Reports include a continuous hourly record of the more important elements of the climate of Hong Kong. The buildings are erected on the peninsula of Kaulung, facing the harbour, on the top of Mount Elgin, a small eminence rising from the plain to a height of about 110 feet above mean sea-level. It may also be noted that the ground has been carefully turfed where the instruments are placed. In addition to the usual tabulations and their averages, the Monthly Report gives a carefully observed log of non-instrumental phenomena, such as dew, fog, unusual visibility, halos, and thunderstorms.

The results show that the amplitude of the daily range of the barometer is greatest from November to February, when the rainfall is least and the air driest, the mean difference during these four months between the morning maximum and afternoon minimum amounting to 0·102 inch. On the other hand, the mean of the four months from June to September, when the monthly rainfall nearly equals 12 inches, only amounts to 0·069 inch. The diurnal range of temperature is small, being for the year only 5°·5, the maximum, 7°·2, occurring in December, and the minimum, 4°·0, in February. The daily minimum occurs at all seasons shortly before sunrise, and the maximum from 1 to 2 p.m. during the dry season, but an hour later during the wet season. The hourly means for the tension of the aqueous vapour are very interesting, as showing very clearly for those months when the sunshine is daily practically constant and the air relatively dry a minimum period during the hottest hours of the day; whereas when the sunshine is much interrupted, the rainfall frequent, and the air moist, the daily maximum tension occurs at these hours.

For the twelve months beginning March 1884, the greatest amount of sunshine was from noon to 2 p.m., and the least from 4 to 5 p.m., the former being per hour nearly double the latter. During the 22 months the greatest monthly number of hours of sunshine for any hour of the day was 26·3 hours from 9 to 10 a.m. of October 1884 out of a possible 31 hours. From midnight to noon the mean monthly rainfall has been 4·98 inches, but from noon to midnight the amount has only been 2·73 inches. The four consecutive hours of largest rainfall are from 5 to 9 a.m., amounting to 1·91 inch, and the four consecutive hours of least rainfall from 8 p.m. to midnight amounting only to 0·76 inch, or considerably less than half the former time of the day. The diurnal period of the rainfall of Hong Kong is remarkable as showing the maximum fall during the period of rising temperature, and the minimum when temperature is rapidly falling, the amounts for the six hours ending noon being 2·66 inches, and for the six hours ending midnight 1·24 inch. Future observations will doubtless modify in some degree the curve of daily rainfall, but from the general accordance of the fall of the individual months with what is indicated above, it is not likely that the change of the curve will be very material.

The daily curves for the winds, both as regards velocity and direction, are very decided. The daily curve for wind velocity has, for Hong Kong, owing to its peculiar position with reference to the island and the continent, peculiar features of its own. Thus for the year the maximum velocity extends from 10 a.m. to 2 p.m., the means for these four hours being the same, while the minimum velocity extends from 6 to 10 p.m., the hour of least movement being from 7 to 8 p.m. From midnight the wind rises to the daily maximum at 10 a.m. The month of greatest force of wind is March, and of least August, the air-movement in the former month being nearly double the latter. As regards direction the wind is about E.N.E. in the winter and E.S.E. in the summer season. For the whole year, the mean direction is E. 3° S., and the diurnal variation from E. 5° N. at midnight to E. 15° S. at noon, the mean variation being thus through 20°. During 1884 the total distance travelled by the wind was 103,237 miles, and of these 63,349 miles, or more than half the whole, was east wind. The least frequent wind is N.W., which showed only 2053 miles.

At a distance of about two miles from the Observatory an important station has been established on Victoria Peak, at which observations are made at 10 a.m. and at 4 and 10 p.m., and the results are published *in extenso* in the Monthly Report. The height of this station is 1823 feet above sea-level. These two almost contiguous stations, the higher being on a peak and the lower also on an eminence sloping directly down to the sea, form an admirable pair of stations for furnishing, in the best procurable form, the observational data necessary for some of the more important physical inquiries of meteorology. So far as we are aware, no pair of stations can be placed side by side with Hong Kong Observatory and Victoria Peak as affording the data for the physical inquiries referred to, except Ben Nevis Observatory and the station at Fort William.

Of these inquiries the important practical question of the rate of decrease of temperature with height may be cited as an example. The remarkable suitability of these two groups of stations for advancing this inquiry lies in the circumstance that in each case the upper station is situated on a true peak, thus reducing to a minimum the influence of the land in changing the temperature of the winds before arriving at the Observatory; and that the lower station is on a rising ground near the sea and sloping down to it, thus minimising the disturbing effects of radiation. At Hong Kong the rate of decrease of temperature with height is 1° for 261 feet in winter; 347 feet in spring; 262 feet in summer; 254 feet in autumn; and 281 feet for the year. At Ben Nevis the rates are for the seasons 279, 251, 268, and 290 feet, and for the year 270 feet—the results being thus closely accordant. On the other hand, such a pair of stations as Obirgipfel in Austria, on a peak 6706 feet high, and the neighbouring station at Klagenfurt, 1437 feet high, cannot furnish the data necessary to this inquiry owing to the circumstance that the lower station is situated in a deep valley. The result is that in January the difference of the mean temperatures of the two stations is less than 1°, although the one is 5269 feet higher than the other; whereas in May the difference of their mean temperatures is 22°·0.

It is earnestly hoped that the publication *in extenso* of the hourly observations at Hong Kong will not be limited to ten years, as seems to be hinted at in the Report, but that the meteorological observations and their publication will be made a permanent part of the work of the Observatory. The unique position of Hong Kong with respect to the great continent of Asia and its meteorology will no doubt secure this object.

CHOLERA IN ITS RELATION TO WATER-SUPPLY

THE epidemic of Asiatic cholera, which has been raging in Spain during the last two years, and which appears even yet to be lurking in some portions of that peninsula, has furnished some interesting data as regards its connection with water-supply, to which it would be wise in us to direct our attention, not only from the interesting nature of the facts as such, but also because it is not improbable that ere the disease quits Europe it may visit our own shores.

Broadly speaking, it would appear that in Spain this formidable disease never became truly epidemic or dangerous in any city in which there was a pure and good supply of water, and proper means were taken to guard against the sources being polluted by any of the specific choleraic poison.

In support of this idea I would desire to call attention to the cities of Toledo, Seville, Malaga, and Madrid, in contradistinction to such places as Aranjuez, Saragossa, Granada, and Valencia. I will commence with Madrid.

This city, whose population at the last census was 397,816, suffered very severely indeed under the last epidemic of 1865, when during several days immediately following a very severe thunderstorm the number of cases varied from 800 to 1200 per day. The first invasion of last year took place in Madrid on May 20, and the disease ran its course during the whole of the summer, gradually disappearing towards the end of the month of September. The total number of cases during the whole of the period was 2207, and the deaths 1366. The total number of cases, therefore, during the five months that the disease never abandoned the city was barely more than what occurred during two days only of the epidemic of 1865, being little more than ½ per cent. of the population. I think, therefore, we may safely say that the disease never assumed a truly epidemic form. The greatest number of cases, as was to be expected, took place during the months of July and August; the first notable increase took place on July 25, and the first notable decrease on August 13.

In connection with this it is interesting to note that Madrid was subject to severe thunderstorms during the latter end of July, and that 119 millimetres of rain fell during the month. These storms began on the 13th, and were especially severe on the 23rd, 24th, 26th, 27th, and 31st, the first notable rise in the cases of cholera occurring between the 25th and 28th. As a general rule, no rain falls in Madrid in July, and the occurrence of these severe thunderstorms and heavy falls of rain was quite phenomenal.

The new water-supply from the Guadarama Mountains was completed shortly before 1865, and the greater part of the drainage was also finished; but at that time the new water supply had scarcely come into use, the large majority of the houses being supplied from the old fountains which existed in various parts of the city. During the last twenty years the use of the Lozoya water has become very general, and an ample supply has been provided for washing the streets and flushing the sewers.

Madrid is now well drained; the sewers are built upon the Paris model, and are not what an English engineer would consider as a good type for self-cleansing purposes, but the fall is, in almost every case, very great, and it is not probable that there can be any collection of fœcal matter at any point. The connection of the street gulleys with the main sewers is made without any trap, and good ventilation is thus provided. As regards the outfall of these sewers, nothing satisfactory can be said. The mouths of the main sewers, which are seven in number, all discharge on the southern side, between the station of the Saragossa Railway and that of the Northern.

The question of the proper disposal of the sewage in Madrid, as in London, has never been decided, and pending this decision the sewers were completed only as far as the outlying houses of the city, and the sewage was then allowed to find its way down to the Manzanares, in the best way it could. During the time the question has been awaiting a solution the town has extended, and houses have been built along the course of these open sewers. As might have been expected, the first serious outbreak of cholera occurred about these spots, the original germ of the disease having been imported from the neighbourhood of Valencia, where the cholera was then raging.

The existence of the disease having been established beyond doubt, one of the first acts of the Municipality was to attend to the water-supply. There existed 12 ancient sources, which supplied 85 taps or fountains, 22 of which were public ones, at which water-carriers were allowed to fill their barrels, and the remaining 63 belonged to groups of houses. In spite of the excellent supply brought in from the Lozoya, these old sources were still a good deal used by the inhabitants—many, from old habits, preferring to use the same water which their fathers had used, many not being willing to incur the expense of laying on the new supply. In view of the impossibility of effectually guarding against the possible contamination of so many sources of supply, the Municipality, by decree on June 18, closed all the old ones with the exception of that of La Fuente de la Reina, which supplied five public fountains and four private ones. The Central Government undertook the custody of the Lozoya aqueduct, the Municipality took charge of the Fuente de la Reina. The Lozoya water is drawn from the sources of the River Lozoya in the Guadarama Mountains, some 50 miles to the north of Madrid.

The river takes its rise in the granite formation; the water is excellent, and from the uninhabited condition of the country through which the river flows before the intake, it is not exposed to direct contamination from any specific poison. From the intake to Madrid the water is conducted by a series of magnificent works, partly covered, partly uncovered, to Madrid, where it is received in covered reservoirs before being distributed in the city; the service is continuous, no cisterns being used. During the whole time of the existence of cholera in the city the uncovered portion of the aqueduct was patrolled by armed guards, no one being permitted to approach without a special order.

Accompanying the extensive Report of the Mayor of Madrid, Don Alberto Bosch, amongst other plates is an excellent map of the city, showing, by a red dot, the situation of every case of cholera that occurred; they are seen pretty thickly scattered about the uncovered exits of the sewers, and on both sides of the River Manzanares—which is, in fact, in summer an open sewer—and in the lower portion of the city overlooking the river, and there is scarcely any part of the town where a dot is not to be found; but, with the exception of the points mentioned, the cases occurring in the remainder of the town seem to be all isolated ones; in extremely few cases do two dots occur together, showing that the disease was more of a sporadic than of an epidemic character.

Now let us take the case of Toledo. This ancient capital of Spain is certainly not a city that could be taken as a model of sanitary arrangements; on the contrary, it seems to be admirably adapted to form a good nest for any wandering epidemic, and yet, although the cholera entered it in the summer of 1884, and did not finally leave it till the autumn of 1885, the total number of cases, according to official returns, did not exceed 200, of which about one-half were fatal. The population of Toledo is over 20,000, so that the percentage of choleraic disease was only about 1 per cent. of the population for the two seasons.

Toledo was supplied with water from the River Tagus, which flows round the city, the water being lifted by pumps. Above Toledo, on the same river, is situated Aranjuez, and above Aranjuez again, on the Manzanares, which is a feeder of the Tagus, is situated Madrid, in both of which towns the cholera existed in 1885, being unusually severe in Aranjuez. The Governor of the province, recognising the suspicious character of the water, stopped the pumps, and obliged the inhabitants to send for their drinking-water to a distant spring; he even forbade any one to bathe or wash clothes in the river. The measure was a strong one, but it saved the city.

Let us next take Seville. Seville is an important city, the third in rank in Spain; it contains, according to the census of 1877, 134,318 inhabitants; it has, strictly speaking, no drainage; a few ancient sewers exist for carrying off the rain-water from the lower portion of the city, but sewerage for houses does not exist. The sewage goes into cesspools, which are, in most cases, situated just outside the house, and under the street; the inhabitants are extremely cleanly in their habits, and the outsides of their dwellings are constantly whitewashed, but it is not

a healthy city—typhoid fever is endemic, and the death-rate rises in some parishes to 35 per mil.

Seville is situated on the River Guadalquiver, of which the Rivers Darro and Genil, that flow through Granada, are feeders; as regards its water-supply, one suburb of the city, called Triana, containing about 30,000 inhabitants, is situated on the western side of the river. This portion is almost entirely inhabited by the poorer class, and they drink generally the water of the river.

The rest of the town is supplied from an ancient Roman or Moorish aqueduct, the water being brought from an underground spring near the town of Alcalà, about nine miles to the east of Seville; this water is carried by a tunnel about two miles in length under the town of Alcalà; it is then carried in a covered conduit to within a short distance of Seville, and from thence by an aqueduct made by the old Moors. The water is excellent.

An English Company has quite lately erected engines at Alcalà, by means of which they pump up to a covered reservoir above the town the water from two other springs, situated also at Alcalà, but on the opposite side of the river Guadaira, which flows past the town. This water is carried from the reservoir into the town by iron pipes, and distributed under considerable pressure; in character it is pure and excellent; the springs rise from the base of the sandstone at a short distance from the engine-house, and are carried across the river by an iron pipe. The cholera broke out in Granada on July 14, 1885, but already on June 14 of the same year the authorities of Seville, by way of prevision, had prohibited the use of any water from the river, either for dietetic or other purposes; had authorised the English Company to lay a temporary pipe across the bridge which connected the city with the Triana suburb, and had opened a number of free taps from which the inhabitants of this suburb could draw the new water.

The old Moorish supply was scarcely susceptible of contamination, as the conduit was covered for the greater part of the way, and where it ran over the aqueduct no one but the Municipal guards had ever been allowed to pass; guards, however, were stationed day and night on the springs from which the English Company derived their water, and no one was allowed to approach them without permission.

The cholera raged fearfully in Granada during the months of July, August, and September; it descended the River Genil, which runs through Granada, and attacked the towns of Herera, Ecija, and others in the province of Seville. It broke out also at Cordova and other towns on the Guadalquivir, of which the Genil is an affluent, and it broke out in Palma, Utrera, Puerto Real, Puerto Santa Maria, and Cadiz, forming a circle round Seville, but the city itself escaped almost completely. Towards the end of September nine cases occurred in one quarter of the city, of which seven were fatal, but the disease did not spread; none of the five houses in which these cases occurred were connected on to the water-supply, and it is possible they may have used well or river water, although this is not known. Jerez, which lies about half-way between Seville and Cadiz, and close to the town of Puerto Santa Maria, which was attacked by cholera, escaped also from the disease. This town possesses a very excellent water-supply, brought down some few years ago from a spring in the mountains by a native Company, at a cost of 300,000*l*.

Malaga has a population of 115,882. This city is in even a worse sanitary condition than Seville as regards its drainage, and a great deal worse as regards its cleanliness. In the old portion of the town the streets are narrow, unventilated, and intolerably filthy; the climate in summer is almost tropical.

It is difficult to obtain reliable data as to the cases of cholera in Malaga, as attempts were made to prove that no real cholera existed in Malaga; but there can be no doubt that from June to September the cholera did exist, and it is probable that during the whole of the summer there occurred some 200 or 300 real cases of Asiatic cholera. But the disease never became epidemic, although to all appearances the city offered a most excellent medium for the propagation of the disease, and on all former visitations had suffered very severely. But Malaga during the last few years has been provided with an excellent water-supply drawn from some springs situated at Torremolinos, on the coast to the westward of the city, and piped from thence into the city; and although the precautions adopted were not so complete as those at Seville, yet a more or less successful attempt was made to prevent the use of any other water than that brought from Torremolinos.

We have now examined the case of the few towns in Spain that possess a pure supply of water drawn from springs not liable to any specific contamination, and we have seen that, in all cases where such a supply existed, the cholera, although present in all of them, never made any headway or became truly epidemic, although in every case, except that of Madrid, there was no proper drainage, and the sanitary conditions were in many cases as bad as they could be.

Let us now look on the other side of the picture. We will commence with Granada—population 76,005. As regards its sanitary arrangements this city is on a par with Malaga; about one-tenth of the town is drained, but the sewers are of a very inferior class The city is supplied with water by canals derived from the Genil and Darro, the two rivers which serve to irrigate the magnificent plain which spreads round it. A small portion is supplied from a spring called La Fuente Grande de Alfacar. The canals are uncovered, and are exposed to all kinds of contamination.

Through the streets the water is conducted in earthenware pipes, after the style of the Moors; many of the pipes are the original ones put down by these people before the conquest of the city by Ferdinand and Isabella. The cholera broke out about the middle of July. It is supposed to have first been brought in by some labourers who had arrived from Murcia, where the cholera was raging. It spread with frightful rapidity, and by the middle of August the official number of cases reported was over 450 per day. It died out, or rather wore itself out, about the middle of September. The total official returns give a total of 6471 cases and 5093 deaths, but in the city itself these returns are said to be much under-estimated; some, indeed, say the numbers should be doubled.

No attempt was made, as was done at Toledo with such excellent results, to suppress the old water-supply, and the epidemic took in a short time such alarming proportions that the local authorities were completely paralysed. It was difficult to carry on the interment of the bodies, and at one time from 400 to 500 corpses were lying piled up in the cemetery, awaiting interment.

The course of the cholera may be followed down the Rivers Darro and Genil, the infected waters carrying death wherever they were used for drinking-purposes.

Murcia—population 91,805—from which the cholera was imported into Granada, suffered heavily also. It was carried into the plains of Murcia by the waters of the River Segura from the baths of Archena, and it was imported into Archena by some invalid soldiers who were sent to the baths from the infected district round Valencia. The plain of Murcia is irrigated by the waters of the Segura, and the disease commenced in this district with the death of a labourer who had drunk the water of one of the irrigation channels. The inhabitants of Murcia and of the plain use principally water from the irrigation canals or from the river; this water is usually stored in large jars similar to those

which held Ali Baba and his forty thieves, and amongst well-to-do people it is customary to keep a year's supply in hand; that is to say, the water is allowed to repose for one year before use in a reservoir or "algibe," constructed on purpose, or in some of these large jars sunk up to their necks in the ground; by this means it becomes perfectly clear, cool, and palatable. The poorer classes are, as a matter of course, not able to take these precautions, and have to drink the water from the canals, or after a few days' repose only.

The epidemic raged principally amongst the little cottages scattered thickly over the plain or garden, as it is called, but the disease never developed itself in Murcia as it did in Granada, and the city itself escaped better than might have been expected. May this not be attributed to the fact that the greater part of the people in the city were drinking water collected in the foregoing year, before the cholera had appeared on the sources of their water-supply? And if this be so, may we not anticipate a fresh outbreak this year, if the choleraic poison or germs are capable of outliving a year's repose and darkness?

In reference to water-supply and cholera, no case is so instructive as that of Valencia. This city is fairly well drained, as drainage goes in Spain, and as regards cleanliness is certainly in a better situation than Malaga or Granada. The water-supply is derived from the River Turia; it is taken from the river near the town of Manises, about three miles and a half above Valencia; it is passed through sand filters situated between Manises and Mislata, and is stored in a covered reservoir, from whence it is conducted by iron pipes, a distance of about one mile and a half into the city.

In one of the interesting letters written by the special correspondent of the *Times* during his tour of inspection of the cholera districts, a very clear description is given of the track taken by the cholera from its starting-point in Alicante, where it had broken out at the latter end of 1884, to Valencia in 1885. During the course of the year 1884 the disease had crossed the frontier of the provinces of Alicante and Valencia, and established itself at Jativa, a somewhat important town, situated on one of the affluents of the Jucar—this and the Turia being the two rivers whose waters are used for the irrigation of the wonderful "Huerta," or Garden of Valencia. During the winter the disease lay dormant, but it broke out in the spring of 1885, and travelled rapidly down the river to Alcira, attacking the various towns situated on the river itself, or on the canals derived from it.

The epidemic was severe at Alcira, but, as the *Times* correspondent suggestively remarked, it ceased so soon as the inhabitants gave up drinking the river-water, and took their supply from a spring situated at a considerable distance from the town. From Alcira it travelled across the network of canals till it reached the river Turia. The *Times* correspondent says:—"It came very near Valencia, and yet never touched the capital till it had worked right round."

At last, in the middle of May, having crossed the water-supply of the city and thoroughly infected the river, it attacked the city right royally, and by the end of June the number of cases had risen to 700 daily, out of a population of 143,861. The disease died out in September, having, according to the official accounts, attacked during the four months 4234 people.

We will now turn to Saragossa. Saragossa, the capital of the ancient kingdom of Aragon, is situated on the right bank of the River Ebro; it contains 84,575 inhabitants, and is an important city. Like most Spanish towns and cities it has no sewers: fœcal matter is collected, as in Seville, in cesspools, which are periodically emptied.

Its principal water-supply is derived from the Canal de Aragon, which in its turn draws its supply from the Ebro, near Tudela. This canal was intended principally for navigation, and is now used for this purpose, and also for irrigation. It passes at a short distance above Saragossa, and the town supply, after being drawn from the canal, is stored in reservoirs, and, after depositing its mud, is then passed through charcoal filters. Some of the inhabitants of the city drank the water from an irrigation canal taken from the River Jalon; some used the waters of the Ebro, which flows close past the old walls of the city.

The disease broke out in Saragossa shortly after the middle of July, and the number of cases during the time the epidemic raged was close upon 10,000. The proportion of deaths was small, thanks to the heroic and energetic conduct of the authorities and the people. Some time before the commencement of the disease in the city a number of small towns on the banks of the Ebro and the Jalon had been attacked by the cholera; there was therefore ample opportunity for the infection of the water-supply. Against such contamination the only protective measure as regards the general supply was the filtration through charcoal; as regards the Jalon water, there was no protection. This source of supply was, however, ultimately stopped by the authorities, who prevented the water reaching the city, with a notable result as regarded the decrease of the epidemic in the quarter served by them.

It would be interesting to follow out still further the line of inquiry I have adopted, but the examination would be too prolix for the present purpose. The cases I have presented are typical ones; they might be increased *ad libitum*, but I think they are sufficient for my purpose. From an examination of them it would appear as though, in the case of cholera, drainage and sewerage is a secondary subject, the primary one being the water-supply. We have seen that the cities of Toledo, Seville, and Malaga, although in bad conditions as regards their sewerage and general sanitary arrangements, yet escaped from any serious attack of cholera, whilst Murcia, Valencia, and Saragossa suffered most severely, although in their case the sanitary arrangements were certainly not worse, but if anything better, than the three former cities. But, in the case of the three first-named cities, each one enjoyed a supply of water drawn from springs situated at a distance from the city, and carefully watched and guarded to prevent any contamination, and the exclusive use of this water was rendered imperative by the authorities.

In the case of Valencia, Saragossa, and Murcia we have a supply drawn from rivers subject to contamination from various sources, against which the only protection was that furnished by the doubtful process of filtration.

There can be no doubt that the cholera attacks in preference those who live under unsanitary conditions, and whose habit of body is by this means prepared to receive the germs of any disease that may be prevalent.

There is no doubt that the virus can be conveyed about from one place to another, like small-pox, typhus, and various other diseases, either by clothes or in the human body, and where it finds a proper medium it will develop itself and extend; but, like these other diseases, it can in these conditions be isolated, fought, and conquered, but without doubt the medium *par excellence* for the spread of cholera-poison is water, and more particularly so when water so infected is used for dietetic purposes.

When it gets possession of the water-supply of a city, no bounds can restrain it; there is but one resource, and that is the cutting off of the water.

We do not yet know in what the choleraic poison consists; it is in all probability a micro-organism of some sort which is capable of very rapid development in water, but it cannot be yet said what is the particular micro-organism which produces cholera. The "comma Bacillus" of Koch has not been accepted by the scientific authorities; on the contrary, very high ones deny

altogether its identity with cholera, and assert that it is to be found in the mouth of every healthy person. Whatever the specific germ may be, it is at least doubtful whether any filtration will intercept it; from the experience obtained at Valencia and Saragossa it appears evident that neither sand nor charcoal will do so.

In a paper read recently at the Institute of Civil Engineers, Dr. Percy Frankland asserts that the London Water Companies do, at the present moment, eliminate 96 per cent. of all the micro-organisms in the Thames water by simple filtration through 3 feet of fine sand. This may be so, but it is equally certain that filtration through sand, even at a very slow speed indeed, will not eliminate the minute particles suspended in waters of a deltaic character, and which gives such waters their peculiar colour. If sand is incapable of intercepting these particles, it may also be incapable of intercepting the specific germs or poison that produce cholera in the human body.

Filtration is, at the best, but a doubtful proceeding for the purification of water. It is impossible to control effectually the speed of the filters; they vary at every moment, and although a mean term may be arrived at by taking the area of the filter-beds and the volume of water filtered in the twenty-four hours, yet this really affords no reliable guide as to the actual speed at which the water has passed the filters. It is probable—nay, almost certain—that, out of a given quantity of water, no two gallons have passed at the same speed, and it is possible and probable that one-half of the total volume may have passed the filter at double or treble the speed of the rest.

To insure immunity from contamination, the only real and practical method appears to be that of capturing the water at a pure source and conducting and delivering it in such a way as to render it impossible that any specific germ or poison should have obtained access to it. In the matter of cholera, for instance, with the experience of Valencia and Saragossa before us, one cannot feel any confidence in water which is taken from a river liable to so many sources of contamination as is the Thames, and it is at least doubtful whether any system of filtration would be capable of eliminating cholera-poison from such waters. It is extremely probable that simple filtration through sand will not do it.

The very interesting series of letters published by the *Times* on the subject of cholera in Spain afford much valuable data as to the causes of the disease, or rather as to its mode of propagation. It is unfortunate that the writer seems to have gone out with a preconceived idea that the cause of the propagation of cholera was defective drainage, and consequently to have devoted the greater part of his time to the examination of the sewerage of the various towns he visited, and of their general sanitary arrangements, the water-supply being as a rule relegated to the second place. He appears to be a strong advocate for traps, and not to be aware that the best sanitary authorities of the present day are beginning to doubt very strongly the utility of traps, and to rest their practice rather on the thorough ventilation of sewers, the rapid discharge of their contents, and a complete disconnection between the house drainage and the main sewers.

It is not too late for some scientific investigator to go over the track of the cholera invasion in Spain, to trace the progress of the disease in the towns it visited, and ascertain all the facts connected with their drainage and water-supply, and also, what is not less important, examine the conditions of those towns which so far have enjoyed a practical immunity from the epidemic. As much is to be learned from this negative evidence as from the other.

Pending the discovery by scientific men as to the particular germ or poison that creates cholera, such a practical examination as I suggest would be of immense value to us, by teaching how the propagation of the disease is principally brought about, and what are the best means of preventing it.

GEORGE HIGGIN

NOTES

THE Royal Society *conversazione*, on June 9, was in all respects satisfactory. We can only afford to refer briefly to a few of the exhibits which attracted the interest of the numerous visitors, who were received by Professor and Mrs. Stokes. A room was devoted to telephones connected with the Savoy Theatre, and the company were delighted to hear the Mikado under such novel conditions. The models of the Romano-British village near Rushmore, on the borders of Dorset and Wilts, between Salisbury and Blandford, exhibited by Lieut.-Gen. A. Pitt-Rivers, F.R.S., attracted much attention. The rare earths from samarskite, gadolinite, &c., with illustrations of their phosphorescent spectra, exhibited by Mr. W. Crookes, F.R.S., were magnificent. The pumice, volcanic ash, drawings, diagrams, &c., illustrative of the effects produced by the great eruption of the island of Krakatáo, Java, in August 1883, exhibited by the Krakatáo Committee of the Royal Society, proved very attractive, as did the fine collection of astronomical photographs exhibited by Mr. Common, Dr. Gill, the Solar Physics Committee, and others. At 9.30 and 10.30 the stellar and solar photographs were demonstrated, and at 10 Mr. Common demonstrated the photographs of nebulæ and comets. The first series included the stellar photographs recently taken by the Brothers Henry at the Paris Observatory. The remaining photographs had reference to solar phenomena, and consisted of two series, one from Meudon, the other from Kensington; the former, contributed by Dr. Janssen, had reference to the minute portion of the solar surface; the latter, to some recent attempts to photograph the spectra of sunspots and prominences. The photographs of planets, comets, and nebulæ, exhibited by Mr. A. A. Common, F.R.S., consisted of (1) series of photographs of Saturn; (2) series of photographs of Jupiter; (3) photograph of Mars; (4) nucleus of the great comet 1882; (5) the Dumb-bell Nebula; (6) the Crab Nebula; (7) the Spiral Nebula; (8) the Great Nebula in Andromeda; (9) series of photographs of the Great Nebula in Orion, with exposures of 1 min. to 80 min. (the above were all taken with the 3-foot reflector at Ealing); (10) recent photographs of Saturn, Jupiter, and the nebulæ in the Pleiades, by the Brothers Henry.

AT the annual meeting of the American Academy on May 25, it was voted to present the Rumford gold and silver medal to Prof. Langley, of the Alleghany Observatory, for his researches on radiant energy.

THE thirteenth annual meeting of Scandinavian naturalists will take place in Christiania between July 7 and 12.

WHILE Mount Etna has again quieted down during the past week, volcanic energy has manifested itself at the Antipodes in an unexpected quarter. Though the North Island of New Zealand is known to be greatly volcanic, and has in Tongariro an active volcano, there has been no destructive eruption within the memory of man. The eruption therefore telegraphed on June 10 was quite unexpected. It occurred in the Tarawera district, on the east side of the Tarawera Lake, lying in a line between the Bay of Plenty and the mouth of the Wanganui River. It is a long way north from Tongariro, and in the midst of the wonderland of Rotomahana's hot springs and many-coloured terraces. The country is stated to be in a disturbed state for many miles around, and it is estimated that a hundred natives and ten Europeans have perished.

A SHOCK of earthquake was felt on Friday night at Sandy Hook and Coney Island, New York, U.S.