

BY ALEXANDER TURNBULL CHRISTIE, M.D.

OF THE HONOURABLE EAST-INDIA COMPANY'S SERVICE;
MEMBER OF THE ROYAL ASIATIC SOCIETY OF GREAT BRITAIN AND IRELAND;
OF THE WERNERIAN AND ROYAL MEDICAL SOCIETIES
OF EDINBURGH, &C.

LONDON:

J. AND C. ADLARD, PRINTERS, BARTHOLOMEW CLOSE.

1833.

A TREATISE

ON THE

EPIDEMIC CHOLERA.

THE observations on the Cholera published by the author in 1828 form the basis of the present essay. They have been already honoured with the approbation of many distinguished physicians and journalists, both in this country and on the continent, and also by certain members of the Institute of France, at a public meeting of that learned body in November 1830. He therefore trusts that it will not be considered presumptuous in venturing to offer the present more extensive remarks for the consideration of his professional brethren. Many parts of his former essay have been completely recomposed, and very much extended; the objections offered to some parts of it have been fairly met and discussed, and advantage has been taken of all the new facts which have been subsequently published, and of the observations of some intelligent friends. His general views have been thus strongly confirmed, while a few of the less important have been slightly modified. But in addition to the contents of the treatise alluded to, the present contains so much additional matter that it must be considered as entirely new. The history of the disease, the chapters on its symptoms and on its causes are new, and large additions have been made to those on its etiology and treatment. No essential change has been made in his theory of the disease, and he is proud to say that new facts, which from time to time have become known, have only tended to develope and confirm it.

He need not repeat what he said in the preface to his former work respecting the extensive advantages he enjoyed during a five years' residence in India for studying the disease in all its forms; for he hopes that the following pages will be found to contain sufficient evidence of them. At the same time, he wishes it to be distinctly understood that he has not confined himself exclusively to his own experience, but has sought for information in the many valuable works which have been already published by his medical brethren in India, and he is inclined to believe that he has thus been enabled to arrive at more correct views respecting the nature of the disease than could possibly have resulted from the experience, however extensive, of one individual. Although it is the very same disease which broke out in the Gangetic Delta and other parts of Bengal in 1817, which continues in India to the present day, and has spread over the greatest part of the old world, yet there can be no doubt that it has presented a variety of features at different times and places. It is therefore evident that a partial acquaintance with it would be likely to convey very erroneous notions respecting its true general character; and it will probably be found that the inaccuracies of some authors have arisen entirely from their having limited their views too exclusively to the cases which came immediately under their own observation. But in expressing himself thus, he means no disparagement to the abilities and accuracy of any of his predecessors; and it is only his good fortune to have come a little later, and thus to have it in his power to benefit by their observations, and to take a more extensive view of the disease than it was for them to command. Were a being from a distant planet to visit our globe, and confine his observations to one of the islands of the Pacific, he would certainly go away with very incorrect notions of the characters of our species; and the same would be the case were he only to pass a short time in any other single spot, and the farther he extended his journey into different regions of our little world, the more and more would he become acquainted with the nature of its inhabitants, and the errors which he at first imbibed would gradually be dissipated. So it is with every other inquiry: we have more correct notions of cholera now than prevailed upon its first appearance; and should it continue longer in Europe, more extensive experience may remove the errors which still cling to us.

In addition to his own experience, he is indebted for much valuable information on the symptoms, autopsy, and treatment of the disease to the Reports published by order of government, under the superintendence of the Medical Boards of Calcutta,

Madras, and Bombay, and to the writings of Messrs. Annesley and Orton. Numerous works have been consulted upon the history of the disease, among which may be enumerated the Asiatic Journal, the Calcutta newspapers, the Reports already mentioned, Colonel Tod's Annals of Rajasthan, and Messrs. Baillie Fraser's travels through Persia, the Courier de St. Petersburg,* &c. He feels himself under a particular obligation to M. Alexandre Tourgeneff, by whose unwearied exertions much valuable information has been collected concerning the history of the epidemic, and its existence in Europe previous to its recent introduction from India, and which he has, in the handsomest manner, communicated without reserve.

He must add a few words respecting the map attached to this essay; for, from its necessarily imperfect state, it might, if unaccompanied by some explanation, be calculated to convey an incorrect idea in regard to the progress of the disease. Upon casting the eye over it, it may appear that the disease has generally followed the course of great rivers, or of frequented lines of communication between different countries; but this is more in appearance than reality, and is owing to various causes.

1st. In all countries the cities and large towns are situated on rivers or on great roads; and they naturally engross our attention, while the villages in the intermediate spaces are neglected; and it would not be possible, even if we had the necessary information, to insert the dates at which the disease had appeared at the small towns and villages, and thus to fill up our map.

2d. In Persia, Arabia, and Syria, we have been able to indicate the dates at which the disease first appeared, only at a few of the principal places, although it is notorious that it spread over the whole of Persia, and we may presume also over a great part of the other two countries just mentioned. Now, as the principal towns of these countries are situated on the great lines of communication between central Asia and Europe, it has been supposed by some that the disease had been carried along these roads by contagion. It would be hardly possible to represent, with perfect accuracy and in detail, its exact progress through a country, its quick passage from place to place, and its sudden appearance and disappearance; but it may be figured to the imagination as a winged restless fiend, hovering over a country, and alighting

* The author has been indebted for a perusal of this journal to the politeness of M. Smirnove.

occasionally, and in a capricious mood, to contaminate with his hateful presence the air immediately around.

Not to extend the map to an inconvenient size, it has been necessary to make the equator its southern limit, and all the places to the south of that line, which have been visited by the epidemic, have therefore been unavoidably excluded.

History of Cholera.

The dreadful scourge under which India and other eastern countries have been suffering for some years, and which is now extending its fatal influence into Europe, is not a new disease. It could reckon numerous victims in India, long before its fearful visitation which commenced in the year 1817, and it appears to have existed there from remote antiquity; it is said to be mentioned in the medical writings of the Hindoos, which date several hundred years before Christ, and certain forms of it were known to the Greek and Roman physicians.

Hindoostan and the neighbouring countries have always been the principal theatres of its awful ravages: they have never been without sporadic cases, have had it for years in some places as an endemic, and have been occasionally desolated by its having spread far and wide under an epidemic form.

The first well-authenticated account of its occurrence in the East is that of the Dutch physician, Bontius, who wrote in 1629, at Batavia. He describes the symptoms accurately, and refers the cause of the disease to a hot and moist disposition of the air, and to an intemperate indulgence in fruit.

We learn from the works of Colonel Tod, that it raged in Rajpootana and other parts of India, at different times, during the seventeenth century. Its first appearance is mentioned in the following passage from his annals of Mewar, where, after having described the magnificent bund or embankment of white marble, which confines the waters of the lake of Rajsmund, and which is the admiration of all travellers, he continues, "one million and one hundred and fifty thousand pounds sterling, contributed by the rana, his chiefs, and opulent subjects, were expended on this work, of which the material was from the adjacent quarries. But, magnificent, costly, and useful as it is, it derives its chief beauty from the benevolent motive to which it owes its birth: to alleviate the miseries of a starving population, and make their employment conducive to national benefit, during one of those awful visitations of providence, famine and pestilence, with which these states are sometimes afflicted."

It was in 1661, only seven years after the accession of Raj Sing, that these combined evils reached Mewar, less subject to them, owing to its natural advantages, than any other state in India. "From all I could learn," he adds in a note, "it was the identical pestilence which has been ravaging India for the last ten years, erroneously called Cholera Morbus."

In the year 1737, or A. D. 1681, when the Rajpoots of Marwar were defending their independence against Aurungzeba, the Rajpoot chronicler thus concludes the events of that year, and incidentally introduces the existence of thi spestilence. "Thus the *saca* (destruction) of Sojut was when 37 ended and 38 commenced, when the sword and the *murrie* united to clear the land." "Murrie," says Colonel Tod, "is the name for that awful scourge, the cholera morbus, which has been raging, to the loss of so many lives, for the last thirteen years, throughout India. It appears to have visited India often, of which we have given a frightful record in the annals of Mewar, in the reign of Rana Raj Sing, (see vol. i. p. 390,) in 1717, A. D. 1661, twenty years previous to this; and Orme describes it as raging in the Deckan in A. D. 1684; no doubt a continuance of the same scourge."*

Mr. SCOT says,† that there is an account, in the records of the Madras Medical Board, of the disease having occurred as an endemic, in various parts of the Madras territories, in the years 1769, 1770, 1781, and 1783; and that it also occurred, in the latter year, as an epidemic all along the Coromandel coast. It was about this time that SONNERAT travelled in India, (viz. between 1774 and 1781,) and he accordingly gives an accurate description of the disease, which he denominated flux. He says, that it twice prevailed as an epidemic; that, during the first time, above 60,000 people, between Cherigam and Pondicherry, perished; and that its second visit was still more dreadful. He attributes its causes to sleeping in the open air, to eating cold rice and curds, (which is a common article of food in that country,) and to eating after cold bathing.

It is mentioned, on the authority of a committee of medical officers, who assembled, in 1819, in the Mauritias, to examine into the nature of the epidemic which then raged there, that a similar disease had occurred in that island in the year 1775.‡

In 1781, the cholera prevailed in the northern circars,

* Colonel Tod's MSS.

† Preface to the Madras Report on the Epidemic Cholera.

‡ Ibid.

and assailed, with inconceivable fury, a detachment of 5000 men, who were then marching through that part of the country, under the command of Colonel Pearse. As usually happens on such occasions, it first attacked the camp followers, then the sepoys, and lastly the Europeans. But few officers were affected, and of these only one died. "The troops had been marching almost incessantly for six days, through sand and salt water, and were at length so enfeebled as scarcely to be able to move. A violent wind blew day and night along the whole shore, and, although it was not quite so strong at night, it was then accompanied with such a penetrating moisture as to wet through the thickest woollen clothes. The troops were, besides, in no condition to withstand the inclemency of the season: they had no tents, and few possessed even a blanket to shelter them on getting to their ground; they generally marched in the night; and many suffered by incautiously lying down while warm from exercise, and falling asleep, exposed to the influence of a damp and noxious atmosphere."*

About this period the disease spread to Calcutta, where it principally attacked the native inhabitants; and it appeared in the northern circars a second time, in 1790.

From 1781 up to 1790, it had occurred every year, and sometimes with great violence, in various parts of the Madras territories; and tolerably accurate descriptions of it, by Drs. Duffin and Davis, are to be found in the records of the Madras Medical Board. But it is to be regretted that, at this time, no post-mortem examinations were made of the fatal cases, except in two or three instances; and in these the morbid appearances are but imperfectly described.

We have no account of the cholera having occurred as an epidemic, in the Bengal provinces, before 1817; but sporadic and endemic cases had not been unfrequent. Mr. Jamieson mentions a remarkable instance of its occurrence at Hurdwar, in 1783, when an immense crowd of pilgrims, amounting, it is believed, to one or two millions, were assembled there for the purpose of ablution in the holy stream of the Ganges. The temperament at this place is very variable. The days are hot and the nights cold, with very heavy dews and chilling blasts, and the devotees were exposed to all the inclemencies of the weather. The disease broke out soon after the commencement of the ceremonies, and in less than eight days is said to have cut off more than 20,000 victims: but so confined was its influence, that it did not reach the

* Bengal Report.

village of Juwalapore, only seven miles distant, and it ceased immediately upon the concourse breaking up, on the last day of the festival."*

In the year 1817, it broke out almost simultaneously in various parts of Bengal; and this was the first time it had visited that country as an epidemic. It occurred in an unusual degree at Buddea, and other southern districts, in May and June. But it was in August that it first began to excite universal alarm by its wide spread, and the rapidity of its progress. In that month it made dreadful havoc in Jessore, a populous town situated in the centre of the Gangetic Delta, about a hundred miles north-east of Calcutta, where it was reported to have cut off, within the space of a few weeks, more than 6000 of the inhabitants. At Calcutta, "several cases of cholera occurred amongst Europeans on the 5th of September, and from that day forward the disease became daily more frequent." It commenced about the same time in numerous other parts of Bengal, and soon after the middle of September, being now strictly epidemical, it extended in all directions; "within the space of a few weeks stretching from the easterly parts of Poorneah, Dinagepoor, and Sylhet, to the extreme borders of Balasore and Cuttack, and reaching from the mouths of the Ganges nearly as high as its junction with the Jumna."

"These facts," says Mr. Jamieson, "are more than sufficient to show the fallacy of every theory which attempts to derive the disease from any local source, or to trace it to any one particular spot, as the centre from which it was emitted to the surrounding countries. They prove, without the possibility of dispute, that it broke out at very remote places at one and the same time, or at the distance of such short intervals as to establish the impossibility of the pestilential virus being, in this stage of the progress, propagated by contagion, or any of the other known modes of successive production; and that its general diffusion was therefore referrible to some cause of more universal operation.

At this period, within an area of several thousand miles, scarcely a town or village escaped; and so great was the mortality throughout the Delta of the Ganges, that the bulk of the whole population was sensibly diminished. "It is remarkable, that the large and populous city of Moorshedabad, from extent and local position, apparently very favourably circumstanced for the attacks of the epidemic, should have escaped with comparatively little loss, whilst all around was so severely scourged.

* Bengal Report, preface, p. x.

The only spots on the eastern side of the Ganges, beyond the precincts of Bengal, invaded by the epidemic, in 1817, were Moozufferpore and Chupruh, the principal stations of the Tirhoot and Sarun districts, and the cantonment of Gazeepore; and in each of these places its attacks were confined to the towns themselves, or the villages in their immediate vicinity; the great bulk of the adjoining country, at this period, having entirely escaped.

It now began to exhibit one of its most striking peculiarities: instead of bursting forth irregularly over the country, as it had hitherto done, it began to run forward in certain paths, and to confine itself within certain boundaries, which could be defined with perfect accuracy.

In the first week of November, "it reached the centre division of the grand army, then encamped, under the personal command of the Marquis of Hastings, near the banks of the Sinde, in Bundelkund."

"It was here that the disease put forth all its strength, and assumed its most deadly and appalling form. It is uncertain whether it made its first approaches on the 6th, the 7th, or the 8th of the month. After creeping about, however, in its wonted insidious manner, for several days, among the lower classes of the camp followers, it, as it were, in an instant gained fresh vigour, and at once burst forth with irresistible violence in every direction. Unsubjected to the laws of contact and proximity of situation, which had been observed to mark and retard the course of other pestilences, it surpassed the plague in the width of its range, and outstripped the most fatal diseases hitherto known, in the destructive rapidity of its progress. Previously to the 14th, it had overspread every part of the camp, sparing neither sex nor age in the undistinguishing virulence of its attacks: the old and the young, the European and the native, fighting men and camp followers, were alike subject to its visits, and all equally sunk in a few hours under its most powerful grasp. From the 14th to the 20th or 22d, the mortality had become so general as to depress the stoutest spirits: the sick were already so numerous, and still pouring in so quickly from every quarter, that the medical men were no longer able to administer to their necessities. The whole camp then put on the appearance of an hospital: the noise and bustle almost inseparable from the intercourse of large bodies of people had nearly subsided; nothing was to be seen but individuals anxiously hurrying from one division of the camp to another, to inquire after the fate of their dead or dying companions, and melancholy groups of natives bearing biers of their

departed relatives to the river. At length even this consolation was denied them; for the mortality latterly became so great that there was neither time nor hands to carry off the bodies, which were then thrown into the neighbouring ravines, or hastily committed to the earth, on the spots on which they had expired, and even round the walls of the officers' tents. All business had given way to solicitude for the suffering. Not a smile could be discerned, nor a sound heard, except the groans of the dying and the wailing over the dead. Throughout the night, especially, a gloomy silence, interrupted only by the well-known dreadful sounds of poor wretches labouring under the distinguishing symptoms of the disease, universally prevailed. The natives, thinking that their only safety lay in flight, had now began to desert in great numbers; and the highways and fields, for many miles round, were strewed with the bodies of those who had left the camp with the disease upon them, and speedily sunk under its exhausting effects. It was clear that such a frightful state of things could not last long; and that, unless some immediate check were given to the disorder, it must soon depopulate the camp: it was therefore wisely determined, by the commander-in-chief, to move in search of a healthier soil and of purer air. The division accordingly, on the 13th, marched in a south-easterly direction, towards Zalgoug and Lileia, and, after several intermediate halts, on the 19th crossed the clear stream of the Betwah, and, upon its high and dry banks at Erich, soon got rid of the pestilence, and met with returning health. But its line of march, during the whole of this progressive movement, exhibited a most deplorable spectacle, although every means had been taken, by giving up the ammunition carts, and collecting elephants and draught cattle to procure sufficient carriage, the sick were found too numerous to be moved, and were, in part, necessarily left behind; and as many who left the carts, pressed by the sudden calls of the disease, were unable to rise again, and hundreds dropt down during every subsequent day's advance, and covered the roads with dead and dying, the ground of encampment and line of march presented the appearance of a field of battle, and of the track of an army retreating under every circumstance of discomfiture and distress. The exact amount of mortality during these few calamitous days could not, from the circumstances of confusion and general disorder under which it took place, be ascertained with any degree of accuracy: from the military returns, however, it appears that, in this fatal week, of 11,500 fighting men of all descriptions, 764 fell victims to the

disorder; and of the camp-followers, it was conjectured that about 8000, or one tenth of the whole, was cut off."

In the year 1818, the epidemic, still avoiding the eastern and northern parts of the country, took a south-westerly direction, and, after following the course of the principal rivers and great roads, to almost every village and town of Bundelkund and Sangor, was successively communicated to the districts of Malwah, Berar, and Kandeish, and thus extended into the presidencies of Madras and Bombay. Kotah and Jeypoor were, at this period, the most westerly places it attained; where, having encountered a high and mountainous tract, which has generally been found to be inimical to its existence, it gradually subsided, and did not penetrate across the hills, either to Ondeypoor or Ajmeer, until the year following.

The inhabitants of Ondeypoor congratulated themselves upon having so long been exempt from the epidemic, and vainly hoped that their eastern mountains would continue to oppose a sufficient barrier against its introduction; but, in July 1819, they were one day astonished and dismayed at the intelligence of their prince having been attacked in the centre of his palace, and, in a few hours afterwards, that his prime minister had fallen a victim to this cruel disease. Lieutenant-Colonel Tod, late resident at Ondeypoor, waited upon the prince during his illness, and was accompanied for a time by the minister. The prince recovered in the course of twelve or fifteen hours, in consequence, it would appear, of the exhibition of large quantities of onion juice; a favorite Hindoo remedy in this complaint. Inquiry was then made for the minister, who had not appeared for some hours, when the melancholy intelligence was brought of his having been already carried off by the dreadful distemper from which his master had so happily escaped. It now, for the first time, made its appearance in the city, and committed sad ravages among the inhabitants.

A curious fact is recorded in regard to its course from Hoshingabad, on the river Nerbudda, to Nagpore. Many of the intermediate places were severely scourged by it, and a small town, named Mooltay, which is about half way, lost five hundred of its inhabitants; but, so very capricious was it in its visitations, that all the places between Mooltay and Negpore, and, among the rest, the large town of Baitool, were entirely exempt.

We will now trace the disease from Allahabad, at the junction of the Ganges and Jumna, to the northern provinces. It first appeared in Allahabad in March, and prevailed for

several months with great malignancy, having swept off nearly 10,000 inhabitants. "The troops stationed in the port and city were not affected until the middle of July following, although holding daily and unrestrained intercourse with the townspeople." Keeping close to the banks of the Ganges, it entered Cawnpore on the 8th of April, attacked the city and neighbourhood of Beethoor; and, although it spared Bareilly, Mooradabad, and almost every other town on the same line, it broke out in Shajehanpoor in July, and is reported to have killed upwards of 5000 of the inhabitants.

It extended up the Jumna in the same way, desolating some places, while it spared others. It is remarkable that Agra was not invaded by it till the 1st of July, while Mutra, situated much higher up the river, received it so early as the beginning of June. The former is a dry, airy town, and suffered comparatively little; the latter a filthy crowded city, and had the disease in all its virulence. It commenced in Delhi on the 20th July, and continued nearly a month, making great havoc among the dense population of that large capital. It raged in the city of Meerut in July and August, and in Saharanpore in September and October; but all the intermediate places escaped. Beyond this, the epidemic could not be traced; the mountains to the north appearing to have put a stop to its further progress. But although such has been generally observed to be the case, it has not been without exceptions, for "in June 1818 it passed the lofty range of mountains guarding Nepaul to the east, and visited Rhatmandoo, Patun, and Bhatgoon in the subjacent valley; and, in October following, it got from Sylhet to the independent countries of Kashar and Munnipoor, on the eastern borders of Bengal: but, even here, it might be seen that the highlands were not congenial to it, for it had been raging with very great violence in the adjoining district of Sylhet, before it was enabled to overcome the obstacles opposed to its progress by the intervening mountains."*

The following extract from a letter of the Medical Board of Bengal to that of Bombay, illustrates in a striking manner how very irregular and capricious, in its visitations, the epidemic had been at this period, in the Bengal provinces. "The disease would sometimes take a complete circle round a village, and, leaving it untouched, pass on, as if it were about wholly to depart from the district. Then, after a lapse of

* Although it has passed over many ranges of hills, I know of no instance of its having appeared at great altitudes: the Neilgerry hills, in southern India, which rise to between eight and nine thousand feet above the level of the sea, have hitherto been free from it.

some weeks, or even months, it would suddenly return, and scarcely reappearing in the parts which had already undergone its ravages, would nearly depopulate the spot that had so lately congratulated itself on its escape. Sometimes, after running a long course on one side of the Ganges, it would, as if arrested by some unknown agent, at once stop; and, taking a rapid sweep across the river, lay all waste on the opposite bank. It rarely, however, failed to return to the tract which it had previously left. After leaving a district or town, it sometimes revisited it; but, in such cases, the second attacks were milder, and more readily subdued by medicine, than those in the primary visitation."*

Having thus given a rapid sketch of the progress of the epidemic in the years 1817 and 1818, through the provinces of Bengal, I will now trace it through the presidencies of Madras and Bombay, to the southern extremity of India; and, in doing this, it will be convenient first to follow its course along the eastern, or Coromandel coast, and afterwards through the central and western parts of the peninsula. It extended from Bengal into the Gaujam district in March 1818; from thence it gradually crept along the coast, visiting almost every town and village on its way, and reached Madras in October. It raged there from the 5th to the 24th of that month, when it received a temporary check from a violent storm which occurred on that day. It recommenced, however, but again began to decline in the beginning of November, and gradually disappeared. It had been principally confined to the lower classes. Still continuing its course to the south, it reached Cuddalore on the 14th November, Combaconum on the 20th, and Vegapatam on the 22d of the same month; it appeared at Madura on the 30th November, and it had arrived at Palamcottah, near the southern point of India, on the 1st January, 1819.

Let us now follow it through the central parts of the country. It was communicated to Nagpore, in the way we have already described, in May 1818; it appeared at Jaulnah on the 3d of July, and in the same month spread from thence N. W. to two detachments of troops in Kandeish, one of them stationed at Mulligaum, the other at Mussurabad.

It made its appearance at Punderpore on the 14th July, where crowds of strangers were congregated for the celebration of a festival, and, as usual under such circumstances, it committed great havoc. Still proceeding southward, it attacked the troops in the southern Mahratea country, and ap-

* Bombay Report.

peared in the towns of Badamee and Darwar in August. It manifested itself at Bellary on the 8th September, at Hurryheir and Chittledroog about the middle of the same month, and at the large military station of Bangalore in the end of October. This place is situated on a high table land, having an elevation of about 3000 feet above the level of the sea; it consequently enjoys a pleasant temperature, is remarkable for its general salubrity, and never suffered much from the epidemic. In the towns of Mysore and Seringapatam, on the contrary, which are situated in a low unhealthy district, the mortality was very great, the disease having appeared there in the beginning of September. From thence it was communicated to the districts of Wynand and Coimbatore, in October and November.

From Joulnah we find that the disease had sent forth another stream, which, proceeding through Hydrabad* where it arrived in the end of July, from thence to Kernal and Gooty, where it appeared on the 6th of October, it thus continued onwards, by way of Cuddapah, into the Carnatic.

Besides the towns in this part of India, already mentioned as having been visited by the disease, many others (and indeed scarcely a town escaped) were attacked by it, in the months of October and November of this year; but in no instance could it be referred to infection or contagion, many places having been attacked simultaneously, and some of the more remote places first.

We must now turn our attention to the western side of the peninsula. After having spread from Joulnah, in the beginning of July 1818, to Aurungabad and Amednuggur, the epidemic reached Seroor on the 18th or 19th, and, in the end of the same month, appeared in the city of Poonah. "On the 6th August it broke out at Panwell, a considerable village on the main line of communication between Poonah and Bombay, separated from the latter by an arm of the sea, and distant about fifteen or twenty miles; but between which a pretty constant communication is kept up by means of boats."*

On the 9th or 10th of the same month, the first case appeared on the island of Bombay. It was supposed by Dr. Taylor, of the Bombay service, to have been introduced by a man from Panwell, where he had caught the disease; but of this there is not sufficient evidence, and we must, therefore, suppose that the epidemic influence spread to this place in the same way it had done over other parts of India. From

* Bombay Report.

hence it extended along the coast to the north, and showed itself in Surat in the end of August; but of its farther progress in this direction, no distinct account has been published.

The dates of its appearance at the different towns in the Malabar coast show that it could not have been communicated from one to another; for it appeared almost simultaneously in distant places, and in some of the more southerly, at a much earlier period than in those farther to the north. Thus, it broke out in Mangalore on the 1st of September, at Cannanore on the 5th December, at Tellicherry (which is a little farther south) on the 25th November, at Calicut (still farther to the south) on the 16th of October, at Cochin on the 8th December, at Allepy and Quilon in October, and at Trivandrum in January 1819, whence it spread as far south as Cape Comorin.

Before leaving this part of the history of the epidemic, it will be necessary to add a few general remarks, in order to supply the want of more minute details, which have been unavoidably omitted in this short sketch. The disease occurred at all seasons, and in all kinds of weather; but changeable damp weather was generally observed to be favorable to its production, and its progress was sometimes checked by the occurrence of a thunder storm, or by the return of a steady temperature and dry air. Some places were observed to be much more obnoxious to its attacks than others, and high and dry situations were, every where, more exempt than low damp and insalubrious places. Ever since the first appearance of the epidemic, certain districts have been so subject to it, that few detachments of troops have passed through them without suffering. This is particularly the case with some parts of the ceded districts, of which the burial ground of Gooty bears many a sad proof; for there repose the ashes of Sir Thomas Munro, and of many other British officers who fell sacrifices to this dire scourge. The same is said of the Surat district, on the Bombay side of India.

The disease varied much in its duration and malignancy in different places. In some it raged with great fury for a few weeks or only for a few days, and suddenly disappeared; in others it continued with little or no intermission, but in a milder form, for several months; but in general it was observed to continue only for a short time, gradually increasing in intensity, to decline slowly, and to disappear within fifteen or twenty days; and few visitations continued longer than a month in one place. It sometimes returned within a very short period after it had completely subsided, or hovered

about a spot, as it were, slightly changing its position, or transferring itself from one description of persons to another. The inhabitants of Gooty, for instance, suffered severely from it in 1827, while the regiment which was stationed there, and furnished guards to different parts in the town, enjoyed perfect health. On a sudden, however, the case was reversed, the townspeople were relieved from the disease, and the soldiers were attacked.

It spared neither age sex nor rank, but it was generally observed that the debilitated, and those exposed to fatigue and to the inclemencies of the weather, were most subject to it. Mr. Scot says, "all accounts agree in stating that the young, the healthy, and the robust are the least liable to cholera. The observations of a great proportion of our medical officers being confined to their practice in military hospitals, we have not sufficient data to determine whether there be any peculiar liability to cholera in one sex more than in another; but, if the preceding remark be well founded, it might be inferred that the greater delicacy of females, and perhaps their greater tendency to nervous disorders, would give rise to a greater predisposition to it in them than in males.* Children are subject to cholera, but it has been observed, particularly in Mr. England's reports, that infants, who have been confined exclusively to the breast, are not susceptible of the disease. This remark, however, is to be received with reserve; as the paucity of that class of subjects, in comparison with any other, must obviously diminish the facility of forming a just conclusion." One attack gave an individual no security against a second, but appeared rather to make him more liable to it. We have no data by which we can ascertain the number of victims swept off during the first years of the epidemic in India.

In regard to the mortality of the disease in Bengal, Mr. Jameson, from extensive inquiries, comes to the following conclusions. "1st. That the sum total of the mortality occasioned by the epidemic fell far short of the rate assigned to it by the voice of the public, during the season of alarm. 2d. That the mortality was proportionately much greater among large and dense, than among small and dispersed, bodies of men. 3d. That, in a given place, it was generally greater in the commencement and middle, than towards the termination of the disorder. 4th. That, when unlimited by the intervention of remedial means, it generally amounted to

* We shall find afterwards, that in Russia this was not the case, but, on the contrary, that men were more subject to the disease than women.

one half, and sometimes to two thirds of the seizures.* 5th. That, when medical aid was daily exhibited, it rarely amounted to one third, and was generally as low as one fifth of the attacked. 6th. That men were generally more susceptible than women, and that infants and children were nearly exempt."

The following table and remarks, from the Report published under the superintendence of the Madras Medical Board, by Mr. Scot, show that in the Madras army the number of fatal cases, among Europeans, amounted to about nineteen per cent. of those attacked, among the natives of India to about twenty-three and a half per cent.

"Epidemic cholera having now existed in these territories for about five years, and, as the preceding narrative evinces, having proved a formidable scourge to all conditions of people, it will be satisfactory here to exhibit that the extent of its ravages in the army falls short of what might be apprehended from a cursory perusal of its history. The following tabular view is taken from the returns in the appendix, and it will not pass unobserved, that, prior to the appearance of the epidemic, cases of cholera were progressively becoming more frequent.

Tabular View of the number of Cases of Cholera occurring in the Army of Fort St. George, from 1815 *to* 1822.

	EUROPEANS.		NATIVES.		STRENGTH.	
Years.	Admitted.	Dead.	Admitted.	Dead.	Europeans.	Natives.
1815	65	0	87	0	13,409	59,672
1816	97	0	92	0	13,943	61,969
1817	168	0	114	0	12,959	61,641
1818	1087	232	3,314	664	10,652	58,764
1819	564	85	3,779	734	10,125	63,782
1820	356	69	3,322	758	9,416	76,870
1821	357	39	2,527	830	9,553	82,046
1822	774	170	548	199	10,813	74,707
From 1818 to 1822,	3,138	595	13,490	3,185		
Add . .	526	100	2,340	550, not in the regular returns.		
Total .	3,664	695	15,830	3,735		

The General Returns for 1815 to 1817, do not exhibit the diseases from which casualties arose, and it is not known, accordingly, whether any, or how many, of the cases of cholera, during these years, terminated in death: but in the course of the first four months of 1818, when seventeen cases of cholera took place amongst Europeans, no death ensued;

* I am rather inclined to think that this is somewhat underrated, for the disease has been certainly more fatal than this in the south of India, and also in other countries, when left to take its course.

in May, fourteen cases occurred, and nine died. Amongst the natives, during January and February, ten cases took place, without a casualty: in March, twelve cases and two deaths; in April, thirty-seven cases and thirteen deaths; in May, seventy-two cases and twenty-four deaths. We may, therefore, conclude, that the epidemic cholera furnished the first casualties amongst Europeans in May, and amongst the natives in March 1818; and that, prior to that period, the casualties from cholera, commonly called cholera morbus, did not exceed the usual proportions.

"From 1818 to 1822 inclusive, the medical returns show 3138 cases of cholera in Europeans, of which, 595 terminated fatally, being in proportion of about nineteen per centum; and 13,499 cases in natives, of which, 3185 terminated fatally, being about twenty-three and a half per centum. As, however, the medical returns of small detachments of Europeans are not always included in the general returns, and as there are no returns at all from some of these detachments, 526 cases, and their proportional one hundred casualties, are allowed, to meet the aggregate of such incidents, which then gives 3664 cases, and 695 deaths. The medical returns of various native troops being missing for certain months, recourse was had to the regimental records, from which it appears, that very nearly 550 men have died of cholera without appearing in the tables in the appendix; which number, at twenty-three and a half per centum, gives 2340 cases: with these additions, the total number of cases in the natives of the army may be stated at 15,830, and the casualties at 3,735. This loss will probably fall much within the calculations of those who have been accustomed to hear of the ravages committed by the disease.

"Great as the proportionate mortality which has just been stated may appear to be, it is nevertheless probably far within the truth. When the disease first appeared, there were many causes tending to magnify the number of attacks, and the number of cures; and a most erroneous estimate was too generally formed of the relations in which these events actually stood to each other; the regimental practitioner was accordingly astonished and dismayed at finding, when the disease attacked his corps, and each case was authenticated under his own observation, that the proportion of deaths was most widely different, and greatly exceeded his calculations.

"It is probable that, since cholera has been prevalent, many cases have been ranked under that head in the returns, which at other times, and under a more careful diagnosis, would have found their places in other columns. The

'Cholera Morbus,' too, has been necessarily blended in the tables with the 'Epidemic Cholera;' for, notwithstanding every precaution, it was found that these forms of disease could not be accurately distinguished in most of the returns: whether, under this uncertainty, that form of the disease has increased in latter years in the ratio of increase exhibited in 1816 and 1817, or not, it is difficult to judge; but there have at least occurred, on several occasions, a kind of cholera, very frequent in its attacks, and in all respects answering the definition of Cullen.

"To ascertain, therefore, the true proportional mortality of the prevailing epidemic cholera, recourse may be had to those formidable visitations in particular corps, which form part of the subject of the preceding narrative, and the result of this inquiry gives 767 cases, and 211 deaths, amongst the European troops; and 4065 cases, with 1544 deaths, amongst the natives.* We have thus the proportion of twenty-seven and a half per centum in the former, and nearly thirty-eight in the latter, which, considering that this disease runs its fatal course very generally within twelve hours, sufficiently marks it as one of the most formidable that has ever afflicted the human race."

Fort St. George; 31st December, 1822.

The epidemic has continued to hover about India up to the present time, but it would swell this work to too great a size to attempt more than a faint history of its first visitations in the numerous countries it has passed over; and we must therefore leave India, to examine how it penetrated to the south and east, into all the islands of the Indian seas, and into China; and how it spread to the west, over Persia, Arabia, Syria, and Russia.

It appeared in the small island of Penang, or Prince of Wales's island, about the 23d October, 1819, and carried off 800 persons in the course of a few months; it visited Queda, on the opposite coast, and Malacca in the month following; and reached Acheen, on the coast of Sumatra, in the end of December. It continued to prevail in many of these islands during the year 1820; and, in the autumn, the government of Manilla, conceiving it to be contagious, ordered "that all

* This is evidently a most incorrect method of estimating the general mortality of the epidemic; for it is, in fact, only selecting the worst description of cases; and I would not even reject the cases of cholera morbus, in calculating the proportionate mortality, since it is notorious that this disease was generally a precursor of the other, and degenerated into it, if not checked by medicine. I believe, therefore, that the preceding table may be considered as exhibiting an accurate statement of the mortality from the epidemic in the army of Madras.

ships reaching Manilla from Penang, Malacca, Singapore, and Batavia, should perform quarantine for forty days outside the harbour." But, in spite of this precaution, it broke out there between the 1st and 3d of October, immediately after a most violent and destructive storm, and continued to rage in the island with great fury for some months. About the middle of this year, it committed great ravages in Siam; and, towards the end of it, it broke out in Canton, Whampoa, and Macao, where the alarm produced by it among the Chinese merchants was so great as to occasion a serious interruption to commerce. In the spring of 1821 it visited Batavia and other towns in the island of Java, and about the end of this year it spread into the countries of Cochin China and Jung King. It has reappeared in many of these countries, since the period under consideration, and probably few places in the Indian Archipelago have entirely escaped; but our scanty information from these distant regions will not enable us to enter more fully into this part of the history of the epidemic.

We have already observed that the epidemic reached the most southerly point of the Peninsula of India in January 1819; and it was at this time it first appeared in the Island of Ceylon, where Colomba was the first town attacked by it. As usual, it gradually spread in all directions, broke out in Trincomalee in April, and in Point de Galle in July, and had visited almost every part of the island before the end of the year.

It has been said that the town of Trincomalee was infected with the disease by the crew of the ship Leander, in July 1820, who were suffering from it before their arrival, and had caught it at Pondicherry; but there is little reason for supposing this to have been the case, the disease having already existed in the island for more than a year, and Trincomalee having been once before visited by it. It has been also supposed to have been introduced by means of contagion into the island of Mauritius, where it first made its appearance in September 1819; but it is sufficient to state, in opposition to this notion, that the medical commission appointed by the government of that settlement, to investigate the nature of the disease, gave it as their opinion that it was not contagious. It found its way to the island of Bourbon in January 1820. The government had taken all the precautions in their power to prevent its introduction into the island, and denounced the penalty of death against any person found clandestinely landing on its shores; but all to no purpose. It must be remarked, however, that it has been supposed that

the disease had been introduced by means of a communication having taken place between a boat from the shore and a vessel named the Picvar, which arrived on the 7th of January from Port Louis, in the Mauritius, where the disease then prevailed.

We have now arrived at that part of our narrative which demands our most anxious attention, viz. which exhibits the disease spreading from India to the west, and thus approaching nearer and nearer to our own homes. In the summer of 1821, it raged with tremendous violence along both sides of the Persian Gulph, especially at Muscat, Bushire, and Bussorah, and at the latter place is said to have carried off 14,000 people in fifteen days. It reached Shirauz in September, and numbered among its victims the mother, one of the wives, and a child of the Prince of Persia, besides many Georgian females; and 6,000 deaths were counted out of a population of 40,000. It reached Bagdad about the same time; it then subsided considerably during the winter months, but burst forth with fresh fury in the summer of 1822, when it attacked Teheran, and spread all over Azorbijan. It was at this time that the Prince Abbas Mirza was carrying on the war against the Turks on the high table-land near the source of the Euphrates, when both armies were destined to suffer more severely from an invisible scourge than from the swords of their antagonists. The following account of the occurrence of the epidemic in the Persian army, after the battle of Toprah Kullah, is extracted from the travels of Mr. Baillie Fraser. "The Prince pursued his success as far as the pass of Deear, about three days' march from Topra Kullah, when the epidemic cholera, which had appeared in his camp even previous to the action, now broke out violently, and he thought fit to commence a retrograde movement to Khoace. From that moment the Persian army also appears to have been virtually dissolved; the men dropt off rapidly, and whole troops deserted to return to their homes, so that, by the time he reached Kooe, he had scarcely any army to dismiss. The loss by disease during this retreat was certainly great, but has been variously represented. The most probable accounts set it down at about four thousand men, or about a tenth part of the whole force; in some battalions three hundred out of one thousand died, and the rear of their line of march was strewed with dead bodies, as if it had been all the way in action." (P. 315.)

"It is difficult to say how or from whence the epidemic cholera, that scourge of the East, reached Tabreez. It was

supposed to have reached from Bagdad along the caravan road, by Hamadan and Sennar, but no accounts to be at all depended on could be obtained of its gradual progress. A whisper had gone forth that the disease had appeared in the town as early as the 12th of July; but a week made it no longer doubtful, and upon our return to Tabreez on the 24th, after a short absence, we understood that from fifteen to thirty were daily dying of cholera.

"A panic now commenced, and the authorities of the place, instead of endeavouring to restore confidence, and maintain order in the prince's absence, encouraged the inhabitants to quit the city. The old Caimoakan set the example, by ordering away the prince's harem, and announcing his intention to follow it; he did not, however, in his alarm, neglect his English friends, but sent a message advising them to follow his example, and offering a garden in the country for their accommodation.

"During the next ten days the state of the distemper varied greatly; sometimes the fatal appearances diminished so much, that it was even doubted whether the alarm had not been a false one; the sick were attacked with vertigo and sickness, which was attributed to the powerful effect of the sun's rays; and though some died, yet more recovered, without having evinced many of those more peculiar and alarming symptoms which generally mark the disease. By degrees, however, these symptoms disappeared; violent vomiting, accompanied with painful cramps, damp clammy sweat, cold and bloodless extremities, burning heat at stomach, a sunken death-like countenance, cessation of all the pulses: these, and other striking characteristics of this fearful disease, marked the fatal cases, and terminated in death.

"Often when the disease was at its height, the first seizure, indicated by vertigo, proved fatal at once. Several instances came to our knowledge of persons thus attacked in the streets, who fell down senseless, and never recovered.

"The treatment pursued by the natives was, in all cases, the same which we had remarked in other parts of Persia. The moment a person was attacked, they seized him, and drenched him in cold water, made colder by ice, which is abundant in Tabreez; verjuice was thrust down his throat when the unhappy patient could swallow, and ice was often heaped upon the stomach. A chill was thus given which probably aided the disease, the nature of which is to drive the circulation from the surface and extremities. This discipline, however injurious in cases of true cholera, was salutary

and successful in cases of mere vertigo, which, from the heat of mid-day in the sun, was not unfrequent; and the occasional cures thus performed on persons supposed to be labouring under cholera, strengthened the faith of the natives in their own practice.

"During this time the natives, panic-struck, fled in crowds from their homes, until the city became a desert."*

It is remarkable, that about the same time that the epidemic broke out along the Persian Gulph, it also made its appearance in Khorassan, without in any instance being traceable to contagion; and is also said to have spread over great part of Arabia, to the holy cities of Mecca and Medina.† It even stretched as far as the eastern shores of the Mediterranean, and inflicted its scourge upon the towns of Aleppo, Antioch, Latichea, and Damascus.

The town of Astracan, which has since been so severely afflicted, received the epidemic for the first time in September 1823, when the Russian flotilla of the Volga also suffered. But it did not continue long, and was supposed to have been checked by the occurrence of a very intense frost. After the year 1823, the disease subsided in all the countries we have just mentioned, and for several years it had completely disappeared, excepting a few sporadic cases, which were always observed to be most prevalent during the autumn. Thus it continued till the year 1829, when it again invaded Teheran,‡ and other towns of Persia; and about the middle of the year it suddenly appeared in the town of Oremburg, situated on the river Oural, between the 51st and 52d north latitude, and at a time when all the surrounding countries for hundreds of miles were healthy, and had hitherto been exempt from the malady.

Again it received a check from the cold of winter; but it only lay dormant for some months, to revive with increased malignancy in the spring of 1830. It was in June that it appeared for the first time in Georgia. It had been raging in the Persian towns of Resht, Zingalak, and Touris, and about the middle of this month broke out in Saliany at the mouth of the river Kur, whence it spread into the provinces of Bakou and Koubac, into the Rhanat of Talyskh, to Derbent, into the province of Seleki, and the district of Elisabethpol. Up to the 21st of July, out of 4557 persons

* Pp. 316, 317. † Lieut.-Col. Monteith's MSS.

‡ M. Moreau de Jonnes is mistaken in supposing that this was the first invasion of the disease at Teheran; for it raged there in July 1822.—See "Letter from a Gentleman in Persia, &c." Asiatic Journal, 1823.

attacked in these different places, 2447 had been cured, 1655 had died, and 457 were still suffering. From the district of Elisabethpol the epidemic ascended the Kur, appeared in the environs of Tiflis on the 9th August, and between the 13th and 19th of that month it carried off 238 persons. It was supposed there not to be contagious, and that the best means to escape from it was to retire to elevated situations; and accordingly the authorities of Tiflis gave the inhabitants permission to seek a refuge in the mountains, and more than two-thirds of them left the city. The total number of cases at Tiflis from the 9th of August up to the 1st of October, when the disease had ceased, was 2222, of which 1575 had proved fatal, and the remainder had been cured.

From Saliany the epidemic took another direction, following the shores of the Caspian Sea and of the Volga. It broke out on the 17th July in the environs of Sedlistoff, and on the 1st August (o. s. 19th July) at Astrakan, when, in the course of ten days, out of 1229 persons who were attacked, 433 died; and afterwards the mortality had increased there to nearly a hundred a-day. It appeared on the 17th August at Tzeretzin, and on the 21st at Saratoff, and at the latter place raged with very great malignancy for nearly a month; for we find, by the official returns, that up to the 21st September it had carried off altogether 2367 individuals, of whom 1133 were men, 1011 women, 118 boys, and 105 girls.

It also extended its ravages into the province of the Caucasus, on both banks of the Terek, to Kizliar, and along the Kuma, to Novotcherkask, and to some places in the territory of the Don Cossacks, where it continued till the beginning of October; and it reappeared in the district of Oremburg, at the towns of Gourieff and Ouralsk.

At this time his Majesty the Emperor of Russia caused the most active measures to be adopted, to stop, if possible, the progress of the disease, and to afford relief to the sufferers. Numerous medical officers, with medicines, were sent into the provinces where the disease prevailed; a medical commission was appointed to investigate the nature of the epidemic, and to take whatever measures they might think fit for checking it; and Count Zakreusky, minister of the interior, was also sent into these provinces for a similar purpose.

Frequent accounts were now received at St. Petersburg of the progress of the disease, towards the north. It had penetrated about the beginning of September to Samara, on the Volga, in the government of Sumbirsk, and to Penza; and several boatmen had died of it on-board of the merchants'

boats at Nigini, Novgorod, towards the middle of September. It reached Kostroma and Yarosloff in the middle of this month, and carried off many victims in these and other towns of the same district. It also continued to spread through the Ukraine, and visited the towns of Kherkoff, Izume, &c. in the beginning of October.

The epidemic now approached close to the city of Moscow, and the military governor, Prince Galatzyne, hastened to take precautions against it. In order to prevent all communications with the inhabitants of the districts where the disease already existed, a military cordon was established along the frontiers of the government of Moscow: four passages only were left open, and there barriers of observation were stationed. Of the eighteen entrances to the city itself eight were closed, and all strangers who arrived at the others were directed to four stations, in order to undergo quarantine. Notwithstanding these careful measures, the disease made its appearance in the city, and the first cases are supposed to have occurred on the 28th September, two days before the above precautions had been taken. A commission was immediately appointed, consisting of two sections, the one administrative, the other medical, the former being charged with the duty of inspecting the different quarters of the town, and of taking measures for preventing the spread of the disease; the latter having to attend to its treatment, and to draw up and publish daily bulletins.

The city of Moscow contains 300,000 inhabitants, and it is remarkable that its sanitary condition was never more favorable than it was at this time, the average number of deaths amounting to only fifteen a-day, whereas they had generally averaged thirty.*

On the 11th of October, the governor-general of Moscow published the following letter, which he had received from his Majesty the Emperor.

"It is with the most profound grief I have received the news you have communicated to me. Make me acquainted, by expresses, with the progress of the disease. My departure will be regulated by the communications you transmit to me. I will come to partake of your dangers and labours. Let us submit ourselves to the decrees of the Almighty! I approve of all the measures you have adopted. Thank, in my name, those who under these circum-

* From the month of September up to the present time, (January 1831,) official bulletins have been published in the Russian newspapers of the number of seizures, deaths, and recoveries in the different governments; but such details would be inconsistent with the nature of the present work, which professes only to trace the general features and progress of the disease.

stances unite their efforts to yours. Meanwhile I build upon them my strongest hopes.

"*24th September* (o.s.), *or 6th October.*"

The impression of this letter was scarcely complete when the Emperor himself arrived in Moscow, which produced the happiest effects upon the depressed spirits of the people. A still more vigorous quarantine was now enforced; and no one was permitted either to enter or depart from the city, except for the conveyance of provisions, for which certain market-places were exclusively appropriated. A double military cordon was also formed upon all the roads which lead to St. Petersburg, and placed under the command of experienced generals, to prevent, if possible, the communication of the disease to that capital.

Every precaution against infection which could be thought of was adopted; and, among other things, large quantities of the disinfecting substance, the chloruret of lime, were employed in all quarters, but to no purpose, the malady continuing its ravages. The inhabitants of Moscow displayed the greatest patriotism and philanthropy, in their endeavours to aid their suffering fellow-citizens. Large sums of money were subscribed, for the purchase of medicines and other necessaries; numerous hospitals were established, and many private houses were voluntarily given up to be converted into abodes for the sick.

In the beginning of November the disease began to decline in various parts of Russia, and had ceased in many of the towns of the southern provinces; but it again burst forth, in the government of Astracan, among the Kalmuks of the Oulouss and Erksteneff, and in the horde of Kirghises, near Kven Peski.

On the 29th October, a committee of health, which had been established at Odessa, had its first meeting, to take into consideration the best means of preventing the introduction of the epidemic into that town. A few cases are said to have occurred between the 29th of this month and the 1st or 2d of November; the disease then subsided until the middle of November, about which time eleven cases were reported, seven of which proved fatal, and by the latest accounts* we learn that it has occasionally reappeared, and had not entirely ceased in the middle of December.

The disease having diminished considerably in Moscow in the beginning of December, the Emperor commanded the ex-

* Received in January 1831.

ternal cordon to be removed, all the internal arrangements, however, being still kept up.

From the first appearance of the disease in Moscow, between the 28th and 30th September, the number of cases gradually and slowly increased till the 20th or 22d October, from which time till the end of the month, the new cases averaged about two hundred a-day, and the deaths about half that number. This was the period of its greatest malignancy, and henceforward it began slowly but sensibly to diminish. During the first half of November, about ninety-five persons upon an average were attacked daily, of whom more than one-half, or nearly forty-five a-day, died. In the latter half of the same month, the number of attacks and deaths averaged respectively about forty-eight and twenty-two a-day. The disease had now very much abated, but still continued throughout the whole month of December, the average number of seizures amounting to fifteen, and of deaths to eight a-day. The total number of cases in Moscow, from the commencement of the epidemic, in the end of September, up to the 2d January 1831, was 6305, of which 3533 had proved fatal; a great mortality, when we consider that the sick had all the advantages of speedy medical aid, local hospitals, and all the resources of a great capital.

"Is the cholera which has spread over the greater part of Asia, and has been recently communicated to Russia, a new disease in Europe?" This is an important question, and must now demand our attention, being not merely one of speculation, but one which is intimately connected with the theories which have been proposed concerning the nature and causes of the epidemic. It shall be shewn, in the following chapters, that there are two distinct kinds of cholera, to which I have applied the names of catarrhal and inflammatory (cholera catarrhalis* and cholera pyretica†), and that the two are sometimes conjoined, and thus give rise to mixed forms of the disease. The latter has always been a well-known disease in all countries; the first has been principally confined to India, and is that which is now desolating so large a portion of the globe.‡

* Epidemic Cholera, Spasmodic Cholera, Cholera Asphyxia Mordechi, of other authors.

† Bilious Cholera, and Cholera Morbus, of other authors.

‡ The disease by which the Israelites were so severely scourged in the time of David, as related by Josephus, bears a striking resemblance to the epidemic cholera, as will appear from the following passage:

"The prophet had no sooner received and reported David's answer, but the Israelites were seized with a most unaccountable distemper, that was still attended with certain death, and accompanied with accidents that baffled all the

Now it is worthy of remark, that the few descriptions of cholera which have been handed down to us from the Greek and Roman physicians, only correspond to the inflammatory or mixed forms, and no mention is made of the disease having ever occurred epidemically. Hippocrates and Galen must have been acquainted with the common cholera, since it is mentioned in different parts of their works; but they give no detailed account of it. The following description of Celsus is the most accurate which is found in the works of the ancients, and corresponds to some of the mixed cases which will be found in another part of this work.

"A visceribus ad intestina veniendum est quæ sunt et acutis et longis morbis obnoxia. Primoque facienda mentio est choleræ; quia commune id stomachi atque intestinorum vitium videri potest; nam simul et dejectio et vomitus est: præterque hæc inflatio est, intestina torquentur, bilis supra infraque erumpit, primum aquæ similis, deinde ut in ea recens caro lota esse videatur, interdum alba, nonnunquam nigra vel varia; ergo eo nomine morbum hunc χολεραν Græci nominarunt. Præter ea vero, quæ supra comprehensa sunt, sæpe etiam crura manusque contrahuntur, urget sitis, anima deficit: quibus concurrentibus, non mirum est si subito quis moritur; neque tamen ulli morbo minori momento succurritur."*

In the fifth chapter of the second book of Aretæus on the causes and symptoms of diseases, we find a tolerably accurate description of the inflammatory cholera; while the following, taken from the twentieth chapter of the third book of Cælius Aurelianus, rather corresponds to our mixed cases: he says,

"Precedit frequenta choloricos stomachi gravedo atque tentio: anxietas; jactatio; vigiliæ; tormentum intestinorum cum sonitu, quem Græix borborismon vocant. Ventris dolor; atque per podicem venti fluor nihil relevans; suctationes fumosæ; nausea; salivarum fluor; gravedo thoracis cum membrorum defectu; surgente passione jugis vomitus, et primo corrupti cibi; sicut frequenter occurrit, et humoris atque fellis flavii, dehinc vitellis ovorum similis; tunc prasii atque æruginosi; ultimo etiam nigri; ventris quoque turbatio cum dolore; et egestio vomitorum similis, hoc est spumora, et acerrima, cum frequenti delectatione vomendi. Crescente passione aquasi atque tenuis liquoris sit egestio, et aliquando similis loturæ carnis. Feruntur etiam cum his humoribus plerumque subalbida desputa; sequitur etiam densitas pulsus, et articulorum frigus, atque vultus nigræ fuscatus; ardor atque sitis insatiabilis; spiratio celerrima; et contractio vel conductio membrorum, cum nervorumtensio, ac surarum et brachiorum. Præcordiorum etiam ad superiora raptus, cum dolore iliaco simili; aliquando etiam egestio ventris sanguinolenta, vultus in maciem atque tenuitatem deducti; oculi rubri; et in ultimo singultus."

Descriptions of the disease have also been given by numerous other medical writers both ancient and modern; among

doctors, either to find a remedy or reason; but they died, in short, one upon the neck of another, and nobody knew how. *Some went off with gripes and torments, that despatched them in a trice; some with incurable faintnesses and langours, in despite of the physicians; others with vertigo, dimness of sight, suffocations, &c.; some, again, expired themselves in the very office of mourning for the death of others.* The mortality was so great, in fine, that, between break of day and dinner-time, there were swept away by this pestilence seventy thousand persons."—*The Works of Fl. Josephus, by* Sir Robert L'Estrange. London, 1702.

* Celsus de Medicina, lib. iv. chap. 2.

whom may be mentioned Paulus Agineta, Avicenna, Sydenham, Riverius, Hoffman, Cleghorn, Sauvages, and Girdlestone; none of whom, however, appear to have been acquainted with the pure catarrhal cholera.

The too famous epidemic known by the name of the black pest, which desolated Europe in the middle of the fourteenth century, has been supposed to resemble cholera.* It commenced in Upper India and the surrounding provinces, in the year 1346. It consisted of a vomiting of blood, attacked all conditions of people, and proved fatal very suddenly, or in two or three days. It spread from country to country, and within a year it included the whole of Asia. It then spread through Turkey into Greece, Sicily, Italy, and the opposite coast of Africa. In 1348 it had included the whole of Italy, except Milan and some parts of the Alps, and in the same year passed into Germany, Savoy, France, and Spain. In 1349, it had spread over the whole of the middle of Europe, except Brabant, which it affected but little, the north of Africa, England, Scotland, and Ireland; and in 1350 it extended over all the northern countries of the continent.† No accurate description of the symptoms of this epidemic have been preserved, so that we cannot say how far they agreed with those of cholera; but the mode of propagation appears to be similar in both, and it is remarkable that they spread over nearly the same tracts of country, and followed the same direction.

We are told by Sydenham that the cholera morbus prevailed with great severity in the year 1676. Among its symptoms are mentioned copious vomiting, spasms, small pulse, fainting, cold sweat; and the remedy he recommends is laudanum in strong cinnamon-water;‡ which shew that this was not the pure inflammatory cholera, but probably belonged to those mixed cases of the malady which I have described in the following pages, and which are of frequent occurrence in the epidemic visitations of India.

Sauvages defines the cholera to be "la complication de la diarrhee et du vomissement, ou de la diarrhee avec les nausees, ou du vomissement avec les tenesmes;" and he distinguishes no less than ten species, viz. cholera sec, chol. des pales cou-

* I understand that Heeran, the celebrated historian and professor at Gottingen, in a memoir lately read before the Royal Society of that city, but which I have not seen, has proposed the question, "Has the cholera which has reached Europe been known in this part of the world before?" and has given as his opinion, that the only disease which has borne any analogy to it is the pestilence mentioned above.

† See Historia di Matteo Villani, Cittadino Fiorentino, il quale continua l'Historia di Giovan Villani, suo fratello, &c. In Venetia, 1562. Lib. i. c. 1.

‡ Sydenham, Epistolæ de Morbis Epidemicis, &c. London, 1680.

leurs; cholera causé par des mauvais champignons; cholera causé par des poissons fossiles; cholera causé par impoison animal; cholera vermineux; cholera dissenterique; cholera gouteux; cholera crapuleux; cholera spontané, ou cholera morbus de Sydenham." It is impossible to say whether any of these correspond in their symptoms exactly to the catarrhal cholera; but none of them had ever occurred as a wide spreading epidemic.

In the Memoirs of the Italian Society of Sciences of Modena for 1805,* there is a description of cholera by Leopold M. Caldani, which more closely corresponds to the catarrhal form of the disease than any of those we have already mentioned. He says "frequent, unexpected, and impetuous vomiting, accompanied with copious dejections, whereby an individual, although very fat, often becomes lean visibly, so that, reduced as it were to a skeleton, he quickly dies, sometimes with severe abdominal pains, at other times with violent convulsions or seized by syncope, constitute that terrible disease which physicians call cholera morbus, or simply cholera." He points out the impropriety of limiting the term cholera to those cases in which the evacuations are bilious, and adds some interesting cases which appeared to have been produced by unwholesome milk, and in which the evacuations resembled that fluid.

Many of the cases of the very remarkable disease which raged in the Milbank Penitentiary in 1823, and which have been so ably described by Dr. Latham, exactly resemble the catarrhal cholera; nay, we cannot hesitate to consider them as cases of that disease produced by a local cause; and it is therefore necessary to bear in mind that, should the epidemic influence extend to this country, there is nothing in the climate hostile to its existence, or capable of arresting its progress.

The disease also which occurred among the boys of Mr. Day's school at Clapham, in August 1829,† strongly resembled the catarrhal cholera in its symptoms, but dissections proved it to be different; for, instead of the peculiar diseased appearances which are always presented by the gastro-enteric mucous membrane in cholera subjects, and which will be found described in the following sections, the mucous glands of these membranes in the fatal cases at Clapham were enlarged, giving an appearance of tuberculation or pustulation. This disease was caused by foul air from a drain which had been opened near the house, and was of a similar nature to the mor-

* Memorie di Matematica e di Fisica della Societa Italiana della Serenze, tomo 12, parte 2do, in 4to. Modena, 1805. Pp. 204, 224.

† See London Medical Gazette, August 1829.

bus mucosus, as described by Rœderer and Wagler,* which raged at Vienna sixty or seventy years ago. The only analogy which exists between these diseases and cholera is, that they have their seat in the same membrane; but the diseased action is evidently different, as shewn by the secretions which are the result of it; and the enlargement of the mucous glands, which appears to be the proximate cause of the morbus mucosus, has not been observed in cholera.

In New York, and indeed generally in the southern parts of the United States of North America, a disease exactly similar to the milder forms of the catarrhal cholera, is prevalent during the summer and autumn. It usually makes its attack at night, consists of vomiting and purging of thin watery fluids without bile, and produces sudden and great collapse, with cold skin. It has never occurred there as an epidemic, and is in general easily overcome (if combated in time) by means of large doses of laudanum.†

I cannot finish this historical sketch without calling my reader's attention to the following remarkable points of analogy which are observable between different epidemic diseases. 1. Most of them are seated in the mucous membranes. An inflammatory catarrh of the air-passages, accompanied in some instances by looseness of the bowels, occurred as an epidemic throughout nearly the whole of Europe in 1580;‡ another of a similar nature spread over a great part of Europe in 1782;§ and the well-known influenza of 1803 consisted of a catarrh, with inflammation of the mucous membrane of the air-passages.‖ 2. Epidemics have generally proceeded from the east to the west, which was the case with the peste noire, with the catarrh of 1782, with the influenza of 1803, which is said to have stretched from the confines of China to the shores of the Atlantic, and thence across to North America; and the same course is now pursued by the epidemic cholera. 3. All epidemics present the same capricious irregular characters in the mode of their propagation, sparing one spot to appear in a more distant one, following a zigzag course, suddenly stopping, and as suddenly and unexpectedly reappearing,

* Rœdereri et Wagleri, Tractatus de Morbo Mucoso.

† I am indebted for this information to Dr. Revere, whose distinguished talents and long experience in the United States give to his observations the highest value.

‡ Schneider de Catarrhis, lib. iv. cap. 5.

‖ See Hamilton's Description of the Influenza in 1782.

§ Numerous other instances might be stated, did our limits permit: I need only refer to Sydenham's Epistolæ de Epidemicis, Parr's Medical Dictionary, Schneider de Catarrhis, Rœderer and Wagler.

proceeding sometimes slowly, sometimes rapidly, and so forth.*

The following conclusions appear to me naturally to arise out of the preceding details. 1st. That in almost all the European medical works, ancient as well as modern, we only find descriptions of the inflammatory and mixed forms of cholera; and that we must therefore conclude that these have, at all times, been the most prevalent kinds of the disease in this quarter of the globe. 2. That the catarrhal cholera (viz. that which is now gradually approaching from India,) has never before made its appearance in the form of an epidemic in Europe; but that sporadical cases have been occasionally observed and described in different European countries, and also in the United States of North America. 3. That epidemic cholera is not contagious,† but exactly resembles other epidemics in the mode of its propagation, and in its general features.

Symptoms.

The epidemic cholera does not always present exactly the same symptoms, and almost every visitation has been observed to be characterized by a certain type: sometimes there is great vomiting and purging, at other times, one or even both of these symptoms have been entirely wanting; spasms have, in certain instances, been unusually severe; very frequently however, and especially among the natives, they have not occurred at all; great pain and burning at the epigastrium have been constantly observed by some practitioners, while others have found them to occur but seldom. It is evident, therefore, that a description of the disease, which had been drawn from a single visitation, would, in all probability, be quite inapplicable to many of its varieties, and that, in order to arrive at accuracy, we must study the numerous features it has assumed at different times and places. By analysing its phenomena from a multitude of examples, we shall be able to determine their simplest form, and (as it were) the essence of the disease, thus employing a similar method to that which we would adopt in any other question in physics.

The epidemic has sometimes been confounded with common cholera morbus; but it will be hereafter shewn that these are

* "Adeolento tracto morbi epidemici integras interdum regiones pervagantur, ut presso quasi pede eorum vestigia legere et consectari nobis liceat. Neque vero ventorum iter aut linearum quamdam rectam sed alios tramites, nondum satis extricabiles, lineamque obliquam sequuntur, factis interdum in progressu saltibus."—Rœdereri et Wagleri, *de Morbo Usu*, sect. 1.

† This important question shall be fully discussed in a future section.

very distinct diseases, although they have been sometimes met with in the same visitations, and even combined together in the same case, thus giving rise to a mixed form of the disease. Different names have been applied to them, but the correct appellations would be catarrhal cholera for the former, and inflammatory cholera for the latter, (*cholera catarrhalis* and *cholera pyretica*:) the reason for which can only be understood after we have studied their symptoms and pathology.

I will first give a simple list of all the symptoms of the epidemic, and will afterwards make observations on each of them, describing their varieties and relative importance, and shall thus be enabled to present a detailed account of all the forms of the malady. I have attempted to place the symptoms, as nearly as possible, in the order in which they usually succeed each other; but many of them being often synchronous, and the disease being sudden in its attack, and rapid in its progress, a mere approximation is here all that can be expected; perfect accuracy, in such circumstances, being out of the question.

1. *Premonitory symptoms.* General uneasiness, lassitude, depression of spirit, and anxiety; simple looseness of the bowels. 2. Vomiting and purging of a sero-fibrinous fluid. 3. A subduing feeling of exhaustion and sinking; jactitation. 4. A sense of uneasiness, burning, and pain at the epigastrium and in the belly. 5. Spasms. 6. Pulse small and accelerated, and at length ceases in all the external parts. 7. Skin becomes gradually colder, and is sometimes covered with a profuse cold sweat, or clammy moisture. 8. The whole surface of the body appears collapsed, the lips become blue; the nails present a similar tint; and the skin of the feet and of the hands becomes much corrugated, and exhibits a sodden appearance; the features of the face collapse; the eyes sink in their orbits, and are sometimes covered with a tenaceous film; the corneæ become flaccid, and the whole countenance assumes a cadaverous aspect strikingly characteristic of the disease. 9. Thirst. 10. Tongue moist, whitish and cold. 11. No urine or saliva. 12. Voice feeble, hollow and unnatural. 13. Occasionally deafness, and tinnitus aurium. 14. Respiration slow, sometimes oppressed, and breath cold. 15. If blood be drawn, it is dark-coloured, or nearly black, thick, ropy, and in many instances does not separate into serum and crassamentum.

It is worthy of remark, that the disease has been found generally to take place at night, or early in the morning, and death usually occurs within eighteen or twenty hours after

the commencement of the attack, and often in a much shorter time.

It is seldom that all the symptoms mentioned in the preceding list have been present in one case; many of them are generally wanting; and cases have sometimes occurred which have proved fatal in a very short period, and in which the only symptoms were anxiety, a subduing sense of sinking, exhaustion, and death. Such, however, are rare, and few cases can be brought forward in which neither vomiting nor purging was present.

1. Although the attack is often very sudden, and without any premonitory symptoms, yet it has generally been observed to be preceded by some of the following: anxiety, with a general uneasiness and depression of spirits, nausea, griping and looseness of the bowels, a sense of debility, and coldness of the skin. No one has studied the premonitory symptoms of the disease so closely as Mr. Annesly, and I hope, therefore, that no excuse will be considered necessary for quoting his observations on this important subject, in his own words. He says, "A practitioner possessed of true professional tact will discover in the countenance of the patient the earliest changes which mark the approaching invasion of cholera. The features are expressive of something approaching a state of anxiety, although the patient himself may not be aware of his state, or even that he is at all ailing. If the medical attendant inquire how he feels at this time, he generally answers, "very well;" but, if pressed upon the subject, he acknowledges that he experiences feelings which he cannot distinctly describe, though he feels neither pain nor sickness. His spirits are however low, and there is sometimes a clammy moisture on the skin, and the pulse, though occasionally full and strong, is evidently oppressed and labouring. It is not, however, that kind of pulse which will attract particular attention, unless we are upon the alert for this disease; but, being prepared for such a visitation, it is impossible to mistake it." However much we may be inclined to value the slightest knowledge of any symptoms which might enable us to detect the approach of this dreadful malady, it must at the same time be confessed that the preceding, copied from Mr. Annesly's work, are so obscure and indefinite, that they may easily elude the most vigilant observer. But they are often combined with others which cannot be mistaken; for "during this stage, Mr. Annesly adds, "the patient feels considerable nausea, and has his bowels more freely moved than usual; but the stools then generally consist of such matters as have been lodged in the large intestines, and consequently they

present various appearances, according to the state of the digestive organs at the time of invasion. The patient, however, often complains of no actual pain, even on pressure made upon the abdomen, either in this or in the subsequent stage, but what is the result of spasm in the latter. He feels chiefly a great degree of exhaustion, and inability to make the least exertion. Colicky pains are frequently felt in the belly, but they often pass off, or are relieved by pressure, and the free evacuations which take place in this stage. The urine, in the period of invasion, is often in small quantity, and seldom voided. In this stage of the disease, and indeed through its whole progress, in many cases, the abdomen is more than usually tumid,* evidently from congestion of the viscera lodged in this cavity.

A very common mode in which the disease commences is by a simple looseness, or diarrhœa, unaccompanied by spasms or pain, which continues for some hours, or even for a day or two, before any of the more violent symptoms develop themselves.†

The attack is sometimes so very rapid that no premonitory symptoms can be observed, and cases have been recorded in which a patient has been seized instantaneously when going about his usual avocations, apparently in a perfect state of health. Mr. Scot supposes that the disease is always of sudden invasion. Mr. Orton says, "the attack of cholera is usually sudden and violent, but, in a great majority of instances, not without some premonitory symptoms;" while Mr. Annesly, on the other hand, asserts that "there are premonitory symptoms, and these of a pathognomonic kind," and that the appearance of a sudden invasion, in some cases, has arisen merely from the patient having not been seen till towards the second stage, when the disease had begun to be formed. I have had occasion, repeatedly, in my own practice, to observe the symptoms which I have mentioned as being indicative of an approach of the disease; but while I agree so far with Mr. Annesly, I conceive that there can be no doubt of the disease being, in many cases, very sudden in its attack; for my own experience not only affords proofs of this, but numerous others might be adduced in support of it, from the reports of the medical officers of all the three Residencies in India.

* But, so far from this being a common symptom, we find it stated in the Report of the Madras Medical Board, that "the abdomen has sometimes been observed to be tumid, but more frequently drawn towards the spine."

† Numerous cases of this description are mentioned in the Madras Report, and many have fallen under my own observation.

2. It often happens that the disease commences at once with a sudden evacuation of all the contents of the bowels, by purging, followed by a repeated discharge, at very short intervals, of a peculiar watery fluid, which in many cases escapes involuntarily on any change of position. There is seldom much griping in this variety, although the calls are frequent and irresistible: the dejections, in general, flow without difficulty or any effort, but sometimes they are thrown out with great force, as if from a syringe. There is sometimes no purging, and the absence of this symptom is supposed by Mr. Scot to denote a peculiar malignancy of the attack.

Vomiting, although a common, is by no means an invariable, symptom of cholera. I have seen cases in which it was entirely absent, and it often occurs only at the commencement of the attack, but soon ceases; the stomach then receiving, and retaining, whatever is poured into it, as if it were a dead substance. The cases in which vomiting has been most urgent have always been found to be less malignant than those in which it was slight, or altogether wanting.

After the first evacuations of the stomach and bowels, of the usual contents, the discharges always consist entirely of a peculiar fluid, which has been very appropriately named the cholera secretion, and is very characteristic of the disease. Although it varies sometimes in its external characters, it has always (as we shall more particularly point out hereafter,) the same chemical composition, consisting of serum and fibrin. In general the fibrin floats in the transparent serum in the form of flakes, or is equally diffused through it, when the whole has a whitish colour, and resembles rice-water.* Sometimes the fibrin occurs in a larger proportion, is intimately mixed with the serum, and forms a variety of the fluid which has somewhat the appearance of chyle, milk, or pus.

In many cases, the cholera secretion, under one or more of the forms just described, is evacuated in prodigious quantity; and "were it uniform," says Mr. Scot, "it might afford us an easy solution of the debility, thirst, thickness of the blood, and other symptoms; but it is unquestionable that the most fatal and rapid cases are by no means those which are distinguished by excessive discharges. We have innumerable instances, on the contrary, of death ensuing after one or two watery stools, without the development of any other symptom

* This has given rise to the vulgar term for the secretion in India, viz. "conjee evacuations;" conjee being the Hindoostanee word for rice-water; and so well aware is every one of the characteristic nature of this fluid, that, whenever the evacuations of a patient are observed to consist of it, no doubt any longer remains of the disease being cholera.

affecting the natural functions. Even collapse has come on before any evacuation, by stool, had taken place." It is worthy of remark, however, that the absence of vomiting and purging, in such cases, is not owing to the total absence of the morbid secretion in the alimentary canal, but entirely to the inability of the stomach and intestines to throw it off. I will shew, when treating of the ratio symptomatum of the disease, that, in those cases in which there was no vomiting or purging, the stomach and intestines were found, after death, to be loaded with the cholera fluid; and had post-mortem examinations been always made in such cases, I am sure that no one would have expressed any surprise at their malignancy; for it is probable that the secretion would have been found even more abundant in them than in ordinary cases. I wish it to be understood, then, that a fluid consisting of serum and fibrin is secreted by the mucous membrane of the stomach and bowels, in all cases of cholera, and is either discharged by vomiting and stool, or retained in the alimentary canal, till the fatal termination of the disease.

The evacuations have been frequently observed to be turbid, and to have a grey, green, or yellow colour, but these appearances can be always traced to the admixture of calomel and other medicines, given for the cure of the disease, and are accordingly never observed at the commencement, but only after the attack has made some progress, or when it has begun to yield. Mr. Annesly has shewn, by experiment, that calomel produces a grey colour when mixed with the secretion, and that when bile is also added, a green colour is the result. Blood is sometimes mixed with the evacuations; but this is of rare occurrence, and is probably to be attributed to the rupture of small blood-vessels, occasioned by the great commotion in the alimentary canal. The preceding description, therefore, may be considered as universally applicable to the cholera secretion, except in a few cases, in which its external characters are altered by extraneous circumstances. The evacuations are always without any admixture of bile, the reappearance of which is considered a certain symptom of returning health.

3. One of the most distressing symptoms of cholera is a subduing sense of exhaustion and sinking, which often comes on at the very commencement of the attack, immediately after the first evacuations. The patient is generally overwhelmed with great depression of spirits, is listless, impatient of disturbance, and averse to speak; but it is very remarkable that his mind still remains clear, and he retains the power of expressing his thoughts, almost to the last moment of his exis-

tence. Jactitation, which occasionally occurs, and has been observed more frequently in Europeans than in the natives of India, is always to be regarded as a most alarming symptom.

4. Burning and pain at the epigastrium have been very common symptoms in some visitations of cholera, and Mr. Annesly tells us that he never saw a case of the epidemic in which they did not exist. In the cases which have come under my own observation, however, they have, I think, been more frequently absent than present; and in the Report published by the Madras Medical Board, we are told that not only in individuals, but also in epidemic invasions, these symptoms have been altogether wanting. When present, they are often accompanied with pain at the umbilicus, and are generally connected with thirst. In many cases, I have observed that this burning sensation and thirst have not occurred till after the disease has continued for sometime; and I have been inclined, in such cases, to attribute them to the active stimulating medicines which had been poured into the patient's stomach. But this explanation will by no means apply to all cases; for these symptoms frequently make their appearance at the very commencement of the attack, and are then probably owing (as I shall more particularly explain hereafter) to spasms in the stomach and bowels, or to inflammation. The agonies which these symptoms occasion are sometimes most excruciating; but this is seldom the case in the most dangerous form of the disease.

5. Spasms were of such general occurrence in the first visitations of cholera, in 1817 and 1818, as to confer on it the specific name "spasmodic;" but since then, in a great proportion of cases in India, they have been completely wanting. They are generally present in those cases in which there is active vomiting and purging, and appearance of irritation in the alimentary canal, and pain and burning at the præcordium; and they occur more frequently in the robust than in the weak and debilitated, and in European than in native patients.

All the voluntary muscles are liable to be affected by the spasms, but those of the legs and feet are most obnoxious to them. They often extend to the muscles of the abdomen and chest, but seldom attack those of the back, loins, or face. They are sometimes of a tonic, sometimes of a clonic character, and are generally attended with very great pain. Even when there are no spasms or actual pain, the patient is often very restless, tossing about, and appearing to suffer great agony.

Cases accompanied by violent spasms are by no means the

most dangerous; and it has been very truly remarked by Mr. Scot that the worst variety of the disease "is that which is noted for the very slight commotion in the system, in which there is no vomiting, hardly any purging, perhaps one or two loose stools, no perceptible spasm, no pain of any kind; a mortal coldness, with arrest of the circulation, comes on from the beginning, and the patient dies without a struggle."

6, 7, 8. None of the symptoms of the epidemic cholera are so truly characteristic and invariable as those which depend upon the retreat of the blood from the surface of the body, including smallness or loss of pulse, collapse, and coldness of the skin. However much they may vary in degree, or in the time of their appearance, they are never wanting in the advanced stage of the disease; and it is only in such cases as are cut short by remedial measures being soon adopted, and consequently in which these symptoms have not time to develope themselves, that they do not occur at all.

The pulse is generally small and accelerated from the commencement; and as the disease advances it gradually diminishes in size, and at length ceases in all the external parts. Sometimes the diminution or loss of pulse is rapid, especially after sudden and copious evacuations of the cholera secretion, by vomiting and stool. On the other hand, it sometimes happens that it is full and strong at the commencement, and diminishes only after the disease has made some progress. Such cases are most frequent among strong plethoric Europeans; and indeed have been seldom observed in the natives of India, owing probably to their vegetable diet, and their abstinence from fermented liquors, rendering their frames less prone to irritation. It is very remarkable that the pulse is often imperceptible for hours before the death of the patient, while at the same time his mind continues clear, and his voluntary muscles obedient to his will: and "instances are not wanting," says Mr. Scot, "of patients being able to walk, and to perform many of their usual avocations, even after the circulation has been so much arrested that the pulse has not been discernible at the wrist: the cases here alluded to are those chiefly in which it has begun by an insidious watery purging; and many lives have been lost in consequence of the patients, under these fallacious appearances, not taking timely alarm, and applying for medical aid."

A species of cholera, known by the name of cholera morbus, differs completely in its symptoms from the usual cases of the epidemic; being characterized by a full strong pulse, severe spasms, pain at the præcordium and in the bowels, and bilious vomiting and purging. It is a much less dangerous disease

than the epidemic, is common in other countries as well as in India, and is probably owing to inflammation of some part of the gastro-enteric mucous membrane. Although it shall be more particularly described hereafter, I have thought it necessary to notice it also at present; for it has been observed to prevail during some visitations of the epidemic; and cases have often occurred in which the symptoms of the two diseases have been combined; the attack having commenced with a full strong pulse, hot skin, and active vomiting and purging of bilious matter, and afterwards degenerated into the more dangerous form, accompanied by loss of pulse, collapse, and sero-fibrinous evacuations. It is of much importance that these symptoms should be carefully attended to, since they require alteration in our plan of treatment.

Nothing in this disease arrests the attention of the bystander so forcibly as the sudden change which takes place in the external appearance of the patient's body. The blood being withdrawn from the surface, occasions a collapse or contraction of all the soft parts; the skin of the extremities becomes shrivelled; the hands have a sodden appearance, as if they had been long soaked in water; the bones in different parts of the body project much more than usual; the features of the face shrink, and their expression is completely altered. Often have persons been horror-struck at seeing their friends, whom they had left probably not more than an hour or two, so altered that they could scarcely be recognized, with death marked in their face in the most fearful characters, the cheeks sunk, the lips shrunk and bloodless, the nostrils contracted, the cheek bones projecting, the eyes sunk in their orbits, with their surface glossy and dimmed, and the brow white and covered with a cold dew. The whole body is at the same time deadly cold, yet the patient complains of feeling hot, and is unwilling to be covered with the bedclothes. Cases have been recorded in which there was no diminution in the heat of the skin, and it has sometimes happened that an increase of temperature has taken place just before death. But it has then been confined to the head and trunk, and has been almost always found to be a fatal symptom, being unconnected with any improvement in the circulation, or in the functions of the lungs. In general, slight coldness of the surface occurs at the very commencement, and gradually increases as the disease advances. Sometimes it is not developed until the malady has made some progress, and cases have not been uncommon in which the attack has been ushered in with a hot skin, and increased action of the circulation. But when the

disease has not proved very suddenly fatal, or has been quickly arrested by medicines, this symptom has almost always occurred in the advanced stage.

The state of the perspiration is more variable than that of the temperature of the body. In many cases it is profuse and watery; sometimes it is scanty, and of a clammy nature; it is often confined to the face or brow; and cases have occurred in which it has been entirely wanting. It is always cold, and I have sometimes observed it to have a peculiar cadaverous smell.

9, 10. Thirst is not a very common symptom at the commencement of the disease, except in those cases in which there is pain and burning at the præcordium, and other symptoms of inflammation. Its occurrence in the advanced stage of the common cases of the epidemic have been supposed to be owing (not without reason, I think,) to the large quantity of stimulating medicines which are usually administered. It is often present when the mouth at the same time is moist and cold.

11. The moisture of the mouth in this disease does not appear to proceed from saliva, (the secretion of which is arrested,) but to the peculiar fluid which is thrown out by the mucous membrane of the mouth, in common with all the other mucous membranes of the body. No urine is secreted during the continuance of the disease, no bile, and in fact no fluid, except the cholera secretion. The urinary bladder is often found to contain a fluid secreted by its lining membrane, and similar to that expelled from the alimentary canal. The reappearance of urine, or bile, is always considered as a decided indication of returning health.

12. In the advanced stage of the disease the voice becomes altered, hollow, feeble, and unnatural; but it is surprising how distinctly the patient is able, in many cases, to articulate until within a few minutes of his end, and long after his pulse has become imperceptible.

13. Deafness, and tinnitus aurium, are mentioned by some authors as of very frequent occurrence, but I scarcely ever observed them in my own practice. They are probably present only when there is much congestion in the vessels of the brain. Vertigo is not uncommon, and sometimes occurs at the very moment of seizure, in rapid cases of the disease. Coma has been mentioned as not an unusual symptom. It may have occasionally occurred towards the fatal termination, but it is certainly not common; for, although the patient is generally in a dozing state, with slow breathing, and is

very unwilling to be disturbed, yet, when roused, his mental faculties are quite collected, and he answers distinctly any questions put to him.

14. The respiration is generally slow, sometimes oppressed and irregular, occasioning great distress to the patient. The breath is usually cold; and it would appear, from the experiments of Dr. DAVY, that it contains less carbonic acid than in a state of health. In cases where there is no spasm, the mechanical part of respiration continues to be performed to the last, only becoming gradually slower.

15. The state of the blood in cholera has universally excited the utmost attention. In well-marked cases of the epidemic, it may be said to be invariably of a dark colour, in the arteries as well as veins; and, next to the peculiar secretion from the mucous membranes, this is probably one of the most constant symptoms of the disease. But it is not at the very commencement of an attack that this change in the colour of the blood is observed, and it does not arrive at its greatest intensity until the disease has made some progress. Besides having a dark, and in many instances an almost black colour, it also undergoes other important changes: sometimes it is thick, like tar, sometimes thin and watery; it always flows with difficulty, and seldom separates into serum and crassamentum, remaining in a perfectly fluid state, or acquiring the consistence of liquid honey, or of tar. Although these changes are less in some cases than in others, yet I believe the blood is invariably darker coloured than in health. This being also observed, however, to take place in various other diseases in India, such as certain cases of fever, rheumatism, &c., it will not alone serve as a diagnostic symptom of cholera. Mr. Scot says, "The blood is generally found to be less changed in appearance in those cases of cholera which have been ushered in with symptoms of excitement, than where the collapsed state of the system has occurred at an early period." I have observed in my own practice, and it has also been often observed by others, that, upon venesection, the blood very often becomes lighter coloured, and more healthy in its appearance, as it continues to flow, accompanied at the same time with an evident amendment in the general state of the patient.

Such then are the symptoms of epidemic cholera, a disease which, if left to take its course, is generally fatal; nay, in many cases, if proper remedies be delayed even an hour or two, the patient's fate is sealed. More rapid in its progress than plague, often more cruel in the tortures it inflicts upon its victims, it has in many countries, when not arrested by

the skill of the physician, cut off thousands and tens of thousands, in a fearfully short time. But it is consoling to know that medicine has the power, in a large proportion of cases, to subdue it; and perhaps never has the triumph of the medical art over disease been so conspicuous as in epidemic cholera; it may be said, with truth, that it has plucked thousands from the jaws of death, for death is the ordinary termination of this dreadful malady, when not counteracted by art.

It has been already mentioned that cases of cholera morbus have sometimes accompanied visitations of the epidemic, and that the two have been occasionally conjoined; thus producing modified forms of the disease, which will now require to be described.

Cholera morbus is a well-known disease in all countries: its symptoms are—pain and burning in the stomach and bowels; pulse strong and full; bilious vomiting and purging; spasms; hot and dry skin; great thirst; anxious, distressed, and flushed countenance. The efforts to vomit are strong, irresistible, and painful, but they produce only scanty evacuations, which consist almost entirely of bile; the purging is also painful, and the stools contain nothing but bile, with sometimes a little blood. The pain in the stomach and intestines is generally excruciating, and is accompanied by severe spasms, which also attack the muscles of the legs, and sometimes almost all the voluntary muscles of the body. The thirst is constant and burning, and is not alleviated by any kind of drink, which is immediately rejected by the stomach. The countenance is flushed, expressive of great pain, and the eyes are generally inflamed. The blood flows freely from a vein, is not darker than usual, and separates readily into serum and crassamentum. Returning health is indicated by the pulse becoming soft, by perspiration bursting out upon the skin, and by the evacuations becoming more copious, less bilious, and expelled with ease, and without pain. All these symptoms are exactly the reverse of those I have already described as belonging to the epidemic cholera.

The combination of the two diseases may give rise to two principal modifications: first, the attack may be ushered in under the form of cholera morbus, and may degenerate into that of the epidemic; secondly, the symptoms of the two may be combined throughout the case, and thus modify each other. Both have been noticed by different authors who have treated of cholera; but having been entirely overlooked by others, we may conclude that they have not been of very frequent occurrence.

The first modification is described in Mr. ORTON's work on Cholera, in the following words: "I have found a very considerable number of cases," says he, "exhibiting singly, or in partial combination, every possible degree, and almost every kind, of increased action. Spasms, such as not to fall short of the highest degree of tetanus; retching, and spasms of the intestines equalling colica pictonum; very full, hard, and quick pulse; hot skin and flushed surface; evacuations of bile, both by vomiting and stool, from the commencement of the attack. And, finally, I have seen some of these cases passing into the low form of the disease; the circulation passing suddenly from extreme strength to extreme weakness; the skin, from being hot and dry, becoming deadly cold, and bathed in sweat; and the increased flow of bile succeeded by white stools and vomiting, clearly indicating the total suppression of that secretion." Nothing can be more distinct than this description; in the first part of which we find the most marked features of cholera morbus, and in the latter part the no less characteristic symptoms of the epidemic; and it could not have been stated in clearer terms, even had it been given for the express purpose of illustrating the views I have taken of the disease. In some cases the symptoms of the cholera morbus continue but a very short time; a few bilious evacuations, and a quick hard pulse, being soon replaced by watery stools, a small pulse, collapse, &c., and the disease becoming thus converted into the usual form of the epidemic.

The symptoms of the second modifications, or of those cases in which the two diseases are blended together, vary considerably, according as the one or the other predominates. If the discharges are not very copious, the pulse generally keeps up, and the skin continues warm; but, as soon as the evacuations become watery, and the true cholera secretion makes its appearance, then the blood retreats from the surface towards the viscera, the skin becomes cold, the pulse small, and collapse takes place. Sometimes the pulse has continued pretty full, and the skin hot, when there has been no bile in the evacuations. Sometimes the evacuations are more abundant than in common cases of cholera morbus, and contain a good deal of serum, but are at the same time mixed with bile; the heat of the skin suffers little diminution, and the pulse is variously affected, being occasionally quicker and smaller than usual, and in other instances continuing soft and full. Cases, again, have been met with in which there was no vomiting, but constant purging, and in which the skin continued hot, and the pulse but little affected. It would be

endless, however, to mention all the varieties which have been observed in different visitations of the disease.

All these mixed cases are less dangerous, and less rapid in their progress, than the pure catarrhal cholera, and are much more frequent among the robust and plethoric than among the weak, and, consequently, among Europeans than among natives of India.

Dr. Monat describes* a visitation of cholera which occurred in his Majesty's 14th regiment, at Berhampore, in March and April 1828, which affords a good example of the manner in which the inflammatory and catarrhal cholera are sometimes blended. Many of the cases were of the pure catarrhal form, the attack having been sudden, the evacuations copious and without bile, the pulse small or imperceptible, and the skin cold and shrunk. There appears to have been no unalloyed case of the pure inflammatory cholera, but numerous cases partook of many of the characters of that disease, some or all of the following symptoms having been present: pain at the præcordium, or in the belly, purging and vomiting of bilious matter, skin hot, pulse quick; and these were either accompanied or followed, unless the disease was soon checked by medicine, by the more characteristic features of the catarrhal cholera. The latter was by far the more fatal form of the disease; "but," says Dr. Monat, "several with bilious vomiting terminated fatally."

It is to be regretted that the author has given a very imperfect description of the post-mortem appearances, and he has given none of his cases in detail; but I have selected a few from a short abstract at the end of his memoir, and have inserted them in the appendix, in order to shew, as far as possible, the nature of the symptoms by which these mixed cases were characterised.

Cases have sometimes occurred in which the catarrhal cholera has been followed by inflammation, and at length by ulceration, or other organic lesions of the bowels; but which have been very rare, having not been even mentioned by the greater number of writers, and I know no author who has described them in detail except Mr. Jameson. I will therefore give that author's description in his own words.

"When the disease," he says, "ran its full course with Europeans, and with natives of robust athletic make, the following appearances generally presented themselves. What may be termed the cold stage, or state of collapse, usually lasted from twenty-four to forty-eight hours, and was seldom

* Transactions of the Medical and Physical Society of Calcutta, vol. iv.

of more than three complete days' duration. Throughout the first twenty-four hours, nearly all the symptoms of deadly oppression, the cold skin, and oozing of clammy sweat from every pore, the feeble pulse, occasional vomiting, purging, and cramps, the thirst, and anguish, continued undiminished. Then the system shewed symptoms of revival, the vital powers began to rally, the circulation and heat to be restored, and the spasms, sickness, and desire to go to stool, to be considerably lessened. The warmth gradually returned, the pulse rose in strength and fullness, and then became sharp, and sometimes hard; the tongue got more deeply furred; the thirst continued, with less nausea; the stools were no longer like gruel, or rice-water; they usually, between the third and sixth day, became first brown and watery, then dark-green, black, and pitchy, and the bowels, during many days, continued to discharge immense loads of vitiated bile, until, with returning health, the secretions of the liver and other viscera gradually put on a natural appearance. These discharges were generally hot and acrid, and passed with griping and tenesmus. Sometimes they were of a bright-yellow colour, and the surcharge of bile was so great as to be ejected in a pure stream from the stomach. It was remarked that, when the motions consisted of a chocolate-coloured fluid, with flocculi swimming in it, the patient rarely recovered.

"The fever, which almost invariably attended this second stage of the disease, may be considered to have been rather the result of an effort of nature to recover herself from the rude shock which she had sustained, than as forming any integrant and necessary part of the disorder itself. It partook much of the nature of the common bilious attacks of these latitudes. There was the hot dry skin; the foul, deeply-furred, dry tongue; parched mouth; thirst; sick stomach; depraved secretions; restlessness; watchfulness; and quick, variable pulse; sometimes with delirium, stupor, and other marked affections of the brain.

"Generally, when the disorder proved fatal, after reaching this stage, the tongue, from being cream-coloured, got brown, and sometimes black, hard, and more deeply furred; the teeth and lips were covered with sordes; the state of the skin varied, chills alternating with heats; the pulse became extremely quick, weak and tremulous; hiccough, catching of the breath, great restlessness, and deep moaning succeeded; and the patient soon sunk, incoherent and insensible, under the debilitating effects of low nervous fever, and frequent dark, tarry, alvine discharges.

"In other cases, this secondary period ran a somewhat

different course. As the action of the heart and arteries was renewed, and the natural warmth of the body returned, an unusual degree of energy succeeded. The brain was evidently affected, and the patient was quite insensible to the great danger into which he had fallen. The pulse rose as high as 120; great heat, especially over the large cavities, was complained of. There was extreme agitation and distressing thirst. The patient continually called for cold water, to relieve the burning sensation of the abdomen. Sometimes a warm perspiration broke out near the wrists and forehead, which afforded temporary relief to his sufferings. To this state of excitement, that of collapse quickly succeeded. There was then great prostration of strength, the bowels became quite torpid; severe pains occurred low down in the abdomen, near the site of the rectum, which were always aggravated upon stools being procured by medicine. The state of the stomach now excited surprise; its natural irritability was entirely gone, and the most nauseating medicine could be poured into it without exciting vomiting. It rarely occurred that the patient survived the great sinking produced by this stage; and even when good fortune, and the strength of his constitution, carried him through it, he suffered long after from debility and disordered bowels."*

I will here recapitulate some of the most important facts detailed in this chapter, in order to bring them at once plainly before the reader. 1. There are two distinct kinds or species of cholera, viz. the catarrhal and inflammatory (cholera catarrhalis, and cholera pyretica.) The most constant and characteristic symptoms of the former are copious discharges by vomiting and stool of a sero-fibrinous fluid; retreat of the circulating fluid from the surface towards the viscera; dark coloured blood; collapse; cold damp skin. The symptoms of the latter are vomiting and purging of bile; pulse full and hard; skin hot and dry; spasms. 2. The catarrhal cholera is the most common form of the disease in epidemic visitations, and is much more dangerous than the other. 3. The inflammatory sometimes degenerates into the catarrhal cholera; and the two are occasionally combined in the same case.

Prognosis.

Little need be said under this head, after the numerous observations I have already made upon the nature of the different symptoms. When an attack commences with symptoms

* Bengal Report, pp. 53—56.

of inflammatory cholera, or with increased action of the circulation, and the patient is seen before the violent symptoms of this form of the disease, such as severe vomiting, pain, heat of skin and spasms, give way to collapse, the case may be considered completely within the reach of art; but when these symptoms begin to pass off, and to be followed by cold skin, shrunk features, loss of pulse, watery purging, &c., the case must be considered as one of great danger, and requiring the most prompt measures. In the true catarrhal cholera every moment is of importance, and the shortest delay may seal the fate of the patient; for if he be seen before the blood has left the surface to accumulate about the internal viscera, before the pulse has ceased at the wrist, and the skin has become cold, we may entertain great hopes of being able to overcome the malady. But if the pulse has ceased, the skin become cold, the features shrunk, and the vomiting and purging have stopped, then our prognosis must be bad indeed.* Even such cases, however, must not be abandoned; I have seen many of them brought round by energetic measures. It must be evident, from all that has been said, that the diagnosis, in cholera, must be principally derived from the pulse. If we find it to increase in strength and size, there is cause for hope; and if this favorable symptom be accompanied by the restoration of warmth on the surface, and the reappearance of the secretion of urine and bile, the patient may be considered safe, although still requiring the most watchful care to prevent a relapse; for a draught of cold water, or exposure to external cold, have sometimes been known to cause a renewal of the disease, after the patient had been considered out of danger.

Autopsy.

It is a prevalent opinion that no post-mortem appearances have been observed in cholera, which could enable us to infer what were the diseased actions which had existed during life, and had constituted the disease. I apprehend, however, that, in many dissections, the examination of the various important parts of the body has been very partial,†

* Mr. Scot says, "The danger of cholera may thus be said to be manifested, not by the violence of morbid actions, but by the diminution or cessation of natural actions." This however is only apparent; for, if we look below the surface, we find that the danger may be measured by the violence of that morbid action which we have shewn to constitute the disease, viz. the catarrh of the mucous membranes, while most of the other natural functions are diminished.

† A medical friend once told me that he had opened the bodies of several subjects who had died of cholera, but that he had found no morbid appearances which could account for the disease. Upon asking him whether he had exa-

and that the nature of some of the morbid appearances has been misunderstood.

It is well known that different visitations of cholera have been characterized by the unusual prevalence, or predominance, of certain symptoms; that Europeans, from their plethoric and irritable habits, are more liable to that type of the disorder which is distinguished by pain and burning at the stomach, violent spasms, and which is sometimes ushered in by increased action; and, lastly, that the abstemious Hindoo is particularly subject to the low and most dangerous form of the malady. It is quite evident, therefore, that if any one derives his notions of the autopsy of the disease from his own observations alone, from one visitation, or from one class of patients, they are most likely to be imperfect or erroneous; and that the only method of arriving at correct views of its pathology is to examine carefully the morbid changes that have been produced by it, in all its forms, in every description of patient, and at different times and places. But it is unfortunate that medical men have often been prevented from ascertaining the morbid changes produced by the disease in the bodies of native patients, by the religious prejudices of the Hindoos and Mahometans against dissection.

I was enabled to obtain an accurate knowledge of the post-mortem appearances in native subjects, when civil-surgeon at Darwar, where my favourable situation, and the assistance I received for this purpose from the civil authorities, afforded me an opportunity of making numerous dissections.* I have consulted Mr. Annesley's work with much advantage, in reference to the morbid changes observed in the bodies of Europeans; have examined all the pathological details contained in the Madras and Bengal Reports, and in other works on Cholera, and can therefore confidently affirm that the following observations may be depended upon as being perfectly accurate.

Many of the morbid changes which have been described

mined the mucous membranes carefully, he said that in no case had he thought of looking at any one of them. This plainly shews that the autopsy of cholera has not received that degree of attention which it deserves. We sometimes find it stated, in the relation of cases, that no morbid appearances could be detected on dissection sufficient to account for the death of the patient; but if the mucous membranes, and perhaps also other important organs, were not examined, of what use is such an observation?

* "Dissections have been chiefly made on the bodies of European soldiers, a class of men acknowledged to be peculiarly liable in this climate to visceral disease of all kinds. Under these circumstances, dissection reports should be received with care, in reference to the general states of morbid bodies, and with the most attentive consideration of the precise import of the terms employed." —*Madras Report.*

by different authors are by no means uniform, and, excepting a few connected with the mucous system, and with the state of the blood, none can be said to be invariable.

Encephalon. Great congestion in the veins and sinuses of the brain, and of its membranes, has been generally observed in post-mortem examinations in this disease. Cases have been mentioned in which the tunica arachnoidea has been found thickened, and adhering to the adjacent membranes, and in which the substance of the brain has been soft and pulpy;* and a gelatinous or serous effusion has been often observed in the ventricles and between the membranes. Traces of inflammation are said to have been seen in the brain, in the tuber annulare, or in the spinal marrow; but they could not be detected in any of the cases that have fallen under my own observation; they are not mentioned by Annesley, or in the greater number of Reports sent by medical officers to the Medical Boards, and must therefore be considered as not belonging at all to the disease, or to be of very rare occurrence. Of all these morbid appearances, venous congestion is the most frequent; but it also is sometimes wanting, many cases having been observed in which the contents of the cranium have been in every respect perfectly healthy.

Thorax. No changes of any importance have been observed in any of the serous membranes of the thorax. A good deal of venous congestion has been generally found in the lungs; and their substance has often presented a bruised, hepatised, or fleshy appearance. They have been described by some authors to have been shrunk and drawn back, as it were, to the spine; but this could not have taken place during life, but at the time only when the thorax was opened; for it is impossible to conceive that the lungs could have exerted a power sufficient to overcome the whole weight of the atmosphere, and to leave the cavity of the pleura empty; or if, on the other hand, this cavity had by any means become distended with air, suffocation must have instantly been the result. I will defer saying any thing of the state of the mucous membrane of the lungs, until I come to treat of the morbid condition of the mucous membranes generally.

The large vessels leading to the heart, and the right auricle and ventricle, have almost always been found gorged with black blood, which has also, in some instances, extended to the left auricle. Here will be the proper place for describing

* This appearance has not fallen under my own observation, and is probably of rare occurrence.

those extraordinary changes in the blood which form one of the most important and prominent features of the disease, and which are perhaps always present in the latter stages. The following are the results of my observations on it, as drawn by venesection, by leeches, or as seen after death, in a great variety of cases. Sometimes it has been perfectly black, of the consistence of liquid honey, or forming a uniform coagulum after a few minutes' exposure to the air; and these appearances it has retained for twenty-four hours, without separating into serum and crassamentum. In some cases it has been darker than usual, has not become fluid, but has coagulated, and separated a good deal of serum. I have observed it of the usual dark colour, with red streaks; and these streaks appeared to increase in some instances as the bleeding was continued; and lastly, I have seen it quite natural, except perhaps being a little darker than usual when first drawn.* The veins of some of the internal viscera were always found distended with dark blood, the vessels at the surface being nearly empty.

Abdomen. On opening the abdomen, a peculiar offensive odour has been sometimes observed to proceed from it. Mr. Annesley says, the omentum was sometimes corrugated, or thrown to one side. The only diseased appearance which has been found in the peritoneal surface of the stomach and intestines is a blue or purplish colour, from venous congestion. A vermilion tint also sometimes occurs, and has been attributed to inflammation, but improperly, for it is evidently owing to the distention of the very minute ramifications of the veins, which, with a little attention, can be traced to the large venous trunks. There is, I believe, invariably great venous congestion in many of the abdominal viscera, but some of them are generally more affected than others: for instance, great congestion has been observed on the surface of the intestines, and at the same time none on that of the stomach; portions of the intestines are often quite free from congestion, in other instances completely discoloured by it. I have never seen any venous congestion in the urinary bladder, which is almost always contracted, and not otherwise altered in its external appearance. The stomach is very frequently distended, sometimes it is contracted. It generally happens that some portions of the intestines are thin and greatly distended with the cholera secretion, or with flatus, while other portions are very much contracted, thickened, and possessing a doughy

* It is worthy of remark, that black-coloured blood is not peculiar to cholera. I have seen blood taken from rheumatic and dysenteric patients, in India, continue black for many hours after it was drawn.

feel. The liver is generally loaded with dark-coloured blood; but many instances occur in which it does not contain more blood than usual, and presents a perfectly healthy appearance. The following observations on the state of the bile are extracted from Mr. Annesley's work.

"The gall-bladder was always distended by thick viscid bile, which was generally of a dark-green or black colour, in subjects who died before the appearance of bile in the excretions; and, although the hepatic duct was large and permeable, the mouth of the common duct was generally constricted, and seldom permitted the bile to flow into the duodenum without considerable pressure made upon the gall-bladder. In those cases which terminated fatally after an illness of long duration, and in which some reaction of the vital energies and a flow of bile into the intestines had taken place, the gall-bladder was generally empty, or contained but a small quantity of bile; and the common duct, although not always free from some degree of constriction, was generally more permeable than in the former class of cases. In a few instances the gall-bladder was quite empty, relaxed, and flabby. In almost all the cases wherein bile was observed in the excretions, and the gall-bladder was found empty on dissection, and consequently when it could be legitimately inferred that this secretion had passed into the intestines during the life of the patient, I remarked that the viscid matter usually found lining the mucous surface of the small intestines, in the former description of cases, was detached to a greater or less extent, and was either floating in the fluid contents of the large intestines, or entirely removed along with the matters which had been ejected from them."

The spleen was generally gorged with black blood, and its texture was often soft and loose. In one remarkable case,* however, which came under my own observation, it was soft, flabby, and *did not contain a drop of blood.*

No morbid appearances have been noticed in the kidneys or pancreas.

I will now proceed to describe the morbid appearances which have been observed in the mucous membranes, which, from their constancy and great extent, must be considered as the most important connected with this disease. These membranes had an unnatural whiteness; were frequently soft and pulpy; and in general, especially in the stomach and intestines, could be easily detached by scraping from the subjacent coat. In some situations, a whitish, opaque, viscid substance was

* Yella's case, in the Appendix.

found adhering to their surface, and was often so abundant in certain parts of the intestines as completely to fill them. The different cavities lined by mucous membranes contained more or less of a transparent or turbid serous fluid; the viscid matter already mentioned being often found intimately mixed with it, or floating in it in the form of flakes, giving rise to the different kinds of the cholera secretion already alluded to in the first chapter. These appearances were sometimes more or less partial, but some of them were generally found throughout the whole extent of the alimentary canal; they extended in many cases to the mucous membrane of the bladder and ureters; and I have observed them, in two or three instances, in the pulmonary mucous membrane.

The venous congestion already mentioned often extended to some parts of the internal surface of the stomach and intestines, which then exhibited patches or spots of blue, purple, or vermilion, according to the intensity and extent of the congestion.

It will be necessary to describe the morbid appearances observed in the different parts of the mucous membranes a little more in detail. That of the stomach was often perfectly white throughout its whole extent; a vermilion blush has been often observed at the pyloric extremity, and has been referred to inflammation, but which has been more probably owing to venous congestion. Purple patches on the internal surface of the stomach were not uncommon, and when the congestion had proceeded to a great extent, it gave rise to an appearance of ecchymosis. Calomel has often been found adhering to the inner coat of the stomach, and surrounded with a ring of a reddish colour. The contents of the stomach varied very much in their appearance, from the mixture of the medicines given to the patient with the cholera secretion; and food has sometimes been found along with them when the case has been rapid, and the vomiting trifling.

The mucous coat of the small intestines, like that of the stomach, was always found unusually white, excepting when discoloured by congestion; it was thickened where the gut was contracted, thinner than usual where the gut was distended, and was always soft, sometimes pulpy, and easily detached. In many works on cholera, a considerable degree of congestion of a blue, purple, or vermilion colour is mentioned as of very common occurrence, on the inner surface of the small intestines; but in my own practice it has been more frequently absent than present. There was often a very large quantity of the cholera secretion in this part of the alimentary canal, and a great abundance of the white viscid matter ad-

hering to the villous coat. "When the disease was of longer continuance (says Mr. Annesley), and more particularly when some reaction of the powers of the system had taken place, this viscid appearance was detached to a greater or less extent, and was floating in the fluid contents of the small and large intestines; and the mucous coat then seemed more vascular, and the arterial capillaries more injected, than in the former class of cases.*"

Nearly the same observations apply to the large as to the small intestines; they were sometimes contracted, sometimes much distended, and their mucous membrane was either white, or more or less deeply coloured by venous congestion.

Worms, especially the lumbricus teres, have been found in the intestines after death, in a large proportion of cases, and have been often passed by vomiting and stool; and I think it highly probable that the peculiar condition of the gastro-enteric mucous membrane, which is favourable to the existence of these animals, may act as a predisposing cause of the disease.

The urinary bladder was always contracted, never containing any urine, but frequently a considerable quantity of the cholera secretion. Its mucous membrane, and also that of the ureters, was invariably white, and sometimes covered with a white viscid substance, similar to that in the alimentary canal.†

Venous congestion is sometimes met with, but is not so common in the urinary bladder as in the different parts of the digestive tube.

For some time, believing the stomach and intestines to be the only seats of the disease, I unfortunately overlooked the condition of the pulmonary mucous membrane, and, since my attention has been directed towards the latter, I have had it in my power only two or three times to ascertain the state of that membrane by dissection. The first of the cases alluded to was that of an old man, a convict, who died of cholera after an illness of about ten hours. The symptoms were frequent watery purging, collapsed features, gradual diminution in the size of the pulse, coldness of the extremities, and difficulty of breathing. Having been attacked with the disease during the night, and not having reported his illness till

* Cases which had proved suddenly fatal.

† It has been observed by Bichat, that the various epidemic catarrhs described by authors have been generally characterized by the disorder being confined to the gastro-pulmonary membrane, the genito-urinary remaining unaffected. Cholera, however, forms an exception to this general rule; for in it the catarrhal affection frequently extends to every mucous membrane of the body.

the morning, the remedies came too late, and the disease proved fatal. The usual morbid appearances were found in the gastro-enteric mucous membrane, with little venous congestion in the abdomen, and no inflammation. The trachea was lined with a thickish mucus, and the minute branches of the bronchi were completely filled with a white froth. The second case being in many respects extremely interesting, and the dissection having been made with great care, in the presence of a medical friend, I will relate it in detail.

15th June, 1826. Anomah, male convict, aged twenty, was brought into hospital about half-past five P.M., from Moogud, a village five miles from Darwar.

Six P.M. It is reported that he vomited and was purged two or three times early this morning; but he himself positively asserts that he neither vomited nor was purged. When interrogated, he complains of nothing but slight pains in his limbs. His intellect is perfectly clear, and, although he is weak, he has a perfect command over all his voluntary muscles. Features considerably collapsed; pulse not perceptible at the wrist or temples; no perspiration on any part of the body; hands and feet cold; tongue coated, whitish, and moist.—Sumat statim Submur. Hydrarg. ℈i., et superbibat Tincturæ Cardamomi ʒi, in paululo aquæ tepidæ. Admoveantur sinapismi pedibus et cruribus, emplastrum epispasticum forte abdomini et arena calida brachiis.

Seven P.M. Has taken two doses of the calomel and tincture of cardamoms. Says he feels a little better. Skin colder since last report; features much collapsed. Complains of slight pains in his knees, and of pain from the cataplasms. Answers all questions most distinctly.—Sumat Submur. Hydrargyr. gr. v., necnon Tinct. Cardamom ʒiij., in paululo aquæ tepidæ quaque semihora.

Nine P.M. Has taken four doses of the calomel and tincture of cardamoms. Is restless, and complains of thirst. Pain in the umbilical region on pressure; pain in his knees continues; skin cold, with a slight cold perspiration; no pulse at the wrist or temples.—Continuantur remedia.

Ten P.M. Has coughed up a quantity of white froth; in other respects the same.

He died about midnight, and the body was examined at six o'clock on the following morning.

Abdomen. Stomach distended, with its external surface natural. Small intestines considerably distended, and of a purplish colour. Large intestines in some places distended, in others much contracted, with their external surface natural. The stomach contained a large quantity of whitish muddy fluid; its mucous coat was lined with a white coagulum, and exhibited a blush of red near the pylorus. The duodenum contained a large quantity of a white turbid serum, and a large lumbricus; its mucous coat was of a white colour, and was lined with a whitish mucus throughout its

whole extent. The jejunum and ileum contained a large quantity of serous fluid, mixed with flakes of a white coagulum; their mucous membrane had a light vermilion colour, and was lined with a white coagulum. The large intestines contained a considerable quantity of turbid serous fluid. The mucous membrane of the cœcum, and greater part of the colon, had a reddish colour, and was lined with a diaphanous mucus. The lower part of the colon and rectum were healthy. The liver was healthy in its structure, with more blood than usual in its veins. The gall-bladder contained healthy and somewhat inspissated bile. The urinary bladder was healthy.

Thorax. Heart natural; blood dark-coloured. Structure of the lungs healthy. A quantity of white froth was found in the trachea. The bronchiæ were filled with a white froth, and a large quantity of grey serous fluid mixed with white flakes.

Encephalon. Considerable congestion in all the meningeal veins. All the contents of the cranium were in other respects healthy.

I will leave this case without any remarks upon it at present, as it has been related here only with the view of shewing that the catarrhal affection in cholera sometimes extends to the pulmonary membrane, as well as to the mucous membrane of the other viscera.

I have been able to gain no information on this subject from any dissections that have been already made public, except in one instance. Mr. R. H. England, assistant surgeon, in a report to the Madras Medical Board, in 1821, mentions that, "on cutting into the lungs, a grey fluid oozed from the divided places." This grey fluid could, of course, be nothing but a secretion from the mucous membrane of the air-passages and cells; and, as the remark is a general one, and not confined to any particular case, we must conclude that it was an invariable, or, at least, a very common appearance.

These instances, then, are sufficient to prove that the catarrhal affection frequently extends to the pulmonary mucous membranes, as well as to the other mucous membranes of the body.

The skin also frequently participates in the diseased action of the mucous membranes; for, in many cases, we find it covered with cold clammy sweat, or with a profuse perspiration. If, with Bichat, we view the mucous membranes and the skin merely as different portions of one continuous surface, the functions of which are analogous, we may consider the vitiated perspiration in cholera merely as the effect of the same morbid action, which in different cases extends to

every part of this extensive membranous tegument, external as well as internal.

From a careful examination of the cholera secretion, procured from the stomach and intestines of several individuals who died of the disease, I found that it has the following chemical characters and composition: It does not affect litmus or turmeric papers. It becomes of a dark-grey colour when mixed with calomel. It consists of two substances; the one a transparent serous fluid, the other an opaque white coagulum. The former is perfectly soluble in cold water, which enables us easily to separate it from the latter, which is quite insoluble. This separation (which indeed often takes place spontaneously, the coagulum being frequently found diffused in the form of flakes in the serous fluid,) may be considered the first step towards the analysis of the secretion; in the same way that the coagulation and separation of the crassamentum form the first step towards ascertaining the nature of blood.

The following experiments were made on the two substances taken separately.*

I. Serous fluid.

a. Tincture of galls produced a precipitate, when added to a mixture of the serous fluid with cold water.

b. Alcohol produced a precipitate, when added to the same mixture.

c. Muriate of mercury produced a white precipitate.

d. Sulphuric acid produced a white precipitate.

e. It was coagulated by heat.

f. It did not affect litmus paper.

II. Coagulated matter.

a. Insoluble in cold water.

b. Slightly soluble in boiling water.

c. Dissolved when boiled in acetic acid.

d. Dissolved by pure aqua ammoniæ.

e. Not changed when triturated with calomel.

f. Prussiate of potassa, when added to the solution *c*, produced a copious yellow precipitate.

The first set of these experiments proves that the fluid part of the secretion is pure serum, which is particularly confirmed by *d* and *e*. The second set proves that the coagulated part of the secretion is fibrin; test *f* being that which, according to Berzelius, particularly distinguishes that sub-

* These experiments were performed two or three times with the same results.

stance. The secretion, therefore, has a composition similar to that of blood deprived of its colouring matter; but the proportions of the serum and fibrin in the secretion are, I imagine, seldom the same as those we find in blood; for, in most cases of cholera, there is an enormous quantity of the serum thrown out by the stomach and intestines, with only a small quantity of coagulated matter.

We must conclude, from these experiments, that the cholera secretion is not merely an increased natural secretion of the mucous membranes, but that while this is increased it is also vitiated; and that it does not originate in an inverted action of the lacteals, as some have conjectured; for, independent of its being very abundant in the stomach and large intestines, where there are few or no lacteals, it has very little resemblance to chyle. The circumstance of its not affecting vegetable colours proves that there is no free acid in the secretion, and thereby shews that Dr. Ainslie's views of the disease cannot be maintained.

The turbid appearance which the serous fluid sometimes has, and the different colours which the secretion occasionally exhibits, ought not to be considered as constituting separate varieties; for, in all probability, they are owing entirely to the admixture of calomel, and other medicines given for the cure of the disease. The creamy or purulent-like matter mentioned above probably differs little from the more common cholera secretion, except in the proportion of its constituent parts. It has a perfectly homogeneous appearance. From a great portion of it not being soluble in cold water, and being precipitated from its solution in acetic acid by prussiate of potassa, it may be inferred that, like the more common secretion, it contains fibrin.

That the disordered state of the mucous membrane is not a partial occurrence, but is invariably present in cholera, is a fact that rests on the very best evidence, viz. on that of Mr. Scot, who mentions it at page 34 of his Report on the Epidemic. "We have seen," says he, "that serous membranes are not necessarily affected in cholera, but that mucous membranes, including the skin, which is of an analogous nature, are affected; and that this affection is, in some part or other, invariable." And again, he says, "The affections of the skin and mucous membranes of the body in cholera are evidenced by a cold relaxed condition of the former, and, in the latter, by the state of the stomach and intestines, from all of which a watery or mucous discharge is largely poured out; and by the state of the bladder and ureters, which are found to be coated with a mucus similar to that which is observed

in the other passages. The fluid discharged at times from the bladder is almost always stated to be limpid, colourless, and in small quantity; leading to the inference that it may not be urine, but a mere watery exudation from the lining membrane. That the mucous membranes are affected is further evidenced by the moist state of the mouth, even under the most urgent thirst; and by the state of the eyes, where there appears to be a peculiar secretion, or exudation, in the form of a film."

Many cases have been recorded, in which we find it stated that, on examination, no morbid appearances could be detected. But, in these cases, were the mucous membranes carefully examined? From what has been stated in a former page, we have every reason to suspect they were not. Even if they were carefully examined, and no morbid appearances could be discovered, we are not the less certain that their *functions* were disordered during life; for of this the copious morbid secretions thrown off by vomiting and stool afford a sufficient proof. It is stated, in case 8th, in the Bengal Report on the Epidemic Cholera, that no morbid appearances could be discovered on dissection: yet, even supposing this dissection to have been made with the greatest care, it is perfectly evident that there was great functional derangement of the gastro-enteric mucous membrane during life; for the most prominent symptoms were frequent vomiting and purging.

The catarrhal affection has its seat generally, I think, in the stomach and small intestines; and in almost all severe and protracted cases, it appears to pervade every mucous membrane of the body. The stomach is certainly most obnoxious to the disease, and I have met with no case in which it was free from it. I imagine that the mucous membrane of the air-passages is not always affected; but it frequently is so, and perhaps invariably, in severe cases.

It has been already mentioned, in describing the symptoms of the disease, that cases have occasionally occurred in which catarrhal cholera has been followed by great excitement and by various symptoms of gastro-enteric inflammation. The only full account of these cases has been given by Mr. Jameson, in his Report drawn up under the superintendence of the Medical Board of Bengal, and I therefore extract the following valuable observations on the autopsy of the disease from that work: "The bodies of such as had sunk in the earlier stages of the malady frequently exhibited hardly any unhealthy appearance. This was more especially observable among Europeans of weak and sickly constitutions, and among natives of the poorer classes. On laying open the bodies of

such persons, it was remarked that the abdomen emitted a peculiar offensive odour, very different from the ordinary smell of dead subjects. In them there was not the slightest mark of previous increased vascular action throughout the whole intestinal canal; which rather appeared paler than usual and flabby, and was filled with an amazing quantity of whitish or muddy fluid, or empty and inflated with air. Sometimes in the stomach this fluid was found mixed with pieces of curdled matter, or lumps of undigested food. This appearance of relaxation was not confined to those in whom the spasmodic affections were absent. It occurred frequently where the cramps of the abdominal muscles had been violent, and the pain in the stomach excruciatingly severe.

"On laying open the abdomen of such as had lived some time after the commencement of the attack, and especially of Europeans and the stouter natives, a different set of appearances was brought into view. The omentum and mass of intestines were often found displaced, and preternaturally vascular, with partial adherence between the diaphragm, liver, and surrounding viscera. The colour of the intestines varied from deep rose to a dark hue, according as the increased vascular action had been arterial or venous. In some instances the outer surface of the stomach, likewise, was florid, and its veins tinged with black blood; but this was not so in the generality of cases.

This organ was, however, much contracted, and its substance hard, and frequently thickened. On cutting into it, it was found sometimes empty, sometimes partially, and at others largely, filled with fluid of various colour and consistence, thin and transparent, milky, green, dark, grumous or muddy. Sometimes this fluid was black, like lamp-black; sometimes it consisted of pure blood; and at other times, of blood mixed with bile. On removing this, the inner surface was frequently seen lined with coagulated lymph, bloody gelatine, or a muddy glossy viscid matter; which, on being washed away, brought the highly inflamed coats into view. Of these the appearance was various; generally they were crossed by streaks of a deep red, interspersed with spots of inflammation made up of tissues of enlarged vessels. Sometimes the inflammation was florid and bright-coloured, so as to give the whole inner surface of the organ the appearance of a minutely injected anatomical preparation. In some instances, ulceration had begun, and the villous coat was partially abraded; in others, incipient mortification had occurred, and the coats were puckered into net-work, or drawn into folds, with patches of red near the pylorus, &c.

In cases of several days' standing, the inner coat of the small guts was ulcerated, and they were filled with sanies, having portions of lymph floating in it. Then the large intestines were lined with a dark, thick, pitchy stuff poured out from the liver, as it had begun to renew its action."*

Etiology.

There has been always much difference of opinion respecting the nature of those morbid conditions to which all the symptoms of cholera are referrible; or, in other words, of its proximate cause. This was to be expected, so long as we continued in ignorance of the morbid changes which accompany, or form part of it; but now that we are in possession of a great mass of well-established facts, relating both to its autopsy and symptoms, we may proceed with more confidence to trace its causes, and to determine whether it is subject to any uniform laws.

Overlooking those theories, or rather hypotheses, which attribute all the phenomena of cholera to an immaterial something,† to some peculiar and undefined influence of electricity in the blood and textures of the body, to concussion of the brain,‡ to torpor of the extreme vessels of the liver, or to some other equally obscure cause; let us proceed to examine the more prevalent opinions of the day. These refer the disease to diminished nervous energy; to congestion of the veins of the viscera; to inflammation of the brain, of the spinal marrow, or of some portions of the mucous membranes; or to the altered state of the blood.

To say that any disease is owing to diminished nervous energy, is, I conceive, only using a peculiar phraseology, instead of furnishing a scientific explanation of symptoms. No one will say that he knows any thing of diminished nervous energy except by its effects. Many however conclude, from the existence of certain phenomena, that there is such a thing as diminished nervous energy; and the next moment they turn round, and have recourse to it, for the explanation of the very phenomena from which its existence was at first deduced.

But it appears to me that we can with less propriety attribute cholera to diminished energy of the nervous system, than almost any other disease with which we are acquainted; for, in cholera, the external senses, the voluntary, and some involuntary motions, continue, in a large proportion of cases,

* Bengal Report, pp. 67-69.
† Bombay Report. ‡ Kennedy on Cholera.

unimpaired; and one of the most important and extensive secretions, viz. that of the mucous membranes, far from being diminished, is always prodigiously increased. Even the other secretions are not invariably diminished; and, when they are so, we can easily perceive that it does not arise from any defect of the nervous system, but from a deficiency of the circulating fluid, which has been withdrawn from these organs, and determined towards the mucous membranes, the seat of increased action.

Cholera is generally described as being accompanied by great debility of the circulating system. This, I suspect, is not strictly correct; for, although a small pulse is almost an invariable symptom of the disease, it is by no means a proof of arterial debility; but merely that the quantity of blood circulating through the vessel has been diminished. It is thus conceivable how an artery, though containing a smaller quantity of blood than usual, may have its action actually increased. Were the smallness of the pulse owing to general debility of the circulating system, we might expect it to arise more gradually, and to continue longer after the removal of the disease, than we find to be the case in cholera. A person enjoying good health is attacked with the disease: his pulse becomes rapidly smaller; his features collapse from diminution of blood; and, if the disease prove fatal, the blood is found accumulated in the internal vessels. Should he recover, the pulse immediately regains its fulness, and sometimes has its action much increased. These facts naturally lead to the conclusion, that the smallness of the pulse is not owing to debility; but only to the circumstance of the blood having been withdrawn from the surface, and determined to the interior.

How the diminished nervous energy produces increased secretion from the mucous membranes, congestion, pain in the abdomen, spasms, &c. we are not told; one of the advocates* of the hypothesis merely says, "that the depravation of nervous influence thus produced extends to all the functions, and immediately produces the disease." Well may we say with the reviewer, in the Edinburgh Medical Journal, that "this is a complete assumption, unsupported by any proof, evidence, or any plausible pretext whatever." I have thought it necessary to dwell thus long upon this hypothesis, since, if adopted, it might be liable to lead to an injurious mode of practice. One of the most powerful and universal remedies in the disease is bloodletting; but it is difficult to understand

* Mr. Orton.

upon what ground it could be recommended in a malady depending upon diminished energy of the nervous system.

The theory which refers all the phenomena of cholera to venous congestion, is much more entitled to attention than that we have just been considering. Venous congestion is present in all severe and fatal cases of the epidemic; but this alone is not a proof of its being the proximate cause. By the term proximate cause, we mean that morbid condition without which the disease could not exist; which, in fact, constitutes the disease, and to which all the other morbid changes, as well as the symptoms, are referrible. It necessarily follows that it must not only be of invariable occurrence, but it must always precede all the symptoms; must form the very first link in the chain of morbid phenomena which accompany the disease, and must be proved to be an adequate cause of these phenomena. Does the venous congestion in cholera answer all these conditions? I will shew that it does not. In a great proportion of cases, the first symptoms are vomiting and purging, with a sense of uneasiness at the epigastrium; and these often continue for a long time, before any others make their appearance. It often happens that a patient ejects a large quantity of serous fluid, by vomiting and stool, when, at the same time, his circulation is not much disturbed, and there are no other symptoms (except perhaps anxiety) to indicate the presence of cholera. No one, however, doubts of the identity of the disease; and the practitioner does not hesitate to treat it *secundum artem*. Now, in such a case, there is surely no indication of venous congestion, and it therefore cannot be the first morbid change in the disease. So little appearance of congestion is there in the very first stage of many cases of cholera, that the pulse is then full and strong; whereas, had the blood left the surface to be accumulated in the internal parts, the pulse must necessarily have been small and weak. But we can produce an artificial case of cholera, which differs from the epidemic only in degree, and we can thus carefully study its progress, and the order of its phenomena. A drastic purge acts upon the gastro-enteric mucous membrane, occasioning an increased secretion; nausea, and uneasiness in the bowels, are produced; abundant dejections are expelled, accompanied sometimes by vomiting, and the blood, at length, retires from the surface towards the viscera, until the operation of the medicine ceases. No one will, surely, pretend that the first effect of the physic is to withdraw the blood from the surface, in order to supply material for the flow of excretions that are afterwards to take place;

besides, such an absurdity is, as we have already stated, exactly the reverse of the order of the phenomena. The same reasoning applies to the true cholera. But, allowing for a moment venous congestion to be the proximate cause, let us inquire how it would account for the morbid appearances, and the symptoms of the disease. A great accumulation of blood in the viscera of the abdomen may be supposed capable of forcing out, as it were, a large quantity of fluid into the alimentary canal; but, if such were its mode of action, why are all the constituent parts of the blood not forced out? why is the colouring matter left behind? why is the constitution of the cholera secretion different from that of the blood? But, if this difficulty occurs in regard to the secretions of the stomach and intestines, how much greater is the difficulty which presents itself respecting the cause of that thrown out from the inner surface of the bladder, where there is seldom any congestion, and from the surface of the eyes, and the lining membrane of the mouth, which are far from the seat of the cause to which they are supposed to be owing. Lastly, this theory affords us no reason for the perspiration, which is a very common symptom; on the other hand, it withdraws the circulating fluid from the surface, in order to supply a *cause* for the increased secretion from the gastro-enteric mucous membrane, and thus leaves no cause whatever for the secretion of the skin.

In regard to the theory which attributes the proximate cause to inflammation, suffice it to say, that inflammation in any part of the body is of very rare occurrence, in cases of the epidemic.

The altered condition of the blood has sometimes been supposed to be the proximate cause of the disease. But it often does not occur until the other symptoms have been fully developed, and therefore does not answer one of the conditions of a proximate cause; and it is sometimes met with in other complaints, when it is not accompanied by any symptoms similar to those of cholera. I do not believe that the changes of the blood arise entirely from deficient oxygenation; for the effects of unoxygenated blood are very different from any thing we observe in cholera. Mr. Brodie says, that "dark-coloured (unoxygenated) blood, which has been transmitted through the circulating system during the suspension of respiration, would seem to act like a narcotic poison upon the brain. *No sooner does it enter that organ, than deleterious effects are immediately produced;* the animal falls into a state of stupor, the pupils of the eyes become dilated, the respiration is laborious, the muscles of the body are convulsed,

and the animal dies poisoned by its own blood." Very different is the case in cholera; for the patient often continues perfectly sensible, his breathing free, and his muscles obedient to his will, for *many hours*, during which dark-coloured blood has circulated through his veins and arteries. Although the blood is variously altered, and darker than usual, yet I doubt much whether these changes be owing merely to imperfect decarbonization of the circulating fluid. The only reason we have for apprehending such to be the case, is the statement of Dr. Davy, who says that "the air expired from the lungs of the sick with cholera did not contain more than one third of the carbonic acid gas contained in the breath of healthy people." But we are not told by what experiments this was ascertained, and whether it was the result of extensive observation; and, besides, greater slowness of the circulation may have occasioned this deficiency to a certain extent; although the blood which actually passed through the lungs was perfectly decarbonized. The dark colour of the blood, therefore, was probably owing to some other cause than to its not having been freed from its carbon; and, upon any supposition, it could not serve to explain the different symptoms of the disease.

It is much to be wondered at that, in all the observations that have been published on the pathology of cholera, so little weight has been given to the disordered condition of the mucous membranes, which forms an invariable character of the disease. This appears the more surprising, when we consider the importance of the mucous membranes in the animal economy; their very great extent; their great sensibility; the numerous sympathies that exist between them and every other part of the body; the many instances in which their diseases have become epidemic; and the invariable derangement of all, or at least of some portions of them, in cholera.

Although many medical men have accurately described the various appearances of the secretion thrown out by the stomach and intestines in cholera, they have very seldom extended their observations to the diseased action of the gastro-enteric mucous membrane, by which these secretions are produced. A very common, and perhaps a natural prejudice, inclines us to consider the intestinal tube merely as a conduit for the passage of excremental and peccant matters, and that all kinds of fluxes are only efforts of this tube to rid the bowels of diseased substances, the presence of which is prejudicial to health. Farther, there appears to be a disinclination, with many pathologists, to admit that the gastro-enteric mucous membrane is ever the seat of the pathological cause

of a disease. Hence it is that cholera morbus has been referred to the irritation of diseased bile, diarrhœa to diseased matters irritating the intestines, and Indian cholera and dysentery to disordered states of the liver, of the brain, nervous system, &c. It is certain that cholera was not considered to be a disease *sui generis* until it occurred as an epidemic. Previous to that period it was generally denominated flux; and, by the natives of India, it is simply denominated vomiting and purging. Under these names, it is a disease that has been well known at very distant periods and places. But, as soon as it became epidemic, its name was altered, and its nature confounded. The discovery of its pathological cause was considered by many to be impossible; and those who did theorize upon it referred it to almost every diseased condition of the human frame, except that to which it had formerly and frequently been attributed.

I have already demonstrated, on another occasion, that mucous membranes are liable to two distinct morbid affections, viz. inflammation and catarrh; and that either of these may occur alone, or conjoined with the other. Without entering very fully into the views respecting the pathology of mucous membranes, which I have explained in the work alluded to, and which I believe have been very generally adopted, it will be necessary to give some explanation of them, in order to make their application to the pathology of cholera properly understood.

It has been stated as a general law, by several eminent authors, that inflammation of mucous membranes is accompanied by increased mucous secretion; and pathologists almost invariably attribute catarrh to an inflammation of the mucous membrane in which it occurs.* This, I apprehend, is far from being correct; for are there not numerous examples of inflammation of a mucous membrane without increased secretion, and of catarrh without inflammation? We have examples of the former in ophthalmia, inflammatory sore throats, some cases of gastritis, and perhaps also of enteritis: of the latter, in a few cases of common catarrh, in diarrhœa, and also (as I shall have occasion to shew in a future part of this Essay) in Indian cholera.

Acute bronchitis frequently affords an example of simple inflammation of a mucous membrane, without increased secretion. In some cases of it, the secretions during the first stage are diminished; and then an increased secretion from the

* This is the opinion of Laennec. Vide De l'Auscultation Médiate, t. ii. p. 65. It also appears to be Broussais' opinion.

inflamed membrane always relieves the disease.* In the first stage of gastritis, and of enteritis, the secretions of the gastro-enteric mucous membrane are generally diminished; and these diseases also are relieved by an increased flow of the natural secretions of the membranes.

There are also numerous examples of catarrh without inflammation. Common catarrh of the air-passages, without inflammation, is familiar to every one. Diarrhœa generally does not exhibit the slightest symptom of inflammation; and in it the secretion of the enteric mucous membrane is increased and vitiated.

There is a species of diarrhœa endemical in some parts of the Southern Mahratta country, the symptoms of which are copious and frequent dejections of a serous fluid, a small pulse, and sometimes coldness of the skin, without the slightest symptom of inflammation. When it is of long continuance, however, inflammation generally supervenes; and the enteric mucous membrane, when examined after death, presents various diseased appearances. But, in one case in which it had existed for a very long time, and at length proved fatal, the mucous membrane of the alimentary canal had a blanched appearance, with only a few rose-coloured spots near the pylorus, and in the large intestines. It is most probable that these spots were not inflammatory, but what Billard calls "rougeur pointillée non inflammatoire." At all events, they were not of a magnitude that could account for the violent and long continued catarrhal affection that affected the patient.

There are some very valuable observations on this subject in M. Billard's work "De la Membrane Muqueuse Gastro-Intestinale," at page 358. He mentions that it is by no means uncommon to meet with cases, in which there are very abundant dejections of serous fluids, and in which no trace of inflammation can be detected in the mucous membrane of the primæ viæ after death. Among others, he describes the case of a priest, who was attacked with an intestinal flux, and passed different vitiated humours, for the space of thirteen days. He then died; and, upon examining his corpse, no appearance of inflammation was found in any part of the intestinal canal. He farther states, that the same thing is daily met with in the theatres of anatomy; and therefore justly concludes, that these fluid excretions from the bowels cannot be considered as indications of inflammation of the mucous membrane of the intestines.

* Vide Hastings' Treatise on Inflammation of the Mucous Membrane of the Lungs, p. 161.

In the description of the symptoms and of the autopsy of the epidemic cholera, it has been mentioned that there is seldom the slightest appearance of inflammation; that the most prominent symptoms are copious vomiting and purging of a sero-fibrinous secretion; that no traces of inflammation could be detected in the mucous membranes after death; but that these membranes, the pulmonary and urinary, as well as the gastro-enteric, were all whiter than natural, and lined with a fibrinous secretion.

Let us now consider the effects of these two morbid affections, viz. of inflammation and catarrh, on the general system. These effects on the circulation are very different, and in fact completely opposite, acute inflammation being accompanied by increased action; whereas, in slight cases of catarrh of any portion of the mucous membranes, the circulation is scarcely, if at all, affected; and, in severe cases, both the size of the pulse and heat of the skin are diminished. This is so important in enabling us to explain the etiology of various diseases, that it will be necessary to shew that numerous proofs are not wanting to establish it as a general law.

It has frequently been observed, that simple diarrhœa, which is merely a catarrh of the mucous membrane of the large intestines, is accompanied by a weak small pulse, and a sense of coldness.

A powerful dose of physic, occasioning an abundant secretion from the bowels, is frequently followed by a small pulse, and coldness of the skin. This was illustrated in a most striking manner in the case of one of my own servants, a young Mahomedan, who had taken too large a dose of the croton tiglium, which occasioned hypercatharsis. His evacuations, after a time, consisted only of mucus and serum; his pulse was scarcely perceptible at the wrist; his extremities were cold, and his features contracted. He was in this state when I first saw him; and from all these symptoms I immediately concluded that he had an attack of the cholera. When I learned the true nature of his complaint, I gave him sixty drops of laudanum, and he soon recovered.

Simple catarrh of the nose, fauces, and air-passages, is always attended by chilliness and a diminution in the size of the pulse; but the influenza of 1803, which was a severe catarrh with inflammation, was denominated a fever, on account of the increased action of the heart and arteries which characterized it.

These proofs, in support of the principle, that catarrh of any part of the mucous membranes occasions a diminution in the size of the pulse, and heat of the skin, will at present

suffice. Many of a similar nature will doubtless suggest themselves to my readers; and I will now endeavour to trace the cause of the phenomenon.

As it is of importance, for the proper understanding of this part of our subject, to have clear notions of the power excited by the capillaries in the circulation of the blood, I will quote the following observations from the elegant work of Dr. Arnott on Natural Philosophy:

"We have seen (says he) that the heart keeps up a tension or pressure in the arteries, of about four pounds on the square inch of their surface, and with this force, therefore, is propelling the blood into the capillaries. If these last were passive tubes, constantly open, such force would be sufficient to press the blood through them with a certain uniform velocity; but they are vessels of great and varying activity: it is among them that the nutrition of the different textures of the body takes place, as of muscle, bone, membrane, &c.; and that all the secretions from the blood are performed, as of bile, gastric juice or saliva, &c.; and, to perform such varied and often fluctuating offices, they require to be able to control, in all ways, the motion of the blood passing through them. The capillaries of the cheek, under the influence of shame, dilate instantly, and admit more blood, producing what is called a blush; under the influence of anger or fear, they suddenly empty themselves, and the countenance becomes pallid; tears or saliva, under certain circumstances, gush in a moment, and in a moment are again dried up: if a person having inflammation in one hand be blooded from corresponding veins in both arms at the same time, twice or thrice as much blood will flow from the diseased side as from the other. Similar changes occur in many other instances. Now, the only mechanical action of vessels, capable of causing these phenomena, must occur in contractile or muscular coats; and, with reference to such action, it merits notice that arterial branches have always more of the fibrous or contractile coat in proportion as they are smaller.

"A muscular capillary tube strong enough to shut itself against the arterial current from the heart, is also strong enough to propel the blood to the heart again through the veins, even if the resistance on that side were as great as the force on the other. * * *

"It is capillary action which absorbs and moves the fluids of the classes of animals which have no heart. It must also be the power which moves the blood in warm-blooded monsters formed without hearts. There are cases of apparent death among human beings, where the heart remains inactive for

days, and yet a degree of circulation sufficient to preserve life is carried on by the capillaries. In illustration of capillary action, we have also the absorption, by the lacteals, of nutriment by the alimentary canal; and perhaps, to a certain extent, the circulation of the blood in the livers of animals. In this last case, the blood collected by veins from the abdominal viscera, instead of going directly to the heart, is again distributed through the liver by the branches of the vena portæ, and is then again collected by ordinary veins, and carried to the heart: it thus moves through two sets of capillaries in passing from the arteries to the heart again.

"The action of the capillaries is the cause of that singular phenomenon which prevented the ancients from discovering the circulation of the blood, viz. the empty state of the arteries after death. All the muscular parts of an animal, including therefore the contractile coats of vessels, retain their life, or power of contracting, for a considerable time after respiration has ceased, as is seen in the recovery of persons apparently drowned or suffocated; in the leaping of a heart taken from an animal just killed; in the actions resembling life which can be produced, by the agency of galvanism, in a body recently dead; but the fact is seen still more aptly for our purpose, in the total disappearance of a local inflammation after the death of the patient; for inflammation involves a gorging, or over-distention of the capillaries, into which, when the heart has ceased to press blood, the contractile force remaining in them, even under disease and in a dead animal, is sufficient to squeeze the blood out of them, and often to remove all trace of the malady which has killed. In ordinary cases, then, the capillaries throughout the body remain alive and active for a considerable time after breathing has ceased, working like innumerable little pumps, and emptying the arteries into the veins. As the red blood is their proper sustenance as well as stimulus, they work as long as there is any of it coming from the arteries behind them; except, however, the capillaries of the lungs, which soon cease to act, because, after breathing has ceased, they are filled with black blood, and are moreover compressed by the collapse of the chest; and all the blood accumulates behind them. The capillaries may continue to be filled from the arteries, either in consequence of their elasticity opening them with what is called a suction power, or of an absorbent power dependent on life, like that of the lacteals and of the absorbents all over the body, and perhaps of the vessels in the roots of vegetables. When death is produced by lightning, or by the poisons which destroy all muscular irritability, the arteries after death are found

to contain blood like the veins. In a living body, if an artery be tied, the part beyond the ligature is soon emptied into the veins, and becomes flat. The experiment has been made even upon the aorta itself."

It is an important law of the animal economy, that there is always a determination of blood towards a part whose action is increased. Let us suppose then the action of the minute vessels of any part to be increased in consequence of inflammation, a determination of blood will take place towards them; but, as the seat of this affection is in the capillaries which connect the arteries with the veins, it is evident that there can be no outlet for the unusual quantity of blood they now receive; it must therefore be propelled forwards with a heightened momentum, which, upon reaching the heart, will be communicated by it to every part and of the sanguiferous system, producing the quick and hard pulse, and hot skin, which accompany all severe inflammations. But very different effects must arise from the increased action of secretory vessels; for, since they discharge their contents upon open surfaces, the more powerfully they act, the greater will be the quantity of fluid withdrawn from the circulation; and the total quantity of it will consequently be diminished. Instead of general excitement, therefore, of the circulating system, as in inflammation, there must be symptoms of diminished action, or, to speak more correctly, the size of the pulse towards the surface will be lessened, from the arteries containing a smaller quantity of blood than usual. Let us suppose, farther, that the excretory vessels of the gastro-enteric mucous membrane have their action increased, or, in other words, are affected with catarrh, the current of the blood will be directed towards this membrane, to supply the expenditure, less will consequently be sent to the other parts of the body; the heart and large blood-vessels having the bulk of their contents in this way diminished, will contract with less effect, and their action will become languid. But we can scarcely suppose that in all cases the exact measure of blood required for the supply of the discharge will be directed towards the affected parts; and if too little be afforded, the catarrh will be of short duration; if too much, there will be congestion. The latter is likely to occur in almost all severe cases; for, an impulse having been given to the flow of the blood towards the alimentary canal, more of it will probably be thus carried to the parts than is precisely equal to supply the increased secretion; and the surplus will therefore accumulate in the veins of the viscera. This state of things will continue until the unnatural drain, which had thus diverted the stream of the vital fluid from its

usual course, is stopped, and the circulation, again set free, is enabled to distribute in due proportions its supplies to the remotest parts of the system. Thus we find that inflammation and catarrh are exactly opposed to each other; and, accordingly, many remedies which are employed against the former act by producing increased secretion, or a catarrh in the mucous membrane; many which are found useful in the cure of the latter occasion an inflammatory action. Of the former we have a familiar instance in inflammatory sore throat, which is relieved by an increased secretion from the mucous membrane of the affected parts; the latter is equally evident in the beneficial effects derived from the employment of opium and stimulants in the catarrhal cholera.

One reason, probably, why an accurate distinction has not hitherto been made between inflammation and catarrh, is that the former seldom continues for any length of time in a mucous membrane without exciting the latter, and *vice versa*. When they occur together, the state of the circulation will of course be modified according to circumstances: it will be increased, if the inflammation predominate; diminished towards the surface, if the catarrh predominate. Accordingly, we find that, in some cases of dysentery, the pulse continues tolerably full at the wrist, and the skin hot, while, in other cases, the pulse is nearly imperceptible, and the skin cold; the former being those in which the inflammation, the latter those in which the secretion, is greater.

From numerous experiments I performed upon dogs, for the purpose of ascertaining the mode of action of several of the more active medicines on the gastro-enteric mucous membrane, and which have been detailed in another work, I found that certain medicines, especially in large doses, increased the secretion of this membrane, at the same time rendering it white; and that others caused an inflammatory action. I also ascertained that if a stimulating medicine be made to act for a length of time upon one spot, it causes inflammation; whereas a short continuance of its action produces only increased secretion. In this way I observed that large doses of tartrate of antimony, of muriate of mercury, and of calomel, produced a great secretion from the gastro-enteric mucous membrane, and at the same time rendered it white; opium occasioned a red colour; and in some cases in which calomel had remained a long time in the stomach, it adhered to its inner surface, and produced patches of inflammation.

In June 1826, I gave a scruple of tartrate of antimony to a patient labouring under an acute pulmonic affection. In half an hour it caused him to vomit a large quantity of serous

fluid; shortly afterwards he vomited three yards of a tape-worm, and, in the course of two or three hours, it produced several copious and perfectly watery stools. The size of his pulse was much reduced; his skin became cool and slightly moist, and in the course of twelve hours all these symptoms went off, and left him quite well. I afterwards gave similar doses of the medicine to three or four other patients, and in these it invariably produced watery vomiting and purging, coldness of the skin, a small pulse, and general debility.

It would appear, then, that a scruple of tartrate of antimony powerfully increases the secretion of the gastro-enteric mucous membrane, without at the same time inducing an inflammatory action. It consequently determines the blood towards the abdominal viscera, and thus reduces the size of the pulse and the heat of the skin. These effects it produced so powerfully, in one of the cases above alluded to, that a person unacquainted with the circumstances might have almost mistaken it for a case of cholera. This practice, I should think, cannot be always unattended with danger; for, were the medicine, instead of quickly passing through the alimentary canal, (and thus merely exciting the action of the excretory vessels,) to lodge in any part of it, there can be no doubt that its continued action would excite inflammation.

The above facts shew that the tartrate of antimony has not a direct sedative property, as some maintain: on the contrary, it powerfully excites the secretion of the gastro-enteric mucous membrane; and the small pulse, cold skin, and debility, are only secondary effects, which go off as soon as the increased secretion is checked.

The experiments of Brodie* and Magendie,† and the observations of various other writers,‡ prove that tartrate of antimony frequently produces inflammation of the gastro-enteric mucous membrane. In the experiments of Magendie, in which the inflammation was produced by tartrate of antimony, the œsophagus was tied, so as to prevent vomiting; which shews that the inflammation was produced by the continued action of the medicine on the mucous membrane. Other experiments are related by Brodie, in which large quantities of tartrate of antimony given to dogs produced no inflammation whatever.§

* Vide Phil. Trans. for 1812, vol. 102, p. 205.

† Vide Orfila, Traité des Poisons, third edit. p. 458; also 479 et seq.

‡ Vide Billard, De la Membrane Muqueuse, p. 201 et seq.

§ The preceding observations enable us to understand why some purgatives are said to be warm, and others cold; the former being such as simply stimulate the bowels, and excite their peristaltic motion; the latter those which occasion an increased secretion from their mucous membrane.

If my reader has accompanied me attentively through the preceding (I am afraid rather tedious) investigation, I feel confident he will be prepared to admit the following conclusions.

1. Mucous membranes are liable to two distinct simple morbid affections; viz. inflammation and catarrh.

2. Catarrh consists of a diseased action of the secretory apparatus of a mucous membrane, which produces an increased and vitiated secretion, and is characterized by the membrane in which it occurs being generally whiter than natural, and by the quantity of the blood towards the surface of the body being diminished.

3. Either of these morbid affections may occur alone in a mucous membrane, or conjoined with the other.

It is worthy of remark, that almost all the remedies which have been found successful in the treatment of the epidemic cholera, are such as stimulate the arterial capillaries, and therefore promote the circulation of the blood; for we find, by the observations of Dr. Arnott, that these minute vessels have as much share in the circulation as the heart itself. Blisters, sinapisms, frictions, and heats, are applied to the surface; stimulating mixtures, laudanum, spices, ammonia, are given internally, all with the same view of exciting the action of the capillaries, and thus causing them to restore the balance of the circulation. It is not improbable that the action of the arterial capillaries, as well as of the heart, may be diminished by the altered state of the blood having deprived them of their natural stimulus; but that they are not *positively debilitated* has been already pointed out.

Let us now apply these principles to the explanation of the phenomena of the epidemic cholera. It has been already mentioned that the first link in the chain of morbid phenomena, in cholera, is a disordered state of the gastro-enteric mucous membrane, which occasions an increased excretion, or catarrh. As in all other similar affections, whether spontaneous or excited by artificial means, a determination of blood takes place towards the parts, the quantity of blood towards the surface is diminished; and, when the catarrh is sudden, severe, and extends to all the mucous membranes, it constitutes a powerful cause fully equal to produce collapse, and all the worst symptoms of the disease.

As it is of importance to demonstrate positively that the catarrhal affection always precedes all the other morbid phenomena in the disease, it will be necessary to enter a little into detail upon this point. It has already been shewn repeatedly that a disordered state of the bowels, very much resembling

cholera, has frequently arisen from a powerful dose of physic; and, during the prevalence of the epidemic, a strong dose of a saline purgative has been often seen to act as an exciting cause. But the immediate operation of purgatives is to excite the secretion of the mucous membrane of the primæ viæ, which must, in such cases, therefore have been the first deviation from healthy action that took place. Moreover, cholera often commences with an insidious diarrhœa, without any other symptom. Can there be stronger proofs than these, that the first link in the chain of morbid phenomena is a catarrh of the gastro-enteric mucous membrane?

During the prevalence of cholera at Darwar, in 1826, a sepoy of the 5th regiment of Native Infantry was brought into hospital at seven A.M. of the 10th of May. He said he had been attacked with purging early in the morning, when on guard at the jail; that the first evacuations had been natural, but that the two or three last were like rice-water, which made him apprehend that he was about to have an attack of cholera. His pulse and skin were natural; his tongue was clean; and he had no other symptom of the disease. He took fifty drops of laudanum, and a strong dose of calomel and jalap, which soon produced several healthy evacuations; in other words, restored the healthy action of the enteric mucous membrane; and he had no return of the disease.

Next morning another sepoy, who had been on guard at the jail, was brought into hospital, with frequent white, watery purging. All the other functions were natural. He took a dose of physic and some laudanum, which soon restored the healthy action of his bowels; and in the evening he was so well that he intended to return to his duty the next morning. During the night, however, or rather early in the morning, he took a large draught of cold water and some buttermilk, which occasioned a renewal of the purging. When I saw him, at six o'clock A.M., he had been purged frequently, and had vomited two or three times; his evacuations being watery, with a few white flakes. His features were considerably collapsed; his pulse at the wrist extremely small. He had already taken fifty minims of laudanum. I immediately opened a vein in his arm, from which very dark-coloured blood flowed sluggishly, in a small stream, or in drops. The bleeding was continued until I had procured thirty ounces, when the blood became lighter coloured, his features brightened, and he expressed himself much relieved. He coughed two or three times, and appeared to breathe more freely than he had done before. The disease, however, had not been overcome; for, although his pulse had consi-

derably improved, it was far from being of its natural fulness; he vomited once, and was purged two or three times. A strong blister was therefore applied to his abdomen, and sinapisms to his legs and feet; and during the day he took several scruple-doses of calomel, with camphor mixture and liquor ammoniæ. He slept a little during the night. Next day he had two or three feculent evacuations, and speedily recovered.

These two cases very clearly point out the nature of the disease. In the first case, and on the first day of the second case, there was evidently nothing more than catarrh of the entero-mucous membrane, and which was easily overcome by simple remedies. In the latter part of the second case there was the same catarrh of the enteric mucous membrane, but increased in severity, extending to the gastric membrane, occasioning the characteristic symptoms of cholera, and requiring for its cure the active remedies usually employed in that disease.

The following passage, forcibly illustrating this subject, is taken from one of Mr. R. H. England's Reports to the Madras Medical Board. "I have frequently," says he, "detected sepoys round an encampment, with diarrhœa unattended with vomiting, pain, or any other unusual symptom. This state, I have the strongest proofs to convince me, was the commencement of the cholera; as a few of these cases terminated fatally, with the usual symptoms of the disease. After a diarrhœa had existed several hours, I have in many cases found it resist every kind of remedy; the purging continued; the vascular action became impaired; prostration of strength ensued, and the patient sunk without any considerable pain. I have often asked these persons why they did not apply to me earlier; and the general answer was, that, as they found no great inconvenience from the diarrhœa, they deemed it unnecessary and improper to make a report of a circumstance so apparently trifling." Mr. Orton, in his Essay on Cholera, says, "This epidemic has frequently been observed to begin with a common diarrhœa, which has gradually assumed the form of cholera, so as to occasion a great difficulty in the diagnosis in the early stages." Similar observations have been made by numerous other medical men, which shew that the term cholera is with general consent often applied to a simple catarrh of the mucous membrane of the intestines, without any other symptom whatever being present.

I am aware it may be objected to the view I have taken of the subject, that in many cases of cholera there has been

neither vomiting nor purging. I will shew, however, that the catarrhal affection of the mucous membrane is not only present in such cases, but is even sometimes greater than in those cases in which vomiting and purging are most urgent. I have opened the bodies of patients in whom the symptom of vomiting had been entirely wanting, and found the stomach filled with serous fluid, and its inner surface lined with a white coagulum.

Case. Shaik Ebram, a convict, aged thirty-six, when at work in the open air, on the 9th May, was attacked with purging at two P.M. He was brought into hospital at half-past four o'clock; up to which time he had been purged only four times, and had not vomited once. He was weak. He exhibited no signs of pain or uneasiness; and, although unwilling to be roused, was perfectly sensible. No pulse at his wrist; features collapsed, and skin cool. Spasms did not occur throughout the case, except a slight twitch, of short duration, in the muscles of the loins.

It is unnecessary to give a minute detail of the treatment. Suffice it to say, that I attempted to bleed him from the arm and temporal artery, but could only procure an ounce of dark-coloured blood from the former. He took two scruple doses of calomel, some tincture of cardamoms, cajeput oil, and camphor mixture. Boiling water was applied to the belly, and sinapisms to the legs and feet; but nothing was of the slightest avail. He died at six o'clock.

His body was examined the same evening, a few hours after his death, and presented the following appearances: Considerable congestion of the veins of the stomach and mesentery. The stomach contained a very large quantity of serous fluid, and a small quantity of food, and its mucous coat was white, lined with coagulated fibrin,* and exhibited a little redness near the pylorus. The intestines were in many places contracted: they contained a large quantity of white and transparent serous fluids, and their mucous membrane was lined with a white coagulated fibrin throughout its whole extent. The liver was healthy. The gallbladder contained healthy bile. Considerable congestion of the meningeal veins. No inflammation in any of the contents of the cranium. The tuber annulare, and upper part of the spinal marrow, were healthy.

About the same time another convict died of cholera, who had no vomiting, and in his stomach I found a larger quan-

* The secretions in this case were examined chemically, and afforded the results already stated.

tity of the coagulated secretion than I had ever observed in any other case. Thus we see that, although there be no vomiting, there is nevertheless a severe catarrh of the gastric mucous membrane. The same observation, I am convinced, will hold good respecting the state of the enteric mucous membrane as connected with purging. Mr. Scot, at page 13 of his Report on the Epidemic Cholera, says, "In cases where little or no purging has taken place during life, the intestines have yet been found, after death, to be filled with the congee-like matter, as if they wanted energy to throw it off, or as if a stricture had been formed on the lower portion of the gut." Indeed, the case of Shaik Ebram also, to a certain extent, proves the same thing; for in it the purging was very trifling, and the quantity of diseased secretions in the intestines was very great. But this case is still further useful, by shewing what an immense quantity of the diseased secretion may be thrown out by the mucous membranes in a very short time; and also that these diseased secretions are sometimes the only morbid appearance of any consequence in cholera.

Let us now inquire how the catarrhal affection, which we have shewn to be invariably present in cholera, produces the other morbid changes, and the symptoms of the disease: and first, respecting the changes in the circulation; the congestion in the veins of the viscera has been already explained. This we have stated to be of invariable occurrence in severe cases, which we might have been led to expect, from the discussions we have entered into upon the etiology of mucous membranes. The greater the discharge from the alimentary canal, the stronger and more abundant will be the current of blood directed towards it, to supply the waste; and the vessels at the surface being thus drained of their contents, all those appearances of collapse, shrinking, with loss of pulse, which have been described among the symptoms, must necessarily take place. But the danger of every disease depends in a great measure upon the rapidity of the invasion; and this is particularly the case in cholera; for the rapidity of the determination towards the viscera being in proportion to that of the catarrhal affection, the former may occasion such a shock to the vital organs as to prove soon fatal. When, on the other hand, the disease approaches gradually, commencing with nausea, or an insidious diarrhœa, the determination of blood towards the viscera takes place slowly, and the circulation is kept up tolerably well towards the surface for some time. Lastly, when the invasion is ushered in with inflammation, the pulse is at first strong and full, and

symptoms of congestion do not occur until the catarrhal affection is established.

Having accounted for the congestion in the abdominal viscera, it may now be asked, what occasions the venous congestion in the thorax and encephalon? I will answer this by putting another question: what occasions a similar congestion in animals which have been bled to death? It would appear that the abstraction of a very large quantity of the circulating fluid tends to cause the remainder to accumulate in the internal parts: how it does so, is another question; but, if the fact be allowed, it exactly accords with my views of cholera; for I have shewn that the quantity of the blood is much diminished by the drain from the mucous membranes. I imagine the congestion in the encephalon generally does not take place until a very short time before death; for we can scarcely suppose that the mental faculties and the senses would remain so unimpaired as they frequently do, until within a few minutes of the fatal termination, if the brain were loaded with blood.

Next to congestion, the most important morbid appearance is the altered condition of the blood; which also receives a clear and satisfactory explanation from the diseased secretion of the mucous membrane. It would have been wonderful, had the blood retained its healthy appearance after being deprived of so large a quantity of serum and fibrin; and are not the diseased appearances observed in it exactly what we might have expected, *a priori*, from the abstraction of so much of these substances? It must necessarily become thicker when deprived of an inordinate quantity of serum, and darker, from none of its colouring matter being discharged, the fibrin which is secreted being always white. It has been sometimes said to have been thin and watery; but this is of rare occurrence, and may have been owing to the cholera secretion containing a larger quantity of fibrin than usual.

The explanation of the diminished secretion of urine and saliva is evident. It must be referred to the small quantity, and perhaps also to the altered condition, of the blood which is sent to the kidneys and salivary glands. All parts of the body are robbed of their due proportion of the circulating fluid to supply the expenditure of the mucous membranes; and the little they do receive is vitiated, and therefore ill suited to administer to their healthy functions.

But we have still to account for an important symptom, which often forms a prominent feature in the disease; I allude to the copious cold sweat. The skin is properly

considered as a continuation of the mucous membranes, which it resembles in its structure and functions. The different parts of the mucous system, including the skin, are linked together by sympathies; one of the most conspicuous of which is that which exists between the gastro-enteric membrane and the periphery. When the action of the former is increased by an emetic, by a purgative, or even by warm fluids, the latter sympathises, and the cuticular secretion is increased. This is a wise provision of nature, whereby the tendency to congestion, from the determination of blood which takes place towards the mucous membranes, is lessened, and a copious perspiration is in this way often a most salutary operation, whether excited by art or by nature. But, in cases of epidemic cholera, the perspiration, however copious, is seldom capable of counteracting the congestion caused by the overwhelming catarrh of the mucous membranes; and the cold clammy sweat has accordingly been sometimes rather figuratively, but perhaps not inaccurately described as an ineffectual effort of struggling nature to restore the circulation towards the surface. It is indeed remarkable that there is sometimes a copious perspiration when the pulse at the wrist is extremely small, or nearly imperceptible. This has generally been considered as indicative of extreme debility of the perspiratory vessels. On the other hand, I am inclined to think that these vessels have their action very much increased; for, were the reverse the case, how does it happen that, when only a small quantity of blood flows sluggishly, or in drops, from a large orifice made in a vein, or even when no blood can be procured, the cuticular secretion forces its way through the minute pores of the skin? When the arteries do not contain a sufficient quantity of blood to enable them to continue their own action, the only way in which perspiration can be thrown out is evidently by an increased action of the perspiratory vessels. But perspiration is by no means an invariable symptom of cholera; for in some cases there is only a slight moisture about the face and hands, and in others the whole skin is perfectly dry.

It is an interesting fact, that a similar phenomenon to the above takes place in animals which have bled to death. Sir Charles Bell says: "If a glass be attached to the artery of a horse, the column of blood will suddenly rise in the tube, marking the force of circulation. If the animal be bled from another vessel, the blood will descend in the column as the force of the circulation is enfeebled. When the blood is very low, and the animal dying, the surface will break out profusely in perspiration. It must be concluded, that the force

of the internal impulse is not the cause of perspiration. Again, the most persevering efforts in injecting the vessels will never bring the water through the pores of the skin; and if a dead body be carried near the fire, the heat will not bring out one drop of fluid from the pores of the cuticle."* Sir C. Bell therefore concludes that the perspiration is produced solely by the vital action of the perspiratory capillary vessels.

Since the epidemic cholera is a disease of the mucous system generally, and since the skin is considered to belong to this system, the increased discharge from the latter may be considered not to arise from sympathy, as already conjectured, but rather as a simple extension to the periphery of that morbid action of the internal membranes which constitutes the disease. But the laws of sympathy are so obscure, and so little understood, that both of these opinions may, for all we know, amount nearly to the same thing, and either may be adopted consistently with our theory. It will be necessary here to take notice of the following argument, which has been urged against these views. It has been said, "it seems but reasonable to expect that, if a disease similar to that which produces such an afflux to the interior existed simultaneously on the surface, there would be a division of the blood between the centre and the periphery, and, instead of smallness or imperceptibility of the radial pulse, we should expect to find it tolerably forcible."† The answer is very simple and obvious: such a determination is generally prevented by the great intensity of the disorder in the internal membranes, which form a surface more extensive than the whole of the skin, and throw off a quantity of fluid far superior to that of the most copious sweats. Nevertheless, the blood is sometimes directed towards the surface; but then what takes place? There cannot be both a determination of blood towards the interior and towards the periphery at one and the same time: the balance of the circulation is therefore restored, and the disease ceases.

A very distressing symptom, which occasionally occurs in cholera, is difficulty of breathing. It is plainly to be attributed to the obstruction of the minute bronchia by their diseased secretion: it cannot be referred to spasm, for it often occurs in cases in which spasms are entirely wanting. The stethoscope might afford us some assistance in the diagnosis of this part of the disease.

* An Essay on the Forces which circulate the Blood, by Charles Bell. London, 1819.

† Medico-Chirurgical Review, No. 19, December 1828, p. 126.

Coldness of the skin, which is one of the most characteristic symptoms in the advanced stage of the disease, is clearly owing to two causes: 1st, to the diminution in the quantity of blood sent towards the surface; 2dly, to the altered condition of the blood.

Debility of the voluntary muscles is a common symptom of cholera; but in many cases it is by no means so great as we might be led to expect from the very extensive diseased condition of the mucous membrane. Sometimes, when the pulse is scarcely perceptible at the wrist, the patient is still able to walk; and, long after the pulse has ceased at the wrist, (although perhaps not able to move about,) he is often sufficiently strong to sit up, to use his arms and hands, to speak, &c.

When we consider the great diminution of muscular power that is sometimes occasioned by simple vomiting, by a diarrhœa, or by a large dose of tartrate of antimony, we cannot be surprised at the great debility that often occurs in cholera; and the only cause of astonishment is, that this debility is not invariable. This, however, in concurrence with the perfect state of sensation, clearly shews that the debility of the muscles is not owing to diminished energy of the nervous system. A person is attacked with cholera; the blood gradually leaves the surface, which, as might be expected, occasions more or less muscular debility; his mental faculties, however, remain undisturbed;* all the external senses continue perfect; and, in fact, almost all the functions of the nervous system are for a long time unimpaired, until, near the fatal termination, they become affected by the great derangement of the circulation.

In some cases of cholera, anxiety, and an overpowering sensation at the præcordium, generally denominated sinking, are very distressing symptoms. The latter is, most probably, only a variety of the former, from which it appears principally to differ in being more severe. Both may be attributed either to the disordered state of the stomach or of the lungs; sometimes, perhaps, they are referrible to the one, sometimes to the other.

Spasms have been by no means of invariable occurrence in the cholera of India, and are clearly referrible to irritation in the gastro-enteric mucous membrane, whether this proceeds from inflammation, or a sudden determination of blood towards the parts, in consequence of the catarrh. They are

* Vide Annesley's Sketches of the Diseases of India, p. 21; also Anomah's case, p. 58, and the cases in the Appendix.

almost always present in cholera morbus, and in mixed cases, and are much more frequent in European than in native patients, owing to the greater irritability and tendency to inflammation in the former.

When we consider what violent spasms arise from comparatively trifling irritation of the primæ viæ, we cannot be surprised at their frequent occurrence in cholera. The absence of spasms in those cases in which there is only catarrh of the mucous membranes, without inflammation, is quite consistent with what we know of the nature of catarrh; for it never directly produces any sensible effect on the nervous system.

If, in addition to the catarrhal affection, inflammation be present in the mucous membranes, the symptoms of the disease will of course be more or less modified. If the inflammation be not very violent or extensive, it will probably be indicated only by local pain or burning, or perhaps merely by pain on pressure. If it be great, it will excite the action of the general circulation.

Frequently pain in the abdomen does not occur until a late stage of the disease, and in these cases is probably owing to inflammation. It has been observed by several medical men that calomel is often found adhering in patches to the inner surface of the stomach of those who had died of cholera, and in these places only was there inflammation. In several cases I have found appearances of inflammation in the pyloric extremity of the stomach, where the stimulating medicines given for the cure of the disease were collected. It would appear, therefore, that inflammation is sometimes occasioned solely by the violent remedies used for the cure of the disease.

It is a curious feature of many cases of cholera, that there is great thirst, while the mouth at the same time is perfectly moist. It is however by no means an invariable symptom; and I am inclined to think that it is sometimes occasioned by the stimulating medicines given to the patient, and sometimes to inflammation being conjoined to the catarrhal affection of the stomach; for it is found to be most urgent in cases where there is great pain at the præcordium.

Cholera morbus is accompanied with increased action of the circulation, hot dry skin, &c. In it, therefore, there ought to be (consistently with our pathological views,) acute inflammation of the mucous membrane of the primæ viæ. The few authors who have taken notice of the post-mortem appearances in this disease state that marks of inflammation were found in the mucous membrane of the

primæ viæ; and the symptoms of inflammation of this membrane are so well marked during life, that we scarcely require more positive proof of its presence. To what else can we refer the burning at the epigastrium, pain of abdomen, especially on pressure, heat of skin, and quick, hard pulse? Moreover, the vomiting and purging in cholera morbus are very different in their nature from those which occur in the catarrhal form of the disease; for they never contain the sero-fibrinous secretions which characterize the latter, but consist principally of bile.

That cholera morbus consists of an inflammation of the gastro-enteric mucous membrane, may perhaps appear questionable, from the circumstance of its generally running its course very rapidly. But it appears to me that this is exactly what we might be led to expect from the nature of the disease; for, if the mucous membrane of the primæ viæ be suddenly affected with inflammation, a rapid determination of blood takes place towards it; and, since it possesses an excretory apparatus, an evacuation will probably be thrown out from its extensive surface, whereby the inflammation will be quickly subdued, and the disease removed; or, if the evacuation be inordinate, it may degenerate into catarrhal cholera, and thus soon prove fatal.

All the other symptoms which occasionally occur in cholera are of minor importance, and do not require to be taken into account in a general view of the pathology of the disease. It is necessary however to advert, in a general manner, to those affections which arise from accumulation of blood in the head, such as apparent coma, tennitus aurium, deafness, &c.; for to this accumulation some have referred the proximate cause of the disease. But, far from its being the proximate cause, it is by no means a general occurrence; and in no case does it occur until the latter stages of the disease, and until after all the other symptoms have been developed.

If the preceding pathological views be found to be correct, it will follow that there are two essentially different kinds of cholera: one, the disease usually denominated Cholera Morbus, or Cholera Biliosa, consisting of an inflammation of the gastro-enteric mucous membrane; the other, the Indian Cholera, or Cholera Asphyxia of Scot, consisting of a violent catarrh of the mucous membranes generally; and, further, that cases sometimes occur of a mixed nature, from catarrh and inflammation being present in the mucous membranes at the same time. Should these views be adopted, the correct designations of the two principal species of cholera would be Cholera Pyretica and Cholera Catarrhalis; the former being

the cholera morbus, the latter the epidemic cholera, (Cholera asphyxia of Scot,) and Cholera spasmodica of some other authors.*

As it is the opinion of some that, in my former work on the Pathology of Cholera, I have allowed to the nervous system too little participation in the phenomena of the disease, I beg leave to state here what are my exact views on this subject. I conceive that every part of the animal frame ought to be considered as a compound body, made up of a certain number of essential elements, such as nerves, blood-vessels, capillaries, &c., all of which act and react on each other, and no one of which can be affected in any way without influencing the rest. Now, in a great many diseases, (although perhaps not in all,) I would be inclined to refer the morbid condition to the compound body of nerve, blood-vessel, and capillary, of which the affected part consists, not to any one of these elements exclusively; just as we refer the phenomena of galvanism to the compound arrangement of two metals and an interposed fluid, and not to any of them taken alone. When I say, therefore, that the cholera is a disease of the excretory apparatus of a mucous membrane, I mean that it is a disease of a certain complicated arrangement of nerves and vessels, which requires the concurrence of all its elementary parts for the proper performance of its functions. These act together to produce certain results, and the derangement or abstraction of any one of them would certainly derange the whole. Let us suppose that the usual powerful and striking effects of our galvanic battery should become enfeebled, we should probably find, upon examination, that this arose from oxydation of some of its plates; but, not content with this discovery, we might push our inquiry a little further, and find that the oxydation itself has been caused by the acid of the interposed fluid. So, in cholera, we have discovered that the disease depends upon an affection of the mucous membranes; and further investigations *may* enable us to make another step, and to demonstrate this affection to be caused, in its turn, by some

* Consistently with these principles, cholera may perhaps be considered objectionable as a generic term. But, if (instead of deriving it from χολη, *bilis*,) we adopt the derivation of Trallian,[a] Castellus,[b] and others, viz. of χολας, *intestinum*, the term will then bear the accurate signification of intestinal flux; and to which the above terms, Pyretica and Catarrhalis, will serve as appropriate specific adjuncts.

[a] Vide Good's Study of Medicine, second edition, vol. i. p. 260.

[b] Nomen habet non tam αχολη, quam αχολας, i. e. intestinum, per quod materia ex ventre excerrutur.—Bertholomæi Castelli, Lexicon Medicum. Lipsiæ, 1713.

peculiar state of the nerves. Should this be clearly made out, I should be the first to hail with pleasure so important an addition to our knowledge of pathology; but I must maintain, that at present we have no proof of any affection of the nervous system forming the first link of the disease. This is an inquiry, however, that is highly deserving of being prosecuted; for there are many familiar facts which shew that the nervous system exerts the most important influence over the actions of the capillary vessels, and especially of those which produce the secretions. I need only mention the action of blushing from shame, the secretion of tears from grief, the secretion from the stomach by disgust. The valuable observations of that excellent philosopher, Sir Charles Bell, on the nervous system, and the late brilliant discoveries in animal electricity and electro-magnetism, would incline us to believe that we are on the very verge of some great discovery on the philosophy of life, which will probably enable us to ascertain the exact influence (no doubt very great,) which the nerves have in the production of the various functions of the animal frame. Our knowledge of the pathology of cholera may be compared to that which the chemists possess in regard to some substances which are *suspected* to be compound, but which have not yet been analysed; and, notwithstanding that their compound nature is admitted to be probable, yet chemists continue to treat them, and to reason upon them, as if they were elementary. We have analysed the cholera to a certain extent, and we may in time gain possession of a formula by which we shall be able to reduce it to still more simple elements: meanwhile, do not let us wander into the regions of conjecture, indulging in wild theories, which might turn us away from the sober but sure path of inductive reasoning and experiment, which alone lead to truth.

Causes of Cholera.

Having pointed out the nature of the disease, and demonstrated, I hope satisfactorily, that it has its seat in the mucous membranes, I will now proceed to inquire into its external causes, and the mode in which it is propagated.

Although epidemic visitations had not been of frequent occurrence before the year 1817, sporadical cases had often been met with in India, and had been almost invariably attributed to atmospherical vicissitudes. The disease is generally most prevalent during changeable weather, and ceases when the weather becomes serene and temperate. It usually makes its attack during the night, or early in the morning, especially

if the individual has been fatigued during the day; and it is notorious that it is most prevalent among troops when marching, for they then undergo more fatigue, and are more exposed to the cold night-air than usual. In these respects, then, it strongly resembles catarrh, diarrhœa, and dysentery. But it is also excited by a different set of causes; viz. by such as, instead of acting on the skin, are applied directly to the mucous membrane of the primæ viæ. Thus, it has often arisen from a large dose of salts; unripe fruit has been known to cause it; and it has very often been induced by a large draught of cold water, buttermilk, &c. Its causes, then, may be said to be such as excite a catarrh in the mucous membranes, especially in those of the primæ viæ.

But, after the disease became fairly established as an epidemic, it broke through all its former laws, sparing neither sex, age, nor rank; prevailing at all seasons, and visiting all situations and all climates. We therefore now arrive at the important question, whether it is capable of being propagated by contagion or infection?* On a slight consideration of the subject, one might be inclined to believe the disease to be infectious or contagious; for, after its appearance in Bengal, in 1817, it gradually spread thence from place to place, till it reached the most distant parts of India, China, and all the islands of the Eastern Archipelago, Persia, and at length Russia; checked neither by climate, contrary winds, nor intervening seas. Upon examining the question a little more closely, however, we shall find that numerous facts and arguments are hostile to this belief; a few of which I will now proceed to examine.

When spreading across a tract of country, the disease has often been known to spare one or two towns, and to appear in the next, although all must have been equally exposed to the infection, had any existed. It has been known to rage among troops in a town, while the townspeople escaped; or to attack the townspeople, and to spare the soldiers. A troop of horse-artillery, of which I had charge at Kulladghee, in 1824, suffered severely for about a fortnight from the disease; while all the other corps at the station, although maintaining an uninterrupted intercourse with the artillery, were exempt. My dresser, who lived in a room attached to the hospital, caught the disease, and died; but not one of the other patients who lay in the same ward with those labouring

* These terms being variously employed by different authors, I find it necessary to state that, by a contagious disease, I mean one which is capable of being communicated by contact; by an infectious disease, one which can be conveyed from one person to another through the medium of the air.

under cholera were attacked. I have repeatedly remained for hours by the bedside of cholera patients, and never received the infection.

A regiment has been frequently known to march through a country, when suffering from cholera, without communicating it to the inhabitants; and, on the other hand, the disease has often prevailed in a country, without attacking the troops which passed through. It has very often happened that a single individual in a family has caught the disease, without communicating it to the rest. Of two corps on a march, and keeping up the most unreserved intercourse, one shall suffer from the disease, and the other escape. "Detachments of a regiment, arriving from a particular place, suffer severely; while the rest of the regiment, which has remained stationary, shall hardly furnish a single case, although the former may be living in the same barracks, and their sick in the same hospital."* Now, although facts like these, if taken singly, might not perhaps be thought conclusive, yet, when it is recollected that they have been of constant occurrence ever since the first appearance of the epidemic, we must, I think, consider them, when united, as affording strong evidence against the infectious or contagious nature of the malady.

It has been supposed by some medical men that the epidemic was introduced into the Mauritius by ships from India; but it is sufficient to state, in opposition to this, that the commission of medical officers appointed by the government of that island to investigate the nature of the distemper, gave it as their decided opinion that it was not contagious. Notwithstanding the strictest quarantine having been insisted on in the island of Bourbon, the disease appeared there in January 1820. The minds of the people being then filled with notions of contagion, supposed it to have been introduced by means of a boat which had communicated with a ship from the Mauritius; but this was merely a supposition, unsupported by proof. That it was introduced in a similar manner into Trincomalee, is also highly improbable; and it has been already mentioned that it had existed in Ceylon for more than a year previously to the arrival of the infected ship which was said to have imported it. I need only refer to the general history of the epidemic, as confirmatory of its non-contagious nature. Thus, in its progress through the Indian islands, it sometimes visited the most distant first; just as it had previously proceeded on the continent of India, where several towns on a river, or high road, were

* Madras Report.

passed over, and those at a distance beyond were first attacked. The progress of the epidemic through Persia, Syria, and Russia, abounds with examples of the same kind.

Amongst its first victims in Shirauz were the wife, mother, and child of the prince of Persia, who, confined to their haram, were little likely to be exposed to contagion or infection. Another case of a similar description, but still more remarkable, has been already mentioned; viz. that the city of Oudeypore had long continued free from the disease, but, while the inhabitants were congratulating themselves with the belief that they were beyond its western limit, they were surprised and terrified at the intelligence of their prince and his minister having been attacked by it in the very palace, while the city was still perfectly healthy. Such being the case, what would avail the most careful sanitary cordon, and the strictest quarantine?

The following paragraph is from the work of Mr. Annesley, whose extensive experience must entitle his opinion to the highest consideration.

"As the non-contagious nature of the disease is very generally admitted by the medical authorities of India, who have had sufficient experience of the disease, and as this property is generally believed in by the community at large, I should not have thought it necessary to advert to a contrary opinion, had not that opinion received the support of some distinguished medical authorities. I cannot, however, but think it unfortunate that the idea was ever suggested, because the dread of contagion may lead to serious consequences; inasmuch as it may withhold from the sick that assistance which they so much require. The strongest proof which I can adduce in opposition to it came fully under my own experience, which has not been inconsiderable, and was derived chiefly from what I observed in the general hospital at Madras, whilst it was under my charge. This hospital generally contained from 170 to 200 patients, natives and Europeans; the wards were open, and a free communication existed between them; and yet, although patients were daily brought into them, suffering under epidemic cholera,—although these patients were indifferently distributed throughout the hospital, and consequently not secluded from the rest of its inmates, no more than five or six persons, exclusive of the two already noticed, were seized with the disease, while patients in the hospital, during a period of five years; and certainly these cases could not be imputed in any degree to contagion. I can view them merely as cases of cholera occurring under circumstances of predisposition, during the

prevalence of an epidemic cause, and as shewing even a much diminished ratio of attack to that observed where the disease prevailed."

Sir Gilbert Blane, in a letter to the court of directors of the East India Company, in 1825, advocates the theory of contagion; but, while we admit the great consideration that so high an authority is entitled to, we must keep in mind that he had never an opportunity of attentively watching the progress of the disease in the countries where it prevailed; and his single opinion is opposed to that of almost all the distinguished surgeons of India.

Monsieur Moreau de Jounes also, in a communication to the Institute of France, on the 22d of November, 1830, professes his belief in the contagious nature of the cholera, derived from the history of its progress through the countries it has already visited; and, consistently with this notion, he supposes it to have been introduced into Oremburg, in Russia, by the caravans which bring from Bokhara the merchandise of Thibet, Cabriel, and India. But Baron Humboldt, who was present at the meeting, stated, in opposition to M. Moreau, that the cholera had not made its appearance at Oremburg before his departure from that town, although the caravans had arrived nearly four months before; and that the plains of the Kirguises, which these caravans had traversed, had not been infected with the malady. It may be also mentioned, that the inhabitants did not suppose it to have been imported, but to have been produced by atmospherical influences.

I would observe, then, in conclusion, that the only plausible argument for supposing the disease to be contagious or infectious is, that it has spread from Bengal, as a centre, in a very gradual manner, to distant countries, and has prevailed in all climates and situations; but that in this respect it does not differ from other epidemics, some of which have had an equally wide diffusion, and which are always admitted to be non-contagious. Further, many facts already detailed respecting the progress of the disease are perfectly irreconcileable with the theory of contagion or infection; and those few which appear favourable to this doctrine are readily explained by the opposite. I have therefore no hesitation in giving it as my decided opinion, that cholera is neither contagious nor infectious, and consequently, that quarantine and sanatory cordons will prove completely inadequate to check its progress.

The disease has been supposed to arise from malaria; but this opinion will be found to be as untenable as that which

supposes it to be contagious. Some sporadic cases have doubtless had the appearance of having been produced by malaria; but this has been by no means the case with the epidemic, the progress of which in India was often in direct opposition to the prevalent periodical winds. It often rioted in the low, confined, and crowded abodes of the poor; but they have escaped when it has penetrated into the spacious airy dwellings of the rich; and occasionally (although seldom) it has extended to lofty dry situations, while the low damp country around was spared. During the prevalence of the epidemic at Madras, "the labourers at certain public works, who were protected from the weather, who were well clothed and fed, and who had no unusual work to perform, suffered from it severely; while a body of many hundred people, employed in digging and cleaning out the beds of stagnant, brackish, and extremely putrid waters, equally during the heats of the season as during cold and rainy weather, entirely escaped. This immunity is the more remarkable, inasmuch as many of them laboured during the night, for the purpose of preventing the accumulation of water, and were of course exposed, with very scanty clothing, to the utmost vicissitudes of heat and cold, and to all the exhalations and depositions of the very tainted air in which they worked."* These facts are directly opposed to the laws which govern malaria, which is capable of being conveyed to a certain distance by the wind, but never travels against it; which is usually generated in low, filthy, or in marshy situations, and seldom extends far from the place which gave it birth.

At the commencement of the epidemic, much importance was attached by some medical men in India, especially by Mr. Orton, to sol-lunar influence, as an exciting cause of the disease; but subsequent experience has decided against this opinion. The number of cases of cholera in the Madras army, for a period of about two years, amounted to 7664; "and of these it appears that 3725 were admitted into hospital during the quarters of the new and full moon, which, according to Mr. Orton, are the morbific periods; and 3939 were admitted during the first and last quarters, which, according to that author, are non-morbific periods. Thus, between the morbific and non-morbific there is only the difference of 214 cases in 7664, and the excess lies on the side of the non-morbific. We may hence safely conclude that cholera is not directly affected, in individual cases, by sol-lunar influence."†

* Madras Report. † Ibid.

It has been very generally supposed that certain articles of food act as exciting causes of the disease; and several facts have been already mentioned which appear to countenance this opinion. Sporadic cases, it is well known, are produced in all countries by unripe fruit; and it is generally admitted in India that cold rice and curds, and cold drinks, frequently act as exciting causes. In fact, it may be said that any thing which has a tendency to occasion a catarrhal action in the mucous membranes may act as an exciting cause, and ought therefore to be carefully avoided during the prevalence of the epidemic; while warm and tonic substances are likely to be beneficial. Accordingly, the Madras Medical Board, in its instructions for guarding against the disease, recommended a general spicy diet. Bad rice, or what is called ooze rice, in India, has not only been considered to act as an exciting cause, but has been even thought to be the sole cause of the epidemic; and this opinion excited at one time much attention, from the persevering manner in which it was supported by Dr. Tytler, of Bengal, who even went so far as to change the name of the disease to that of *Morbus oryzeus*. This theory has now very few, if any advocates; and it is notorious that all persons, whatever may be the nature of their victuals, are liable to be attacked. Certainly, articles of diet undoubtedly predispose to, or act, as exciting causes of the disease, but there is not a single reason that would lead us to suppose them to have a more extensive influence.

The epidemic has been supposed to be owing to certain changes or peculiarities in the electrical state of the atmosphere; but this theory rests upon such slender grounds, and, from the present imperfect state of our knowledge respecting the constitution of the atmosphere, is so little susceptible of being fully developed, that it affords us little room for discussion. There can be no doubt that the air is often affected by changes which are not indicated by our most delicate instruments, but which are nevertheless very sensibly felt in our frames. Who has not observed the oppression and uneasiness which, to all appearance, is shared by all animals before a thunder-storm, and contrasted these with the feelings of buoyancy and exhilaration which have succeeded when the weather has become serene? Now, it is a curious fact, that the cholera has often been observed in India to have been cut short by a thunder-storm. An instance of this sort has been already noticed in the history of the disease, as having occurred at Madras in 1818; and another fell under my own observation at Kulladghee in 1824, when the epidemic, after having continued for about a fortnight in the troop

of horse-artillery stationed at that place, was suddenly cut short by a severe storm of thunder and lightning. We may therefore reasonably expect that the science of meteorology, when brought to a higher state of perfection by extensive and accurate observations, and by the aid of more delicate instruments than we now possess, will detect many properties of which we have at present no conception, and which will afford explanations of numerous diseases, and other phenomena of organic bodies. But until then, while we strive by experiment, and a severely strict mode of reasoning, to add to our knowledge, we must not hesitate to confess our ignorance, and to abstain from conjecture and hypothesis, which might lead us away from the truth, and, by obscuring it, might induce us to relax our efforts in its search.

Not to refer the cause of cholera, then, to any indefinite and unintelligible property of the earth or air, I will attempt to generalize the facts connected with the subject already in our possession, and which have been detailed in the preceding chapters.

1. Cholera may originate spontaneously in places which have been long free from it; as shewn by its repeated occurrence in India, and by its occasional appearance in other countries.

2. Unusual and disturbed states of the atmosphere have generally been found to precede its appearance, and may therefore be considered to be favourable to its development.

3. The concourse of great numbers of people; exposure to the inclemencies of the weather; fatigue, filth, and poverty; draughts of cold fluids; unripe fruit, and saline purgatives, have been always found to act as exciting or predisposing causes of the disease.

4. The epidemic influence is capable of spreading in all directions over great tracts of country, and across a wide expanse of ocean, without being conveyed by individuals in the form of contagion, or wafted in the form of gas or vapour by the air, like malaria. Quarantine observances are therefore incapable of arresting its progress.

5. One attack of the disease does not secure an individual against a second.

6. A clear serene atmosphere, and a great elevation above the level of the sea, have generally been found hostile to the disease.

7. This bears a very striking analogy to other epidemic diseases; all of which have their seat in the mucous system, are considered not to be contagious, affect all situations and every description of people, and one of them (the influenza

of 1803,) stretched over a surface equal to that already visited by the cholera; viz. from the confines of China to the western parts of Europe, and thence across the Atlantic to North America.

Treatment of Cholera.

The great value of a correct knowledge of the pathology of a disease consists in its making us acquainted with those morbid conditions, the removal of which will restore the body to health. If then the preceding views be correct, we have gained a most important desideratum. We know what those morbid conditions are in cholera against which our remedies must be directed, and the removal of which must form the grand object of our treatment. Accordingly, in the catarrhal cholera, there will always be two principal indications of cure; viz. to remove the diseased action of the mucous membranes, and to restore the circulation of the blood towards the surface. The first will always be present; the second only after the disease has made some progress, and in all severe cases. But, in order to effect these indications, we shall require to employ different means under different circumstances, and to vary our remedies according as certain symptoms predominate, or are wanting. We cannot expect therefore to discover any remedy or specific that will be applicable in all cases; and it is clear that there is just as much necessity for a practitioner to exercise his judgment in treating this, as in treating any other disease in the whole range of the nosology.

Bloodletting. It is generally admitted, in India, that bleeding is one of the most useful remedies we possess in the treatment of cholera. I conceive that it ought to be practised not only when there is increased action, but even in every case in which blood can be obtained, however much its quantity may have been diminished towards the surface; except only when there had been great debility previous to the attack. It appears to act as an indirect excitement; it causes the heart and blood-vessels to propel the blood with great energy towards the surface; unloads the congested vessels of the viscera, and thus restores the balance of the circulation. Even in the advanced stage of the disease, when the pulse has been scarcely perceptible at the wrist, I have known it to rise as the blood continued to flow, and the circulation to be restored after the abstraction of twenty or thirty ounces. Numerous cases of a similar description have been published in the Indian Reports. A remarkable effect also which is produced by venesection, is the change in the state of the blood, which, from having been thick and of a dark colour, becomes, after

the abstraction of a certain quantity, thinner, and of a natural red. "This is the change, (says Mr. Annesley,) which should always be looked for, and, whether it takes place after the abstraction of one ounce or thirty, is of no consequence; this change must supervene before the patient can be considered safe. Under all circumstances, therefore, I think we should never forego a trial of the lancet." This alteration in the state of the blood is probably to be attributed to the removal of the diseased condition of the mucous membranes.

After the first stage, it is always difficult to procure blood from a vein, on account of its diminished quantity towards the surface, and also of its thickened state, and the slight action of the vessel preventing its ready flow. Our efforts, however, ought to be persevered in as long as there is the least chance of success; if it does not flow readily from one arm, a vein ought to be opened in the other, at the same time, and leeches applied to the temples. The reason why I recommend this situation is, that I always put a blister on the abdomen, and the temples are then the most convenient place for their application.

"Few remedies, on a fair trial, have been more generally and unequivocally advocated than free bloodletting; and the most that has been urged against it is, that it is not always successful."* I have often found it to be most beneficial in the worst description of cases; but it ought not to be depended upon alone, for this is a disease whose rapidity requires the most prompt and decisive measures, and that we should call all our forces into action as quickly as possible; and, while we solicit the circulation towards the surface by means of bloodletting, we ought to urge it on by stimulants given internally, and by blisters and sinapisms applied to the surface.

I conceive that the success of bloodletting depends in a great measure on the quantity abstracted. It has been often observed that, after a small quantity of blood has been withdrawn, the veins of the arm are emptied, no more blood is propelled into them, collapse continues, and the patient sinks. But, on the other hand, when we succeed in keeping up a

* Madras Report. I have been lately favoured with the perusal of a letter from a Russian physician in Moscow to a gentleman in London, in which it is stated that bloodletting had been found there to be more hurtful than salutary; but at the same time the author recommends the application of leeches to the epigastrium. In India, leeches were never had recourse to, except where blood could not be obtained from a vein; and, in the absence of more definite information from Russia, I do not hesitate to give it as my opinion, that venesection, as employed in India, in conjunction with other means, will be found to be a most powerful remedy against the disease; for it would appear, from all that I can learn, that the symptoms of the epidemic in both countries are the same.

steady stream from the vein, and in thus causing a current from the interior towards the surface, we may entertain great hopes of success; and, in order to obtain this happy result, we ought not to allow our efforts to relax until all hope has fled. I have seen cases in which, upon a vein being opened in the arm, the blood has come from it at first only in drops, but, after long perseverance, by means of frictions to the arm and the application of warmth, the blood has at length flowed in a steady stream, has changed its colour, and the circulation towards the surface has been restored.

Blisters and Sinapisms. These are among the most beneficial, and certainly the safest remedies, that can be employed in cholera. Their mode of action is quite evident, from what has been said concerning the pathology of the disease. It has long been proverbial in medicine that there is always a determination of blood towards a part which is stimulated. By stimulating the skin, therefore, by epispastics and rubifacients, we restore the circulation of the blood towards the periphery, and thereby relieve the internal vessels, and consequently moderate the diseased action of the secretory apparatus of the mucous membranes.

I generally apply a strong cantharides plaster to the abdomen, and sometimes to the chest; cataplasms of mustard and capsicums to the feet and legs; and hot sand,* or friction, to the arms and hands. It is, I think, only in extreme cases that we ought to have recourse to boiling† water or acid for the purpose of raising a blister;‡ for when there is sufficient time to admit of a blister being raised by means of a plaster, the constant stimulus which it keeps up appears to be more effectual in occasioning a steady determination towards the surface, than the sudden and violent stimulus of the former.§ However, in two or three almost hopeless cases, I have seen the boiling-water blisters attended with the most favourable results. One of these was the case of a native woman in Darwar, who had been ill the greater part of the night. Her friends did not apply to me for medicines till nine o'clock in

* It has been suggested to me by a Russian gentleman, M. Smirnoff, that chaff would answer equally well, and would be pleasanter to the feelings of the patient. Either it, or the sand, may be heated up to 120 Fahr., enveloped in a soft cloth, and thus applied to the parts to be heated.

† The following is the most convenient method of raising a blister by means of boiling water: A cloth, slightly twisted, must be held by its two ends, and its middle part must thus be dipt into a pot of boiling water; when well soaked, it must be suddenly drawn out, and instantly applied to the skin.

‡ I have never succeeded in raising a good blister by means of acid, which has only acted as an escharotic; but the skin may be rubbed gently with it before the application of the cantharides plaster, in order to hasten its effect.

§ Vide Orton on Cholera, p. 418.

the morning. She then had no pulse at her wrist; her features were collapsed, and her skin cold. I ordered the boiling water to be applied immediately to the abdomen, and that she should have a little tincture of capsicums in some warm water. This was done: the circulation returned to the surface; and before the evening she was free from the disease.

Stimulants. The most difficult part of the treatment of cholera is the management of general stimulants. Most of them, when judiciously employed, may be productive of benefit; but there can be no doubt that they have sometimes done harm. It is therefore an object of the first importance to ascertain the principles which ought to guide us in the exhibition of them. When applied to a mucous membrane, they stimulate the arterial capillaries, have thus a tendency to produce inflammation, and increase the action of the circulation. It is also probable that they check the secretion of the membrane. Their utility therefore is evidently confined to cases of the pure catarrhal cholera, and they are counter-indicated by pain and burning at the epigastrium, or in the abdomen, which they always aggravate. Alcohol, æther, ammonia, various stimulating tinctures, essential oils, bitters, tonics, and aromatics, have all been used with success in the low form of the disease; and especially when combined with bloodletting, blisters, external heat, and calomel; but all of them ought to be avoided when inflammation is present.

Ammonia, besides its stimulating property, may perhaps have some effect by dissolving the fibrinous matter which lines the inner surface of the bowels, and thus by allowing the other medicines to come in contact with the mucous membranes. The grey stools, which have been already described as a favorable symptom, are probably owing to the combination of ammonia and calomel with the cholera secretion, and appear therefore to point out this medicine as having a favorable effect upon the disease. It is astonishing what large quantities of stimulants may be given with impunity in the catarrhal cholera; but it must be always kept in mind that, as soon as the healthy action of the gastro-enteric mucous membrane is restored, they will begin to produce their usual effects, and will then (if in great quantity) be liable to induce inflammation. Purgatives must therefore be either given along with them, or as soon as the disease begins to take a turn, in order to make them pass rapidly through the bowels, and be discharged by stool. Many of those cases in which great excitement has been known to follow the disease, are, I am convinced, to be attributed to the large quantities of spirits, and other stimulants, which had been given to the patient during the attack,

and which might probably have been prevented by a freer use of purgatives. The *drogue amère*, which was much in vogue at one time in India, and was employed in many cases with success, is a compound of stimulants, bitters, and purgatives, and appears well adapted to meet the indications of cure in many cases of the disease.

Calomel has been generally recommended in India as a powerful remedy in cholera, but practitioners have not always followed the same indications of cure in its exhibition. Some have given it merely with a view of exciting the biliary secretion; others, under the idea that it has *a specific effect* on the stomach and intestines; some suppose its efficacy to depend entirely on its sialagogue property, and that in this way it cures the disease by a sort of revulsion; its effects, again, have been attributed to its equalizing the circulation, or to its supposed sedative property. I conceive that most of these opinions are more or less erroneous. Its usual action on a mucous membrane, when given in a large dose, is to increase the secretion; in which case it renders the membrane white. If, however, its action be continued long on one spot, it gives rise to inflammation; which has been often observed in cholera; spots of inflammation having been frequently found, after death, in those parts of the mucous membranes to which the calomel adhered. The increased secretion which it produces is generally of a healthy description, is not inordinate nor watery, like that occasioned by the neutral salts, and is accompanied with an increased flow of bile. In regard to its general action on the system, "when given in moderate quantity, it communicates general vigour; it increases the force of the circulation, when this has become languid, by the increased vascular action which it excites; it gives to the blood the disposition to assume the buffy coat; and, by its stimulant operation on secreting organs, it promotes the secretions, and hence acts as a general evacuant."* How does it happen, then, that it has been considered by some, when given in scruple doses, to act as a sedative? This has evidently arisen from its secondary effects only having been taken into consideration, while its appropriate and primary effects have been overlooked.

Now, upon a consideration of the properties which we have just mentioned, we may conclude that, in all probability, calomel would be productive of more harm than benefit in catarrhal cholera, if employed alone; but, when combined with opium or stimulants, there is ample evidence to shew that it

* Murray's System of Materia Medica, vol. i. p. 196.

has been highly beneficial. In this form of the disease, our object, in its employment, ought to be to correct the diseased action of the gastro-enteric mucous membrane; to promote the secretion of the glands; to equalize the circulation; and, by its exciting the peristaltic action of the bowels, to cause all the medicines to pass along, and be applied to every part of their inner surface. We are told by Mr. Annesley, that calomel is most useful in removing the fibrinous matter, already described, from the mucous surface of the intestines; which I believe to be the case, and to be another highly important advantage of this medicine. He also supposes that the dark grey stools, whose appearance is always considered to be a most favorable symptom, are owing to the combination of the cholera secretion with the calomel. But I must mention that, by numerous experiments, I found that calomel produces no change upon the pure cholera secretion; and I imagine that the grey colour must be owing to the presence of ammonia, the combination of which with calomel is well known to occasion this colour. It is not improbable, therefore, that the secretion of ammonia by the gastro-enteric mucous membrane is a symptom of returning health. At all events, the occurrence of dark grey coloured evacuations may be always considered as an indication of a favourable change, for they shew that the calomel has done its duty, that part of the viscid fibrinous matter which might have obstructed the action of the other medicines has been removed, and that the peristaltic motion of the bowels has been restored. When bile also is added, a green colour is produced; and, accordingly, evacuations of this colour may be considered as a certain symptom of a return to healthy action in the abdominal viscera.

The usual mode of administering calomel in India has been to place twenty grains upon the tongue, and to wash it down with a draught of warm water and laudanum, or stimulants. The medicines which are given along with it must be regulated by circumstances: when there is no inflammation, stimulants ought to be preferred; when the bowels appear to be torpid, purgatives should be conjoined, or the drogue amère may be substituted. European physicians will probably be startled to hear of the large quantities of calomel which have been employed in this disease, for it was by no means uncommon to give it in repeated scruple doses to the extent of five or six scruples. Small doses in such a disease would be worse than useless; and the want of success in the employment of this medicine in Moscow, may perhaps have arisen from this circumstance not having been attended to.

Opium has been much extolled in the treatment of cholera.

Its primary effect is that of a diffusible stimulus; and it diminishes irritability, represses the secretions, and moderates inordinate actions. These properties point it out as a medicine well adapted for the catarrhal cholera; and, when given at the very commencement of an attack, it has often checked the disease. But, beyond this, it ought never to be depended upon alone; and indeed, in the opinion of many able practitioners, its employment, after the first stage of the disease, is considered to be more hurtful than beneficial. In the advanced stages therefore, stimulants may be substituted, or the opium may be employed only in conjunction with calomel. The latter combination was, in fact, at one time much recommended in India, and appears well calculated for fulfilling the intentions of cure in the catarrhal cholera; the requisite properties wanting in the one medicine being supplied by the other. Thus, calomel keeps up a permanent stimulant effect on the system, which opium does not. Opium represses the abundant discharge from the gastro-enteric mucous membrane, while calomel corrects it. Lastly, calomel increases the peristaltic motion of the bowels, and thus effects the discharge of vitiated secretions, while opium relieves irritation. It must at first sight appear paradoxical that purgatives should be required in a disease, one of whose principal symptoms is violent purging, but it has been already stated, in the description of the disease, that purging is sometimes entirely absent; and in many cases, in which there is an almost constant flow of serous fluid from the bowels, their peristaltic motion is nevertheless suppressed, and the fibrinous matter which has been so frequently mentioned is retained. Accordingly, it has been found, in many post-mortem examinations, that the medicines had proceeded no farther than the stomach, and that the intestines were loaded with the cholera secretion. Purgatives, therefore, are indicated in all cases in which the bowels appear not to propel forward their contents, and in which the action of the medicine is prevented by the retention of the viscid fibrinous matter which lines their mucous surface. They are also absolutely necessary in all cases during convalescence, in order to rid the bowels of the stimulating medicines, which would now prove hurtful, together with their diseased secretions; and also to prevent inflammation, which is sometimes a sequela of the disease. From the above observations, it is evident that their employment, during the attack, must be left in a great measure to the judgment of the practitioner. The purgatives which may be employed in the catarrhal cholera, in addition to calomel, are colocynth, jalap, or aloes, combined with some aromatics, or stimulants, or the drogue amère. The neutral

salts are clearly inadmissible. Clysters may be used with the same view as purgatives; or stimulating medicines may be thrown into the large intestines, for the purpose of restoring the healthy action of their mucous membrane.

At the commencement of the epidemic in India, the *warm bath* was occasionally employed; but, although the utility of external heat has been universally acknowledged, yet this has been almost always found to be an inconvenient mode of applying it; and in some cases it appears to have been attended with positively injurious effects. Great expectations were at one time entertained of the benefit to be derived from the *vapour bath*, which was first recommended by Mr. Dalton, of the Madras Medical Establishment; but this also, after a fair trial, was abandoned. The same remedy, however, has been revived, with some appearance of success, in Moscow; and the manner of employing it is nearly the same as that recommended by Mr. Dalton in India, as will appear from the following description which has been transmitted to M. Alexander Tourgeneff from a correspondent in Russia. The patient is put in bed, under which are placed two or three basins with burning balls or heated bricks; vinegar, not too strong, is poured upon these, to produce vapours; the bed is covered, and carefully surrounded on all sides, so that the vapour may act upon the whole body of the patient, except his head, without penetrating through the bed-clothes. This is called a vapour bath; and a bed or machine has been already contrived for this operation." Now, as this remedy was not employed in Moscow until the disease had begun to decline, it is not improbable that the success which appeared to attend it was to be attributed to the less degree of malignancy which is known always to characterise those cases which occur when the malady is subsiding.

Experience has led medical men in India invariably to prefer *dry heat;* for which purpose, heated sand, or chaff, as already described, or bottles of warm water wrapped in cloth, may be employed.

It is not necessary to give an account of the various *empirical remedies* which have been recommended. They have either been ascertained to be entirely useless, or to be applicable only to particular cases. In a treatise on any disease, it is of most importance to point out correctly *the principles of treatment;* for it would be almost impossible to enter into details which would be applicable to all its modifications.

Cold drinks are clearly counter-indicated in catarrhal cholera; but there appears to be no reason why tepid drinks should be withheld. I would recommend a weak infusion of ginger,

or ginger-tea, as it is called; and if this cannot be had, weak brandy and water may be substituted. I know that some practitioners have recommended cold drinks; but, if they have ever proved beneficial, this could only have been the case in the inflammatory or mixed form of the disease, for both theory and experience forbid their use in the catarrhal cholera.

It is unnecessary to describe the treatment of the inflammatory cholera, a disease so well known in all countries, that most physicians are familiar with it. I will therefore only remark, in order to contrast it with the catarrhal cholera, that the indications of cure are to remove the inflammation of the mucous membrane of the primæ viæ, to subdue the spasms, and to prevent congestion; the most effectual remedies for which will be free bloodletting, scruple doses of calomel, followed up by castor oil, frictions; and, in severe cases, in which there appears to be a tendency to congestion, blisters. Simple tepid drinks may be given to alleviate thirst, and stimulants are to be avoided.

In mixed cases, viz. in such as have inflammation added to catarrh, and the symptoms of which have been described in a former chapter, the treatment must be modified; and, the greater the symptoms of inflammation, the more guarded must we be in the employment of opium and stimulants. In such cases we must principally depend upon bloodletting, blisters, and calomel; opium being only given at the commencement, to repress the action of the stomach, and enable it to retain the other medicines. It must be remembered, however, that such cases often degenerate into the worst form of the catarrhal cholera, and must then be treated accordingly.

Recovery from cholera is generally rapid; and a proper attention to the state of the bowels is generally all that is required to ensure a speedy restoration to health. Cases do sometimes occur, however, which are followed by inflammation and organic derangement of the mucous membrane of the stomach and intestines, and demand the utmost skill and attention of the physician; but, as they form diseases distinct from cholera, and which are well known in Europe, their treatment does not require a description here. Happily they are not of frequent occurrence, and may be often prevented by a judicious treatment in the first stages of the disease.

It may be useful now to give a short connected account of how a common case ought to be conducted. It must be constantly kept in mind that the disease is so rapid in its progress, that minutes are of more importance in it than hours in most other diseases; and we must therefore bring

our different remedies into operation as quickly as possible. Suppose a patient to be brought to us with symptoms of catarrhal cholera, (for instance, with vomiting and purging, a small pulse, cold skin, &c.) a scruple of calomel must be given to him, and must be washed down with fifty or sixty drops of laudanum in a little warm water, or with a dose of one of the stimulating or antispasmodic draughts, the prescriptions of which are given in the next page. Blood must be drawn by venesection, and by a large orifice, until an alteration be produced upon the circulation, indicated by the pulse becoming fuller, by the blood flowing more freely, and regaining its healthy appearance. A strong blister must be applied to the abdomen, and sinapisms to the legs and feet; and the external heat must be kept up by means of heated sand or chaff, in the manner already mentioned. Should the disease continue, or become aggravated, the pulse ceasing at the wrist, and the coldness or collapse increasing, we must then renew the scruple of calomel every hour, and accompany it with doses of the drogue amère, or of some stimulating draught; and our efforts to procure blood from the arm must be persevered in, or leeches applied to the temples. When the circulation begins to be restored towards the surface, the stools to be of a dark grey colour, and the secretion of urine to be renewed, we may consider the disease to have taken a favourable turn; and, when the dejections become green, we may generally consider our patient as safe. If this stage be accompanied by no reaction, all we have to do is to free the bowels from their diseased secretions, and from the stimulating medicines which had been previously given; which may be best effected by colocynth, jalap, or an infusion of senna with tincture of rhubarb. During the whole attack, the patient's thirst ought to be alleviated by a weak infusion of ginger.

Now I do not pretend to say that this treatment is applicable to all the varieties of the complaint. I have merely given it as an example of how one of the most frequent cases ought to be managed; but, under any circumstances, the practitioner who understands the principles upon which the treatment must be founded will experience little difficulty; and I need scarcely repeat, that the greatest difficulty he will probably have to contend with will be *want of time*.

When the attack has been fairly mastered, we have then only to attend to the convalescence of our patient; when it will be necessary to insist upon the use of the most digestible kind of food, and that in small quantity; to forbid cold drinks, and exposure to cold air; and to keep the bowels in

a regular state. These measures will seldom fail to restore the patient soon to his usual state of health; and, in fact, it is wonderful what a very short period of time (a few hours only in some cases,) is sufficient to rescue an individual from the most aggravated form of the disease, and to bring back all the feelings of health, accompanied only with debility.

PRESCRIPTIONS.

I. Mist. Camphor. lb. i.; Tinct. Cardam. ℥ss.; Spirit Ammon. Aromat. ℥i. M. Two ounces for a dose.

This mixture will be found well adapted for the low form of the disease: it is stimulating, and, at the same time, the ammonia having the property of dissolving the fibrinous matter which lines the alimentary canal, will have the effect of removing it, and of thus enabling the other medicines to act.

II. *Antispasmodic Draught.*

℞. Mist. Camphor. ℥ij.; Tinct. Opii, Castor, *aa* ʒss.; Spt. Ammon. Aromat. min. xx. M. *(Madras Report.)*

This ought only to be given in cases accompanied by severe spasms.

III. *Stimulating Tincture.*

℞. Fruct. Capsici. Annui, Zingiberi, *aa* ʒiv.; Alcohol dilut. lb. ij. M. et post sex dies cola.

Half an ounce may be given in warm water, along with the calomel, as directed in the text.

Should none of these medicines be at hand, simple warm brandy and water may be substituted.

Drogue Amère.

℞. Aloes Socot. lb. i.; Gum Myrrh, G. Mastich, G. Benzoes, ad. Colomb, *aa* ℥viij.; Croci Anglici, Rad. Gentianæ, *aa* ℥iv.; Eau de vie, lb. xxxvj.; Genèvre, lb. xij. M. To stand forty days, then filter through paper for use.

This medicine was much employed, and often with great success, at Pondicherry and Madras. It may be given in doses of an ounce, as soon as possible, and be repeated at short intervals. It possesses many of the properties which are likely to meet the indications of cure; being stimulant and tonic, and the purgative it contains being likely to excite the peristaltic motion of the bowels, and thus cause the other medicines to pass through, and the cholera secretion to be discharged.

APPENDIX.

Cases of Catarrhal Cholera.

Darwar; 14th May, 1825.

Case I. Lingah, male convict, æt. twenty-two, was admitted into hospital at five A. M. with frequent vomiting and purging. His evacuations consisted of a greenish-coloured serum, in which floated a number of white flakes. Features collapsed; hands and feet cold; pulse extremely small. Complained of no pain or uneasiness. Took several doses of laudanum, several five-grain doses of calomel, and some pepper-water. Hot sand was applied to his hands and feet, and a blister to his belly. He sunk rapily, and died at eleven A. M.

Dissection. Peritoneal coat of the intestines of a rose colour. Mesenteric veins not larger than usual. The mucous membrane of the stomach and intestines appeared thicker than usual; was pulpy, easily lacerated, and was lined with a thick, white adhesive mucus. Liver natural, but contained a good deal of dark-coloured blood. Gall-bladder contained healthy bile. Dark-coloured blood in the left cavities of the heart. Brain not examined.

Darwar; 15th May, 1825.

Case II. Royapah, male convict, æt. twenty-nine. Six A. M. was attacked very early this morning with severe vomiting of a whitish watery fluid. Has vomited four or five times since he came into hospital. No purging. Is very restless; pulse quick, and very small; extremities cold, countenance anxious, complains of thirst.—Emitt. sanguinis e brachio ʒxvi. Capiat Calomel gr. v. quaque semi-hora. Capiat stat. Tinct. Opii, gr. xv. Admoveantur empl. epigast. abdomini, et arena calida manibus et pedibus. Habeat subinde paululum Infusionis Piper.—Nigri tepidæ pro potu.

Five P. M. Two veins were opened, from which fourteen ounces of dark-coloured blood were procured. No vomiting since he took the laudanum. Has taken five doses of the calomel. Bowels not yet moved. Pulse very small; skin cold.—℞. Calomel, Extract. Colocynth. comp. āā gr. x. Misce, fiat bolus stat. sumend.

16th. Seven A. M. Feels much better. Has had two watery yellow stools. Pulse continues small; hands and feet cold.—℞. Infus. Quassiæ ℥ij.; Alcohol. dilut. ℥sss. M. ter in die sumend.

17th. Convalescent.

Darwar; 17th June, 1826.

Case III. Nursumloo, æt. twenty-five, sepoy 5th regt. N. I. Half-past six A.M. Was attacked with vomiting about four o'clock this morning; but it appeared to

him of so trifling a nature, that he delayed coming to hospital till now. Features much collapsed; is very weak; pulse thready, scarcely perceptible at the wrist; extremities cold; tongue clean.—Emitt. sanguinis e brachio ℥xxx. Sumat. stat. Calomel ℈i.; et superbibat paululum mist. Camph. in aqua tepida. Admoveantur empl. epispast. validum. abdomini et thoraci; sinapismi pedibus, et arena calida brachiis.

Half-past seven A. M. His pulse ceased at the wrist a few minutes after last report. Only two or three ounces of dark-coloured blood could be procured from his arm. He vomited a large quantity of serous fluid, mixed with white flakes; immediately after which, another scruple of calomel, a drachm of laudanum, two drachms of tincture of cardamoms, and some warm water, were given to him, which remained on his stomach. Features much collapsed. No pain, even in the abdomen on pressure; extremities cold; no pulse at the wrist or temples.—℞. Calomel gr. v.; Tinct. Cardamomi ʒiij.; Aquæ tepidæ ℥ij. Misce fiat haust. Stat. sumend. et repetend, quaque semi-hora. ℞. Infus. Sennæ ℥vj.; Ol. Ricini ℥i.; Tinct. Cardamomi ʒij. Misce fiat enema stat. injiciend.

Two P. M. The enema brought away nothing except a lumbricus. He has taken the calomel and tincture of cardamoms nearly every half-hour. No pulse at the wrist or temples; skin very cold.—Omit med. Habeat infus. Piper. Nigri pro potu.

18th. Six A. M. Has taken nothing since last report except a little pepper-water. Features still much collapsed; pulse just perceptible at the wrist; skin a little warmer. The blister has begun to take effect. Had several watery brownish stools during the night, and made water freely this morning. Has just now had a very scanty stool of thick mucus, tinged with blood.—℞. Ol. Ricini ℥ij.; Aquæ tepidæ ℥xij. Misce fiat enema stat. injiciend.

Six P.M. The enema came away a few minutes after it was administered, and brought nothing along with it. Has had no other evacuation since last report. Features still considerably collapsed; pulse somewhat improved; skin warmer.—Habeat aquam oryzæ pro potu.

19th. Six P. M. Slept a good deal last night, and has continued easy all day. Had two grey-coloured evacuations last night, and two dark green rather consistent evacuations this forenoon. The blister has risen a little. Pulse and features improved; extremities rather cold.—℞. Infus. Quassiæ ℥ij.; Tinct. Cardamomi ʒij. Misce, ter in die sumend.

20th, mane. Has had one dark greenish-coloured stool since last report. Slept well during the night. Features much improved; pulse natural; skin warm; mouth slightly affected by the calomel.

21st. Convalescent.

Darwar; 17th June, 1826.

Case IV. Vyapoory, æt. twenty, sepoy 5th regiment N. I. Has been in hospital since the 15th instant, with an ulcer on the leg.

Two P. M. Reported to the dresser about half an hour ago that he had vomited two or three times a large quantity of white watery fluid; but that, excepting weakness, nothing else was the matter with him. His illness had not even attracted the notice of the other patients in the ward. Pulse already imperceptible at the wrist; features collapsed; extremities cold; no perspiration. Has taken fifty minims of laudanum.—Sumat. stat. Calomel ℈i., et superbibat. Tinct. Cardamomi ℥sss. in paululum Aquæ Piperit. tepidæ. Admoveantur empl. epispast. validum. abdomini. sinapismi pedibus et arena calida brachiis.

18th. Six A. M. In addition to the medicines prescribed above, he took ten grains of compound extract of colocynth yesterday evening. His pulse began to be perceptible last night at ten o'clock, and is now just perceptible at the wrist. Skin a little warmer. Had two watery yellow stools yesterday evening.—℞.

Calomel, Extract. Colocynth. comp. āā gr. x. Misce. ft. bolus stat sumend. et superbibat Tinct. Cardamomi ℥sss. in paul. aquæ tepidæ.

Six P. M. Has had five or six yellow watery stools since he took the calomel and colocynth. The blister has not yet taken effect. Pulse much improved; skin warmer.—Habeat aquam oryzæ tepidam pro potu ad libitum.

19th. Six A. M. Slept pretty well during the night. No evacuation since last report. Complains only of weakness. Features much improved; pulse tolerably good; skin warm.—Sumat Infus. Quassiæ ℥ij. ter in die.

20th. Convalescent.

Darwar; 23d August, 1826.

Case V. Muddry Mootoo, male convict, æt. forty-five, was brought into hospital this morning with a bowel complaint.

Half-past five P. M. He reported to the dresser, about an hour ago, that he had vomited once, and had been purged two or three times since the morning. Evacuations white and watery. A blister was immediately applied to his abdomen, sinapisms to his legs and feet, and hot sand to his arms. A scruple of calomel was given to him, and was washed down with a little tincture of cardamoms and warm water; but was retained a very short time. Another scruple was therefore given, with thirty-five drops of laudanum. At present, features collapsed; skin very cold, dry; pulse small; tongue covered with a white coating, complains of no pain or uneasiness; intellect clear.—Emitt. sanguinis e brachio ℥xxx. ℞. Calomel. ℈ij.; Extract. Colocynth. comp. gr. x. Misce, fiat bolus stat. sumend. et superbibat Tinct. Cardamomi ℥ss. in aquæ tepidæ ℥ij.

Half-past six P. M. About ten ounces of dark-coloured blood streaked with red have been procured. Continues quiet. Suffers no pain; complains of thirst. Pulse scarcely perceptible at the wrist; breathing slow, and scarcely perceptible; no vomiting or purging.—℞. Ol. Ricini ℥ij.; Tinct. Cardamomi ℥ss.; Aquæ tepidæ ℥xij. Misce, fiat enema stat. injiciend. Habeat aquam oryzæ ad libitum.

Half-past ten P. M. Thirteen ounces of blood were procured; it has separated into serum and crassamentum, the latter of which continues dark coloured. Had two copious white watery stools, after having had the enema. Skin cold; pulse indistinctly perceptible at the wrist.—Rep. Enema. ℞. Tinct. Cardamomi ℥ss.; Aquæ tepidæ ℥i. Misce, omni hora sumend.

Half-past eleven P. M. Has vomited a quantity of white watery fluid. Skin very cold, and somewhat moist; pulse thready; complains of thirst.—℞. Calomel ℈i. et superbibat Tinct. Opii gtt xxv. in aqua tepida.

24th. Seven A. M. Has had two watery dark-grey coloured stools. Skin cold and dry; pulse just perceptible at the wrist; no pain; intellect clear. The blister has not taken effect, but occasions a burning sensation.—Admoveatur sinapism. pectori. Rep. enema.

25th. Seven A. M. Had one yellow watery stool yesterday, and one nearly natural stool this morning. The blister has risen pretty well. Pulse natural; tongue cleaner; no thirst.

26th. Convalescent.

Darwar; 3d September, 1826.

Case VI. Beema, male convict, æt. eighteen. Ten A. M. Was brought into hospital at eight o'clock. He reports that, when working on the roads yesterday, he vomited two or three times. In the evening he ate a little rice, and slept pretty well last night. Had several watery stools this morning, and, when brought to hospital, had no pulse at the wrist. Skin very cold; features collapsed; breath cold. No pain or uneasiness; is very weak; speaks distinctly; intellect clear. Has taken two scruples of calomel, half an ounce of tincture of cardamoms, and some warm water. A strong blister has been applied to the abdomen and chest; sinapisms to his legs and feet; and hot sand is constantly

applied to his arms.—Affigantur hirudin. xvj. temporibus. Sumat stat. Extract. Colocynth. comp. gr. ix. et superbib. Tinct Cardamomi ℥ss. in paululo aquæ tepidæ. ℞. Tinct. Opii gtt. xxx.; Tinct. Cardamomi ℥ss.; Aquæ tepidæ ℥ii. Misce, omni hora sumend. Aqua oryzæ pro potu.

Twelve, noon. Has taken one dose of laudanum and tincture of cardamoms. Fourteen leeches have adhered to his temples. Complains of pain from the sinapisms. No pulse; skin cold; no perspiration; intellect perfectly clear; voice weak.—℞. Infus. Piper. Nigri ℥x.; Ol. Ricini ℥ij. Misce, fiat enema statim injiciendum.

Five P. M. Has had two clysters, which came away without any thing else shortly after the last was injected. No other medicine has been given. The leeches appear to have drawn about twelve ounces of blood, which, after having stood about two hours, is black, fluid, of the consistence of honey, without having separated any serum. Pulse perceptible at the wrist, 130, very small. Complains of a burning sensation from the sinapisms and blister. Voice fuller; skin cool; no perspiration.—℞. Infus. Sennæ comp. ℥iv.; Tinct. Rhei ʒij. Misce, stat. sumend. Contin. arena calida et aquæ oryzæ.

4th. Seven A. M. Has had a copious turbid watery evacuation this morning, consisting partly of some of the enema. Complains only of the blister, which has risen a little. Countenance much improved; pulse pretty full; skin natural; tongue furred, brown. The blood which was drawn by the leeches continues black and fluid.—Habeat aquam oryzæ ad libitum.

5th, mane. Had one thin yellow feculent stool yesterday forenoon. The blister rose pretty well. Pulse ninety, pretty full; tongue furred, brown in the middle; skin natural.—Sumat stat. Ol. Ricini ℥i.

6th. Convalescent.

Darwar; 8th September, 1826.

Case VII. Yellah, male convict, æt. forty-five. Half-past six A. M. Has just been brought to hospital. Reports that he vomited once or twice yesterday when at work on the roads, and was purged two or three times; but that he eat his dinner, and slept pretty well during the night. He vomited again this morning. Features much collapsed; skin deadly cold; no pulse; is extremely weak; voice weak; breath cold; is perfectly sensible; and complains only of thirst; mouth moist, with a good deal of mucous; no perspiration.—Sumat. stat. Calomel ℈ij. et superbibat Tinct. Cardamomi ʒss. et Tinct. Opii ʒi. in paululo aquæ tepidæ. Admoveantur empl. epispast. abdomini et pectori, sinapismi pedibus et arena calida brachiis. Affigantur hirudin. xxx. temporibus. Habeat aquam oryzæ calidam pro potu.

Nine A. M. No alteration. Has not vomited or been purged since last report. Intellect clear. Complains of thirst, and of burning from the cataplasms.—℞. Submur. Hydrarg. Extract. Colocynth. comp. āā gr. x. Misce, fiat bolus s. s. et superbibat Tinct. Cardamomi ʒss. in paul. aquæ tepidæ. ℞. Ol. Ricini ℥ij.; Tinct. Cardamomi ℥ss.; Aquæ tepidæ ℥xij. Misce, fiat enema statim injiciend.

Eleven A. M. Retained the enema about a quarter of an hour, when it brought away a quantity of serous fluid and white flakes; no vomiting; thirst continues; pulse very indistinctly perceptible at the wrist, stops occasionally for a few seconds, and is again renewed. The leeches have dropped off, after having drawn about twelve ounces of blood, which is black, mixed with a few red spots and streaks, and is of the consistence of liquid honey.—Rep. Hirudin. xx. ℞. Tinct. Cardamomi ℥ss.; Aquæ tepidæ ℥ij. Misce, omni hora sumend.

Five P. M. Has had two white watery stools since last report. Complains only of the pain from the blister and cataplasms; pulse not perceptible at the wrist; thirst less. About ten ounces more blood have been procured, which is watery, of a black colour, with a dash of red.—℞. Infus. Sennæ comp. ℥iij.; Tinct. Rhei ℥ss.; Cardamomi ℥ss. M. stat. sumend. Rep. Hirudin. xx.

About ten or twelve ounces of black fluid blood were drawn by the leeches. The patient continued without any suffering, and died at ten P. M.

Dissection. Abdomen: Great venous congestion in the mesentery, stomach, and intestines; the mesenteric veins being much distended, and their ramifications traceable over the intestines, which were thus rendered of a purple colour. Stomach much contracted, and contained a small quantity of turbid serous fluid mixed with white flakes: its mucous membrane exhibited numerous purple spots, and was lined with a whitish viscid substance. The small intestines, thin and much distended, contained a large quantity of grey fluid mixed with grey or white flakes, and several lumbrici. Their mucous membrane was thin, easily lacerated; in some places white, in others pinkish, and in others purple coloured. Large intestines contracted, except a part of the ascending colon, which was very much distended; they contained a considerable quantity of a purulent like matter, and their mucous membrane was in some places of a deep purple, in others white, or of a pinkish colour. Spleen soft, flabby, and *containing not a drop of blood.* Liver healthy, with very dark-coloured blood in its large veins. Gall-bladder distended with healthy bile. Urinary bladder contracted: its mucous membrane exhibited traces of venous congestion, and was lined with viscid white mucous matter, which also lined the ureters.

Thorax: Extensive pleuritic adhesions; much venous congestion in the lungs; a good deal of white froth in the trachea and bronchia; their mucous membrane lined with a diaphanous mucus. A small quantity of blood in both sides of the heart.

Head: Meningeal veins loaded with black blood. Drops of black blood issued from the divided surfaces of the brain. Much congestion in the upper part of the spinal marrow.

Observations. I have never in any case observed so much venous congestion as in this. None of the morbid appearances in the viscera in this case can be attributed to inflammation, but solely to venous congestion; the turgid mesenteric veins being in many places traceable to the purple patches on the intestines. An interesting circumstance in this dissection is the total want of blood in the spleen, which must be attributed to the great determination of the blood from all the other parts of the body towards the mucous system, the seat of increased action. It necessarily happens that the liver is also generally the seat of great congestion; for through it must all the blood pass from the stomach and intestines in its return to the heart.

The following four cases, taken from the Report published by Mr. Scot, under the superintendence of the Madras Medical Board, are good examples of the catarrhal cholera, and exhibit some of the characteristic phenomena of the disease.

Case VIII.* Mootein, sepoy, admitted 23d October, ten o'clock A.M.; æt. twenty-seven, rather of a robust habit of body. Was seized, about eight hours ago, with violent vomiting and purging of a watery nature; when he was brought to hospital, his pulse was not to be felt at the wrist; skin covered with a cold clammy sweat; complains of a burning sensation about his stomach; intense thirst; tongue dry, and a little furred; great prostration of strength.—Submurias Hydrarg. gr. xvi., washed down with equal parts of hot brandy and water; hot bricks to his extremities, and to be well covered with cumlies.

Eleven o'clock. Has had two watery stools.—Continue the hot bricks, and the brandy and water, to allay his intense thirst; let him have a clyster, combined with two scruples of laudanum immediately.

Twelve o'clock. A return of vomiting; one watery stool; skin a little warmer;

* By Assistant-Surgeon Wilson, 2d bat. 23d regt., Madras, Oct. 1818.

pulse not to be felt. The clyster was ejected without doing any good.—Continue as before.

Two o'clock P.M. No alteration.—Repeat the calomel; continue the hot applications, and the brandy and water.

Six o'clock. No return of vomiting; still watery purging; in other respects the same.

Nine o'clock. At his urgent request, being a Christian, his frieuds were prevailed upon, without my knowledge, to send for a clergyman, to administer the sacrament to him, previous to death, which he conceived to be inevitable.

Half-past nine. I observed, for the first time, the diaphragm and muscles of respiration acting very laboriously, with great apparent difficulty in breathing. I ordered immediately a strong liquid blister to his chest, and took away, with great difficulty, twenty ounces of blood from his arm: the blood was of the darkest colour, and very thick. Ten minutes after the bleeding, his pulse was feebly felt at the wrist, but his countenance of a much livelier appearance, and he thinks himself much better.—Continue the brandy and water, and hot applications as before.

Twelve o'clock. A large bilious stool, of a most offensive nature; skin warmer; pulse rising.—One o clock. Left him asleep.

24th. Six o'clock A.M. Slept for nearly four hours: has had two more stools of the same nature; pulse rising fast; skin warm; thirst abating; feels hungry. —Let him have arrowroot, with a little port wine in it, for breakfast.

Ten A.M. Doing well.—Capiat statim misturæ purgant, ℥ij.

Five P.M. The purgative gave him four stools; the three first of a bilious nature, but the last nearly natural.

Eight P.M. Improved.—Capiat Submur. Hydrarg. gr. iv.; Pulv. Antimon. gr. ij.; Opii gr. i.; Conserv. Rosa q. s. M. et fiat pilul. ij. statim sumend.

25th. Passed a good night.

26th. Convalescent.—Port wine and nourishing diet.

31st. Discharged.

Case IX. Neucanah, sepoy, admitted 12th October, four P.M.; æt. twenty, of a robust habit of body. Was seized, while on duty this morning, with vomiting and purging of a glairy matter almost colourless. When he was brought to the hospital, his pulse was not to be felt at the wrist; extremities cold, and his skin covered with a clammy sweat; eyes sunk; complains of deafness, and great difficulty in breathing; tongue dry and furred; intense thirst.—Submur. Hydrarg. gr. xvi.; Pulv. Antimon. gr. ij.; Opii gr. jss.; Conserv. Rosa. q. s. M. et fiat bolus. Let him have an anodyne enema immediately, hot applications to his extremities, and equal parts of hot brandy and water to be given, when called for.

Six o'clock. No return of vomiting; the enema was ejected in the course of four minutes after it was thrown up, without affording any relief; two stools of a watery nature; complains of very great difficulty in breathing.—Twenty ounces of blood were taken from his arm with great difficulty; it was of the darkest colour, and thicker than any blood I ever saw drawn from a vein before. Immediately after the bleeding he breathed much easier, and his pulse at the wrist could be faintly felt; skin a little warmer.—Let sinapisms be applied to his extremities, and his body be well rubbed with hot salt, and the brandy and water be continued.

Eight o'clock. One large bilious stool, which afforded him great relief. Breathing completely relieved, from the bleeding; pulse rising.—Mist. purg. ℥iij.

13th. Passed a good night; has had several bilious stools. His only complaint now is that of great prostration of strength.—Nourishing diet, and four glasses of port wine during the day.

14th. Free from complaint.
15th. Capiat mistura purgant ℥iij.—18th. Discharged.

Case X. Captain G. D., æt. thirty-four, of a robust habit of body, was brought to my quarters on Monday morning, who informed me that, the day previous, he had been seized, about eleven o'clock, with vomiting and purging of a watery nature; that he vomited three or four times, and was purged as often; that he felt himself much better about two in the afternoon; at night he went his rounds, being on guard at the fort. On his return, he states himself to have been in a state of perspiration, when he drank a tumbler of cold water; after which he was seized with incessant vomiting and purging, which continued until his arrival at my quarters. Immediately after my seeing him he had one watery stool, with a great inclination to vomit, and incessant craving for cold water, in consequence of violent thirst and burning sensation about the stomach; tongue dry and furred; pulse not to be felt at the wrist; extremities cold, and his whole body covered with a cold clammy sweat; countenance expressive of great despondency. A careful examination of the region of the liver took place; no complaint on pressure of that organ. He was immediately undressed, and put into my warm bed, which I quitted on his arrival, and covered over with blankets; bottles of hot water to his extremities. At this period there was not any appearance of spasms, nor could he recollect having suffered any pain during the preceding day.—℞. Submurias Hydrarg. gr. xvij. statim sumendus; postea Tinct. Opii ℥ij., and a claret glass of hot brandy and water. The medicine remained on his stomach about an hour and a half, during which time he was supplied with hot brandy and water to allay his thirst; at this period part of it was disgorged.—Continued the hot fomentations to his extremities.

Ten o'clock. Pulse felt at the wrist, small and slow; extremities rather warmer; has had another watery stool.—Let him have an enema with two drachms of laudanum. The enema was ejected in the course of five minutes, without producing any good effect. No inclination to sleep, but thinks himself rather better.

Eleven o'clock. Capiat statim Submur. Hydrarg. gr. x. From eleven until two, appears improving; watery purging still continues.

Half-past two, had a return of sickness.

Four o'clock. Sickness of stomach entirely left him, but still watery stools, without any appearance of bile or fecal matter.—Capiat statim Submurias Hydr. gr. vi.; Extract. Colocynth. comp. gr. vi.; Pulv. Antimonialis gr. ij.; Conserv. Rosæ q. s. M. ut fiat bolus.

No alteration from four until six; has had another watery evacuation.

Six o'clock. Spasms appeared in the abdominal muscles, when a large blister was immediately applied to the part. The spasms increasing, called in Mr. Surgeon Davies, when it was agreed to take blood from the arm, which was done to the extent of forty ounces, with great difficulty, from the thickness of the blood, notwithstanding a large orifice had been made. Threw up another injection. He feels himself relieved from the loss of blood; pulse rising, skin more natural.—Calomel gr. v. statim.

From this period until eleven o'clock, no alteration; constantly complaining of great thirst, which was relieved by small quantities of brandy and water; no prostration of strength since the attack.

Eleven o'clock P. M. Complains of restlessness, and appears very despondent. From the dormant state of the liver, it was agreed to endeavour to assist the operation of the calomel by a brisk cathartic, and gamboge was thought most likely to remain on his stomach; four grains of which were accordingly given, and retained, but without the desired effect.

Three o'clock Gave him three grains of calomel, and an enema of Pulv. Ipecac. ℥ii.; Magnes. Vitriolat. ℥i.; Congee water ℥xv., which was ejected, after being retained for a few minutes.

Five o'clock. Countenance expressive of great mental agony; conceives himself beyond all hopes of recovery.

Six o'clock, no alteration in his evacuations; skin still moist, and the stomach retains all the medicines. Blister rose well; pulse very feeble. Pulv. Jalap. gr. xxv. to be taken in a little jelly.

Ten o'clock. Remains the same; no alteration in his evacuations; agree, if possible, to effect a change by mercurial frictions, combined with camphor, on his thighs and arms, every two hours; and one grain and a half of calomel to be taken every hour, in a little jelly; which was continued, until his decease.

Eleven o'clock A. M. The pulse began to sink, extremities clammy; hot bricks, warm applications, and frictions, applied; and he was supported with small quantities of brandy and water. From twelve until two, he took warm congee and tea, and slept a little; appears rather better.

He continued in the same state until nine o'clock, during which period he was supported with soup and hot brandy and water; half-past nine he started from his bed, had a convulsive spasm, and instantly expired.

Dissection. I examined the body in the presence of Mr. Surgeon Davies. The liver appeared sound, but of a paler colour than usual, the gall-bladder was much distended with bile, of the consistence and colour of tar; the spleen and pancreas quite healthy; the stomach empty, and of a natural appearance; the intestines, particularly the duodenum throughout their internal structure, were lined with bilious matter, nearly of the same colour and consistence as that of the gall-bladder, which adhered firmly to their villous coats; no appearance of fecal matter in any part of the canal; the urinary organs sound, and the bladder empty; no appearance of inflammation in any of the viscera of the abdomen. On examination of the thorax, the heart and pericardium were found in a sound state; the lungs were completely distended with blood of the darkest colour; the left lobe, to all appearance, must have ceased performing its functions some hours previous to death; the right was nearly in the same state, except a small portion, which appeared nearly in a natural condition. On examination of the head, there was not any appearance of a determination of blood to that organ; and, after a careful dissection of the brain, there did not appear any fluid in the ventricles, or any other appearance of disease.

Case XI.* John Burnes, private, October 28th, complains, eight P. M., of vomiting and purging, attended with severe spasms of the lower extremities; great prostration of strength; skin cold; pulse small and rapid; eyes dull and heavy; uneasiness of the epigastric region; says he was attacked with the above symptoms in barracks a few hours after his return from Madras. He is ordered immediately of laudanum 120 drops, tincture of capsicums, two drachms; spirits, three ounces; fomentations to the abdomen, heated sand and bottles with warm water, to the extremities; spirits and water, and ginger tea, for drink.

The spasms abated considerably for nearly an hour, and the vomiting and purging ceased for the same time, when, at ten A. M., the spasms and other symptoms returned with increased severity; the former extending to the thorax and upper extremities, affecting his breathing and hearing, and he appeared to labour under excessive sufferings. The abstraction of twenty-five ounces of blood from the arm was productive of immediate and permanent relief from the spasms, and other painful symptoms. He is now ordered the following draught, and,

* Garrison-Surgeon M'Cabe, Poonamalee, October 1818.

after it, twenty grains of calomel, and to be repeated as occasion may require. Tinct. Opii gtts. 130; Tinct. Capsic. ʒi.; Spts. Æther. Vit. ʒi.; Spt. Tin. ℥iij. ft. h. Fomentations, &c. to be continued.

29th. He had a tolerably quiet night, and it was not found necessary to repeat the draught. At nine A.M. he vomited some yellow bilious matter, and had a small stool of the same appearance.—He is ordered twenty grains of calomel instantly, with Aq. Menth. ℥j.; Tinct. Opii, Spt. Æth. Vit. āā gtt. xl.

Two P.M. Stomach settled; complains of giddiness and thirst; no motion; urine free.—Inf. Sennæ comp. ℥iv.; Tinct. Cardam. ʒiv.; Tinct. Jalapæ ʒiij. statim sumendus.

Six P.M. Three copious motions. Says he feels his body all over sore, and a stiffness in his legs and hands.—He is ordered the following: Calomel, Camphor, āā gr. iv. h. s.; Mist. Camph., Aquæ Menth. āā ℥jss.; Tinct. Opii, Spt. Æther. Vit. āā ʒi. fiat h. s. s.

30th. He had a good night; complains only of a soreness of his breast and limbs.—Repet. Mist. Aper. Cont. Pil.

31st. Going on well. Cont. medic.

Cases of the Mixed Form of Cholera.

Darwar; 12th July, 1826.

Case XII. Lieutenant S. had for some time been labouring under a derangement of his stomach and bowels, having occasionally slight nausea and diarrhœa. This complaint had been removed, and he was sufficiently well to attend to his various duties. When out in the middle of the day, in his palankeen, he became rather suddenly sick, and vomited what he had eaten at breakfast, and also a little bile. He considered this to be merely a return of his stomach complaint, and at the house of a friend he took forty drops of laudanum, which checked the vomiting. When he returned home, the vomiting recommenced with violence, and was accompanied with purging; he sent for me immediately. Before I arrived he had vomited very often, and had been purged above twelve times. At first he vomited a large quantity of bile, but when I saw him he was vomiting transparent and nearly colourless serum; his stools were copious, watery, at first bilious, afterwards nearly colourless. When I first saw him, at one P.M., he complained of a sinking at his stomach, pain in his abdomen on pressure, thirst, and parched mouth, and two or three times of spasms in the muscles of his neck and calves of his legs; his features were considerably collapsed, pulse at the wrist thready, skin warm. Sixty drops of laudanum were given to him in a little warm water; two veins were opened in his arm, and, with considerable difficulty, about fourteen ounces of rather dark-coloured blood were obtained; a large blister was applied to his abdomen, and cataplasms of mustard and capsicums to his feet. The laudanum was retained about a quarter of an hour, when vomiting recommenced. A scruple of calomel was then given, and was washed down with one drachm of æther, thirty drops of laudanum, and some warm water; warm barley-water was given to him occasionally.

After the bleeding, his pulse improved a little; he retained the medicines and barley-water; and by four o'clock there was a great improvement, the vomiting and purging having ceased, and the spasms having been entirely removed. He took no more medicine, and I left him with directions that he should only have some barley-water, with a little white wine.

I saw him again at seven o'clock, when he told me he had perspired a good deal, and now felt perfectly easy. He had a feculent evacuation next morning; his mouth became slightly affected by the calomel, and he speedily recovered.

Observations. In this case the bilious vomiting, pain in the abdomen, thirst, parched tongue, and spasms, clearly shew that there was inflammation of the

gastro-enteric mucous membrane. The collapsed features, small pulse, great discharges of serum by vomiting and stool, prove that the action of the secretory vessels of the gastro-enteric mucous membrane was increased. The indications of cure were evidently, first, to repress the vomiting, in order to enable the other medicines to remain on the stomach; secondly, to diminish the increased and to support the healthy action of the gastro-enteric mucous membrane; thirdly, to restore the circulation towards the surface. The first was effected by means of the laudanum and æther; the second, by means of the bleeding, calomel, and laudanum, assisted by all the other remedies; the third, by means of the blister and sinapisms, by the general stimulating property of the calomel, and evidently also by the venesection.

An abstract of ninety-four cases of the disease is given by Mr. Mouat, in his Memoir on Cholera, in the third volume of the Transactions of the Physical Society of Calcutta; but as many of them belong to the low form of the disease, and as we have only to do with the mixed form at present, I will select some cases of the latter as examples, and in the author's own words.

Names.	When admitted.	When sent to hospital.	State of disease on admission.	Remedies employed.	Remarks.
John Casey	17th, 10 P.M.	11 P.M.	Seized with pain in epigastrium; vomiting, but no purging; pulse quick; skin hot; cramps occasionally.	Bled to twenty ounces; calomel in scruple doses; blister to epigastrium; magnesia for the vomiting; friction; afterwards small doses of antimony, calomel, and purgatives.	Convalescent.
Henry Cavanaugh	17th, 5 A.M	8 A.M.	Vomiting and purging; pulse feeble; skin hot; countenance a little altered, and great thirst.	Bled to thirty oz.; scruple doses of calomel; afterwards purgatives.	Discharged well.
Christopher Travesick	17th, 4 P.M.	5 P.M.	Bilious vomiting; frequent watery stools; anxious, restless, faint; pain at the epigastrium; great thirst, pulse quick, and sinking fast.	Bled to twenty oz.; scruple doses of calomel, with laudanum; afterwards calomel, antimony, and purgatives.	Discharged well.
James Watts	20th	2½ P.M.	Vomiting of watery bilious fluid; purging; pain at præcordium and belly; restlessness, anxious and faint, sinking, pulse feeble.	Scruple doses of calomel; blister to the scrobiculus cordis; magnesia for the vomiting; frictions; afterwards purgatives.	Discharged well.

Names.	When admitted.	When sent to hospital.	State of disease on admission.	Remedies employed.	Remarks.
John Shell	27th, 8 P.M.	10 P.M.	Seized with severe vomiting of bilious matter, succeeded by watery stools; oppressed, very low, and dejected; pulse feeble; severe cramps in legs and thighs; cold sweats, skin clammy; pain and heaviness at the epigastrium.	Small doses of calomel, with opium; frictions; anodyne enemas; stimulating draughts; blister to the epigastrium; brandy, and sago.	Doing well.
John Rickett	28th, 8 A.M	9 A.M.	Seized with vomiting, succeeded by bilious purging; severe cramps in legs; griping pain about the epigastrium; eyes red and heavy; skin cold and damp; great thirst; pulse feeble.	Blister to the scrobiculus cordus; large doses of calomel, with opium; anodyne enemas.	Convalescent.
Matthew Darlow	28th, 6 P.M.	8 P.M.	Purging; vomiting of bilious matter; pain at the stomach; pulse quick; great restlessness.	Bled twice; scruple doses of calomel, with opium.	Convalescent.
Richard Kemp	10 A.M.	11 A.M.	Seized with pain in belly, succeeded by vomiting and purging of watery fluid; eyes heavy and dull; pulse quick; skin hot; excessive thirst; cramps in legs.	Bled to twenty oz.; scruple doses of calomel; fomentations; magnesia for the vomiting, and afterwards gentle purgatives.	Convalescent.

Cases of Inflammatory Cholera.

Nellore; 16th May, 1823.

CASE I. — Burns, gunner, æt. thirty-five, is a sober man, and has enjoyed very good health since he left St. Thomas's Mount.

FOUR P.M. Was exposed a good deal to the sun to-day. About two hours ago he was attacked with vomiting and purging of a green bilious matter. Complains of severe pain and burning at the epigastrium, spasmodic pains in his bowels, and intense thirst; severe spasms occur, at short intervals, in the calves of his legs; pulse 100, full, and hard; tongue furred, dry; skin warm; countenance anxious.—Emittantur sanguinise brachio ℥xxiv. R. Calomel ℈i.; Opii gr. i. Misce, fiat bolus statim sumend. R. Tinct. Opii ℥ss.; Ol. Olivar. ℥i. Misce fiat embrocatio qua perfricetur abdomen.

17th, mane. Was much relieved by bleeding; no vomiting or purging since last report; the pain and burning at the epigastrium, and the spasms, gradually ceased. Had a small green-coloured stool this morning, and complains of pain

in his bowels; pulse natural; tongue furred.— Sumat statim Sulphatis Magnes. ℥i. The salts operated freely, and he got completely rid of the complaint: it was succeeded, however, by a diarrhœa, which soon yielded to opium and ipecacuanha.

Coduganoor; 17*th May*, 1823.

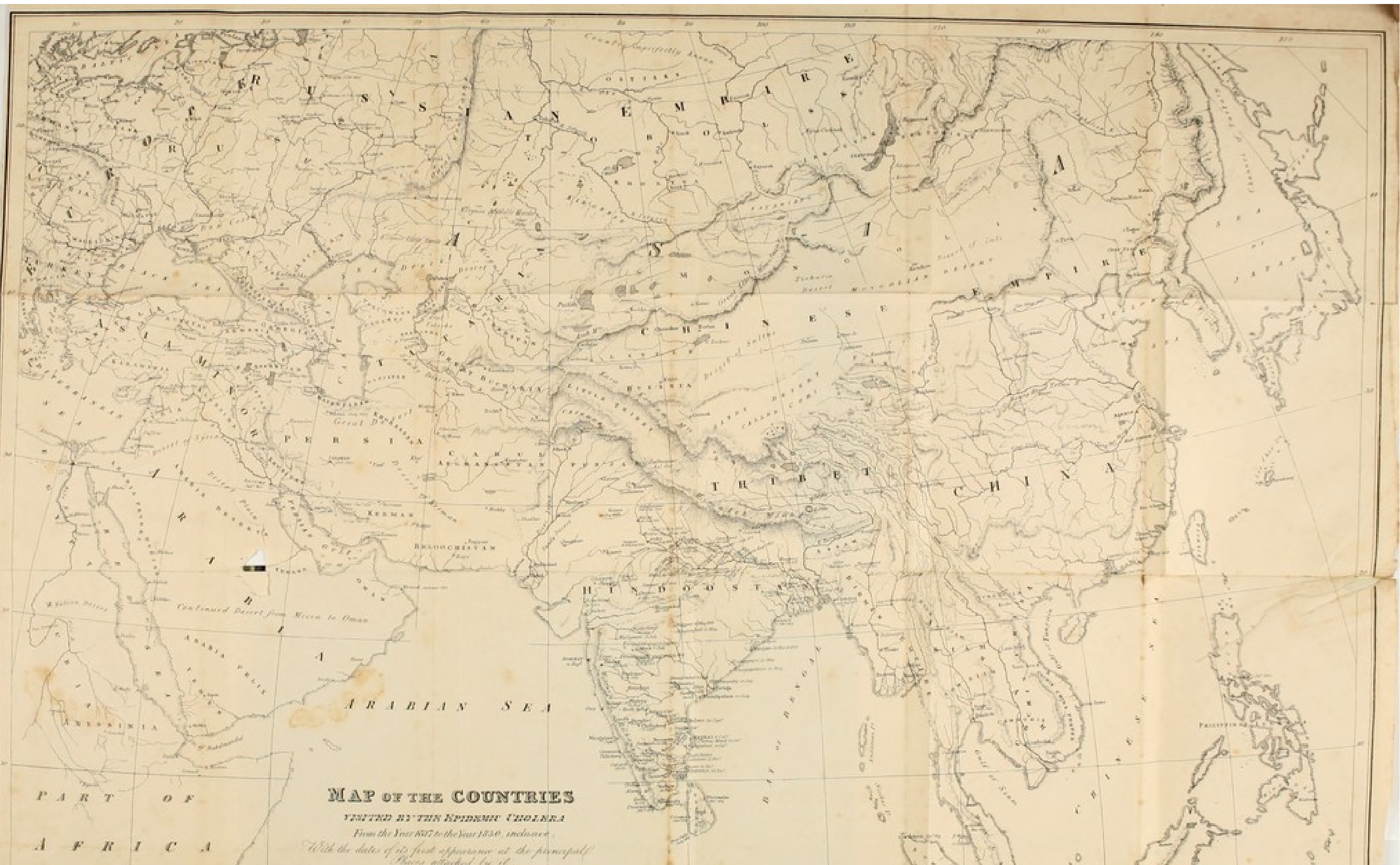
Case II. — Harris, gunner, æt. forty. Half-past two P.M. Exposed himself a good deal to the sun this forenoon. Was attacked, about half an hour ago, with purging, which he says was at first feculent, afterwards watery, bilious, and slimy; complains of severe pain and burning at the epigastrium, spasmodic pain in his bowels, intense thirst, and nausea; no vomiting; violent spasms occur occasionally in his extremities, and sometimes in his back; pulse 100, full, and hard; countenance anxious, and expressive of great pain; tongue furred, dry; skin hot and dry.—Emitt. sanguinise brachio ℥xxxvi. ℞. Calomel ℈i.; Opii gr. i. Misce, fiat bolus statim sumend. ℞. Tinct. Opii ℥ss.; Olivæ ℥i. Misce, fiat embrocatio qua perfricetur abdomen.

Six P.M. He was almost immediately relieved by the bleeding; complains now only of weakness and thirst; is perspiring.—Habeat aquam oryzæ tepidam pro potu.

On the 18th he had slight dysenteric symptoms, which however were easily removed, and he soon recovered.

THE END.

J. and C. Adlard, Printers, Bartholomew Close.


MAP OF THE COUNTRIES
VISITED BY THE EPIDEMIC CHOLERA
From the Year 1817 to the Year 1830, inclusive,
With the dates of its first appearance at the principal
Places attacked by it.
RUSSIAN EMPIRE
CHINESE EMPIRE
PERSIA
TUBET
CHINA
HINDOOSTAN
ASIA MINOR
ARABIA
ARABIAN SEA
BELOOCHISTAN
KERMAN
ABYSSINIA
PART OF AFRICA
BAY of BENGAL
SIAM
SEA OF JAPAN
PHILIPPINE