extent of the cerebrum was lined with a false membrane, which varied greatly in thickness, being merely a thin film in the middle cranial fossa, whereas over the parietal regions it was fully a quarter of an inch thick in places. This membrane was adherent to the arachnoid all over the vault, though not very firmly, except in the part corresponding to Broca's lobe, where a fibrous band was noted. It left the cerebellum uncovered, but was observed to pass downwards beneath the pons and medulla so as to invest the spinal cord also. The pia-arachnoid was congested and thickened, especially so along the vessels, and over the surface of the arachnoid a number of fine, white, non-adherent grains were observed, whilst a considerable amount of sub-arachnoid fluid gave the brain a jelly-like appearance when first removed. The pia mater was found to be universally adherent to the cortex over the cerebrum, and there was also an attachment between the anterior lobes of the brain just in front of the genu of the corpus callosum. There was marked superficial atrophy of the brain, most pronounced in the frontal and parietal regions, where the convolutions were very distinct and the sulci wide, and the encephalon as a whole was abnormally small, the cerebrum, cerebellum, pons, and medulla, with the small portion of cord removed with them, weighing only 26 oz. (of which the cerebrum made 21 oz.)—some 10 oz. less than the average at that age. On cutting into the brain the grey matter, both of the convolutions and the basal ganglia, was seen to be of a deep reddish-grey or brown colour, and its vessels were full of blood; but, whereas the cortex was tough in consistence, the ganglia were soft and friable. The former was everywhere atrophied, and in no region could the usual layers be distinctly made out in it. The white matter was pinkish in colour, and though of soft consistence was tough. The ventricles were dilated, and contained some turbid fluid, whilst the ependyma (at least, in the lateral ventricles) was thickened and tougher than normal. Fine granulations were visible on the floors of the lateral ventricles, whilst that of the fourth ventricle was covered with a great profusion of coarser ones. The soft commissure in the third ventricle was exceedingly tough. The choroid plexus of the lateral ventricles was congested and contained some cysts. The cerebellum showed much the same conditions as the cerebrum, except that there was no subdural membrane and the pia mater was not adherent. There was nothing very remarkable about the pons or medulla. The vessels of the cord, as elsewhere, were injected. Had any doubt still remained as to the nature of the disease it would have been completely removed by the study of the microscopic appearances. Sections of the cortex were cut by the modified fresh method of Bevan Lewis from the anterior part of the frontal lobe, the motor area, and the occipital and temporo-sphenoidal lobes, and were stained with aniline blue-black. The pia mater wherever retained was found to be thickened, while the tissue immediately underlying it was fibrillated and contained numerous spider cells. The latter were also visible in the deepest layer of the cortex, as well as (in some places at least) in its thickness, and they were detected in the white substance, especially near some of the arterioles. The capillaries were more prominent than normal, and their nuclei appeared to be multiplied in places, whilst the small arteries frequently showed great proliferation of the adventitia nuclei, and the perivascular spaces sometimes contained masses of pigment. The pyramidal cells, large and small, were in an advanced stage of degeneration, losing their processes and breaking up; but, on the other hand, the cortex contained an abnormally large number of round cells. The changes were unusually uniform all over the brain, but perhaps, on the whole, more advanced towards the anterior part. Sections cut from the cervical region of the (hardened) cord and stained by Vassale's modification of Weigert's method showed much degeneration, which, although somewhat diffuse, was especially marked towards the posterior parts of the posterior and lateral columns, and in a less degree in the region of the direct pyramidal tracts in front. Transverse sections of a nerve taken at random from the cauda equina and similarly treated showed many degenerated fibres. The false membranes, both inner and outer (sections of which, including the dura mater, were stained with hematoxylin and eosin), consisted of vascularised fibrous tissue, the most internal layers of which—i.e., those nearest the brain—had in some places acquired a homogeneous hyaline appearance. The vessels of the true dura mater were here and there dilated owing to the increased blood-supply required for the new membranes, and the dura mater itself, which

was thickened, contained in places, in its actual substance, structures resembling in every respect the earlier stages in the formation of false membranes—i.e., a network of fibrinous bands containing round cells in its meshes—an interesting fact which was noticed and pointed out to us by Dr. W. F. Robertson. The minute white particles strewn over the surface of the arachnoid were not examined, but they were similar to particles seen by one of us in another case, and which appeared to be composed of fibrin entangling numerous colourless cells. Further observations, however, are required. As regards the other organs, little need be noted. The serous cavities were drier than normal. There was a slight adhesion over the apex of the right lung, and the latter contained a small, well-defined, yellowish nodule, which showed no signs of breaking down, and was possibly of syphilitic origin, as no distinct evidence of tubercle was elsewhere discovered. Both lungs were congested and slightly emphysematous, and the bronchial glands were enlarged, though not caseous. The heart, which was contracted, was healthy, and the vessels were normal, so far as examined; the liver was soft and flabby, with much fatty infiltration; the spleen was pale and soft; the kidneys were congested and fatty, the capsules being adherent in places. There was an hour-glass contraction of the stomach, rather nearer the pyloric than the cardiac end, but the rest of the intestinal tract seemed to be normal. The bladder was greatly distended. The uterus and ovaries were healthy.

FILTERS IN CONNEXION WITH THE SPREAD OF DISEASE.

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THE following two instances of the apparent distribution of disease through the medium of ordinary water filters, such as are commonly used in India, have been kindly communicated to me by Surgeon-Captain Aldridge, A.M.S., who on both occasions had the cases under his observation, and they appear to be of such high interest and importance as to deserve publication in THE LANCET. The cholera outbreak at Lucknow is already attracting public attention, and some of its details will now have a special interest. I will merely state the facts as observed by Surgeon-Captain Aldridge. The lesson to be learned from them and the conclusions to be drawn are obvious.

1. *Cholera*.—During the recent very serious outbreak of cholera among the troops at Lucknow the disease was almost confined to the East Lancashire Regiment (in which there were about 135 cases and ninety deaths) and to one ward in the station hospital. Amongst the other troops of all arms, European and native, there were only eight or ten cases in all. The disease was distributed pretty generally through the different barracks occupied by the East Lancashire Regiment; there were cases in ten out of sixteen barrack buildings. In the station hospital men in one ward only were attacked; this was the special ward in which the severe and acute cases of disease were under treatment—chiefly cases of enteric fever. In this ward about seven of the patients were attacked with cholera. The first case occurred about August 1st. In the regimental barracks nine cases occurred between July 19th and 28th. On July 29th about 350 of the men were sent into camp on the brigade parade ground close by, where they remained under the same condition of food and water-supply. Cholera continued among them, and these men were marched on August 1st to camp at Kakra, about six miles distant. Between July 29th and August 9th 117 cases occurred. Amongst the men about 250, who remained all the time in their barracks, there were far fewer cases than among those who went out into camp.

The milk-supply was from cows kept at the regimental barracks; the men consumed very little milk. The same milk was supplied to the married quarters, in which there were only a few cases of cholera, and to the Station Hospital, in which cases occurred in only one ward, and the disease could in no way be attributed to infected milk. The drinking water was from two wells, one for each division of the barracks, a road dividing the two divisions.

The wells are completely closed in and free from any ascertainable source of contamination. The water is pumped up from the wells into the filtering tanks, and thence drawn into buckets and passed through Macnamara's filters. The filtering medium of the tanks consists of sand and gravel. Filter tank No. 1 was recharged with new sand and the water again used on July 14th. The first case of cholera occurred on July 19th, the second case on July 24th, in the part of the barracks using water from this tank. Filter tank No. 2 was recharged with sand on July 21st or 22nd. The first case of cholera among the men using the water from this source occurred on July 24th. The filter-tanks in the barracks occupied by other corps were recharged under a separate contract and at different dates. Those in the barracks occupied by the Royal Irish Regiment, in which only one case of cholera occurred, were recharged six months previously. The mineral water factory of the East Lancashire Regiment obtained water from the same tanks as the barracks of the regiment, and supplied only the regiment and the station hospital. In the latter the aerated waters were chiefly used in the "special" ward in which cholera broke out. The men out in camp, when they moved from the station, had a different water-supply, but the same mineral waters, which were sent out daily in large quantities, as they were considered to be safe for drinking, and the supply was barely sufficient to meet the demand, so that they were drunk at once after manufacture.

The barracks occupied by the East Lancashire Regiment were separated only by a road from those of the Royal Irish Regiment, and the Station Hospital was alongside of the latter. The sand with which the filter tanks were recharged was said to have been procured from the banks of the Gumti River, about two miles from the station; there was at the time cholera among the natives, and, as is well known, the natives regularly resort to the banks of rivers and tanks to obey the calls of nature, to bathe, and to wash their clothes. The sand was said to have been washed and roasted before use, according to regulation, but this was done by the contractor who supplied it, and may have been done very imperfectly. A new pipe water-supply was introduced at the end of July, but the water was turbid at first, and its use discontinued. After a few days it was again brought into use, and for a week or so both water-supplies were used by the men remaining in barracks. On Aug. 9th the supply from the filter tanks was shut off, and cholera ceased from that date.

About Aug. 11th Mr. Hankin made bacteriological examination of the water used at the barracks. He reported as follows: "Water from wells Nos. 1 and 2, no cholera vibrios. Water after passing through filter tanks Nos. 1 and 2, cholera vibrios present in both. Soda-water freshly manufactured from this tank water, cholera vibrios present." This outbreak of cholera was practically limited to the men of the East Lancashire Regiment in barracks and camp and to those in the "special" ward of the hospital. The only condition that was common to these two sets of men and not to the rest of the garrison, and that could be connected with the outbreak of cholera, was the water that had passed through the filter tanks, some of which was used for the mineral waters.

The first case of cholera in each division of the barracks occurred from two to four days after the filter tanks had been recharged with sand, and the first case in hospital was a few days later, in the ward where the mineral waters were chiefly used. Many of the cases in camp occurred at a long interval (ten days) after the men had been removed, and had ceased using the water direct from the filter tank, but these continued to use the freshly manufactured mineral waters. The men sent into camp suffered very much more than those remaining in barracks. The latter used both the water-supplies—that from the tanks and new pipes—and they also consumed much less of the mineral waters. That men sent into camp during cholera epidemics suffer more than those who remain in barracks is by no means an uncommon occurrence, and the thought often presses itself on one that when cholera appears in a community sending the men into camp is a mistake. It is of course the generally accepted practice, founded apparently upon experience, that when cholera breaks out the men should be sent into camp and moved at short intervals, and in India regulations have been laid down in accordance with the idea. But what are the facts? When cholera appears, say, in a regiment, if during the first ten days the cases are at all numerous the men are moved out into camp. It then almost

always happens that for the first few days or the first week in camp the disease increases, it then begins to decline and becomes less severe, and in the course of another week or so it finally ceases, except for a few isolated cases. This is the natural history and behaviour of the disease. In any restricted community it reaches its acme in about a fortnight, then gradually lessens, and in three or four weeks is at an end. Of course, in large towns or widespread communities it lasts much longer, but even in Hamburg the epidemic only lasted for about two months.

Up-country in India outbreaks of cholera almost always occur in the rainy season, when men in camp are exposed to great discomfort and suffering, and, far worse, to the sources of such serious diseases as malaria, dysentery, &c. Clearly they should not be subjected to such exposure unless the benefits are undoubted. With our present knowledge of the various ways in which cholera may be introduced into the system, many of which may be absolutely guarded against, it again requires consideration whether the men may not be safely left in cantonments and every possible precaution taken to prevent the food, the water, and the air (as by dust) being contaminated, and all other possible channels of infection. This can certainly be done more effectually in cantonments than in an exposed camp in the rainy season.

2. *Enteric fever*.—The second instance, an outbreak of enteric fever in the 3rd Battalion Rifle Brigade, occurred at Jullander in 1891 and points strongly to a similar cause. The first case, that of a woman, was admitted into hospital on March 27th. She had been ill in quarters for a few days previously. On April 14th the next case was admitted—one of the men from barracks—and during the next five weeks eleven more cases occurred in the barracks. No direct infection and no pollution of wells seemed to be possible. The milk was from the regimental dairy and seemed to be unimpeachable. The material used in the filter-tank through which all the drinking water passed was sand and gravel. The sand was dug from the side of the river, at the time practically stagnant, and at the spot where the sand was collected, and for a few hundred yards above and below, the clothes of the regiment were washed. The first case, that of the woman, occurred a few days previous to March 27th. The filter tank was recharged with sand from the place indicated on April 1st or 2nd, the woman's clothes having been washed near the spot a few days before. On April 14th the first case from barracks was admitted. Here, again, the evidence is very strong that the sand used in the filter tanks was the source of the outbreak, and the same thing may easily have occurred in numberless other outbreaks. Experiment has shown that no filters, except perhaps the Pasteur-Chamberland, will prevent the passage of pathogenic germs for more than a very short time. The Macnamara filter cannot, therefore, be relied on to free drinking water from such organisms if they be introduced into the water from the sand filter tanks.

SYPHILIS ACQUIRED IN CHILDBED.

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A SERIES of cases of syphilis acquired in childbed and exhibiting tertiary phenomena rarely comes under observation. The unhappy victims of this misfortune were not in the first instance attended by medical men, but were all delivered by the same midwife, who had been inoculated on the hand with syphilis while nursing a prostitute. All the confinements took place in 1882—six in August, three in September, and one in October. There is no reason to suppose that the midwife ceased to follow her vocation after the latter date, and it is certain that the cases which were traced did not include all that occurred. In none of the cases could any history of inherited or previously acquired syphilis be obtained. Seeing that the events in question took place twelve years ago, and that most of the women suffer from impairment of memory, it is not surprising that their recollection of the dates of the primary and secondary symptoms is very defective.

CASE 1.—This patient was delivered of a child in October, 1882. The first sign of inoculation was a sore situated just within the labia, and not accompanied by any special symptoms. The midwife's explanation of it was that she