

April 20th and 21st: 400 grammes of lean meat. On the 21st, in addition vegetable salts. April 22nd, 23rd, and 24th: Uric acid and chlorine-free diet, consisting of eggs, milk, and fruit.

Analytical methods.—The urea determinations were done by Brandeis's improved hypobromite method, using a titrated solution of ammonium chloride or sulphate so as to obviate the necessity of making calculations of the temperature and barometric pressure. For ammonia I have substituted Malfatti's process for Folin's; for sulphates, Folin's modifications; for uric acid, Hopkins's method and Folin's; reference to paper on urinary reactions, &c., for other methods. Chlorides by Mohr's process, subtracting one-tenth of the result. Volhard or Denigé's methods have been used where great accuracy was required.

A ROUGH BACTERIOLOGICAL EXAMINATION OF THE CONDITION OF SWIMMING-BATH WATER.

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SOME weeks ago Mr. Alderman Hirst, as chairman of the sanitary and education committees of the borough of Batley, suggested to me that it would be of interest if a bacteriological examination of the water in the borough swimming-baths was undertaken, in view of the fact that, apart from ordinary bathers, several hundred school children from the elementary schools in Batley regularly visited the second-class swimming-bath, and that a comparison of the water of this bath with the water in the first-class bath, after use by a number of bathers, would be instructive from a sanitary point of view. I heartily endorsed Mr. Hirst's proposal and took steps to carry out the examination, which I have now completed. The examination took place in the bacteriological laboratory of the public health department, Batley.

The first step was to take a sample of the water in its ordinary condition as it leaves the supply pipe, for without this knowledge the examination would not be conclusive. The result was a good one, showing that the Batley water from a bacteriological standpoint compares favourably with other water used for drinking purposes, it being water from the ordinary town's supply which is used for swimming-bath purposes. Plate preparations were made on gelatin and agar-agar, the former being incubated at 20° C. and the latter at 37° C., and the colonies forming were examined from day to day. According to Miquel's standard, pure water may contain from 100 to 1000 organisms per cubic centimetre, very impure being defined to contain 100,000 and upwards per cubic centimetre.

In the water under examination, taken from the supply pipe as it entered the bath, the number of organisms developing on gelatin, incubated at 20° C. and counted in 48 hours, equalled about 43 per c.c. of water. Coliform or intestinal organisms were present in 5 c.c. of water but not in 1 c.c.

A sample of the first-class swimming-bath water was then taken on June 16th, persons swimming in the water at the time of sampling, the water having been in the bath for three days, and 194 persons having bathed in it. The same process having been followed, it was found that about 2850 organisms were present in 1 c.c. of water. I found coliform or intestinal organisms present in 5 c.c. of water.

A sample of the second-class swimming-bath water was taken on the same date and under exactly similar circumstances. The water had been in the bath three days, and 767 persons, mostly children from the elementary schools, had bathed in it. This gave about 15,000 organisms per c.c. of water. Coliform or intestinal organisms were present in 0.5 c.c. of water but not in 0.1 c.c.

Another sample of the second-class water was taken on June 21st, the water having been in the bath for three days, and the number of bathers, mostly children from the elementary schools, amounting to 974. The number of organisms per c.c. of water in this sample was about 300,000. Coliform or intestinal bacilli were present in 0.5 c.c. but not in 0.1 c.c. *Bacillus enteritidis sporogenes* I found to be present in 10 c.c. of water.

Of the several samples of water examined I made various subcultures of the numerous colonies, with a view to ascertain as far as practicable the nature of some of the more numerous ones. Many of the bacilli isolated were harmless ones, although all were not. I found the bacillus

prodigiosus present in each sample. The bacillus fluorescens liquefaciens was found in great numbers. This germ occurs in putrid infusions and also in sewage. The bacillus subtilis was found, as was also the bacillus proteus vulgaris. The latter is found in sewage water, and is one of the class of germs which cause putrefaction. It is also found in cases of abscess of the lungs and several diseases of the lung, &c. A number of colonies of moulds occurred in the samples of second-class bath water which I examined. The bacillus coli communis was present in samples of water from both the first-class and second-class baths. I found the staphylococcus pyogenes aureus present in great quantity. It must not be forgotten, however, that this germ is present normally on the skin of many persons. The streptococcus pyogenes aureus was also present.

The great difference found between the samples of water taken is most interesting, for in the case of the first-class swimming-bath water the first sample taken on June 16th, having been in three days and 194 persons having bathed in it, gave 2850 organisms per cubic centimetre, whereas in the sample taken on June 26th (which I did not examine, but which was examined elsewhere, as explained below), where the water had been in the bath for the same period, but only 127 persons bathed in it (instead of 194 in the other sample), the bacterial content of the sample was 219,000 organisms per cubic centimetre. This very great difference, it appears to me, can only be accounted for by the bacteriological condition of the bodies of the 127 bathers being in a much worse state than that of the 194 bathers on the previous occasion. The same peculiarity occurs in the case of the samples of second-class water as follows:—June 16th: Bathers, 767. Bacterial content, 15,000 organisms per c.c. Water in bath three days. The bacillus enteritidis sporogenes was found in this sample by Dr. P. L. Sutherland (see below). June 21st: Bathers, 974. Bacterial content, 300,000 organisms per c.c. Water in bath three days. *Bacillus enteritidis sporogenes* found in the sample which I myself examined. June 26th: Bathers, 938. Bacterial content, 63,000 organisms per c.c. Water been in bath four days.

The average number of organisms found in the two samples of first-class water was 110,927 per cubic centimetre. The average number of organisms found in the three samples of second-class water was 126,000 per cubic centimetre.

From the above it will be seen that in reality, although many more persons, mostly children, used the second-class water, it was not so very much worse than the first-class water. If so many organisms, pathogenic and non-pathogenic, are found in a cubic centimetre, it is interesting to speculate on the number of micro-organisms contained in a large swimming-bath full of water.

As I have previously pointed out, many of the organisms were harmless, but such was not entirely the case, and it can be easily understood how disease can be communicated from one person to another by the use of swimming-baths. Diphtheria germs can be found in the throats of persons who have had the disease, although they themselves present no signs of diphtheria, and all persons using a swimming-bath get more or less an amount of water into their mouths and nostrils whilst in the bath. Again, the germs of consumption could get into the water in a similar manner, and the prospect to swimmers who swallow mouthfuls of water containing the bacillus enteritidis sporogenes is anything but pleasant. Cases of sore eyes in children I have personally known to be caused through swimming in infected bath water, and it is an easy matter to speculate on the number of diseases which might be conveyed from person to person through the medium of polluted swimming-bath water. On the other hand, I cannot say that in my experience I have been able to trace many cases of infectious disease to swimming-baths, and one readily admits the great advantage to the health of a community from frequent bathing and washing. There is no doubt that persons whose bodies are frequently washed are healthier than are those who do not cleanse themselves regularly, and hence in the long run the advantages obtained from the use of swimming-baths are undoubtedly greater than the disadvantages.

The only practical conclusion I can arrive at is that the baths should be emptied at more frequent intervals, although here I am again aware of the difficulty on the ground of expense. Each time they are emptied the sides and floors should be thoroughly scrubbed with an efficient disinfectant before refilling. At present we are faced with the fact that

this analysis tells us that the water examined was nothing more or less than dilute sewage, and this condition can be remedied by the course mentioned. The baths manager told me that numbers of pediculi capitis are found on the towels after use, and they are also found sometimes in the dressing-boxes. One is aware that in many cases the condition of the hair of the girls in the schools is bad, and it should be insisted upon by the authorities that children whose hair is known to be verminous should not be allowed to use the bath at all whilst in that condition. Another useful regulation would be that all girls with long hair should be compelled to wear bathing caps whilst in the water.

I am aware that in certain towns the experiment of treating the water in the swimming-baths by certain chemical reagents, such as chlorine, has been tried, and in others frequent filtration of the water has been resorted to, and I believe the results have not been unsatisfactory. To my mind, however, there is an objection to this water being used over and over again, for although it may be comparatively pure after treatment, from a chemical and bacteriological point of view, there is a feeling that, after all, one is only bathing in water that has previously been bathed in by hundreds of other people, and the feeling is, to put it mildly, not a nice one, although, of course, I am aware that to the chemist and bacteriologist this objection is nothing more or less than a sentimental one.

In addition to the examination of the water carried out by myself in Batley, I forwarded some samples to Dr. Sutherland, bacteriologist to the West Riding county council, and I append the reports on these waters which were received by me from him.

16th June.—First-class swimming-bath in use at time of sampling. Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 2390 per c.c. of water. Coliform or intestinal organisms: Present in 10 c.c. of water but not in 5 c.c. Bacillus enteritidis sporogenes: Not found in 10 c.c. of water.

16th June.—Second-class swimming-bath in use at time of sampling. Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 16,950 per c.c. of water. Coliform or intestinal organisms: Present in 0.5 c.c. of water but not in 0.1 c.c. Bacillus enteritidis sporogenes: Found in 10 c.c. of water but not in 1 c.c.

22nd June.—First-class swimming-bath (from supply pipe entering bath). Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 43 per c.c. of water. Coliform or intestinal organisms: Present in 5 c.c. of water but not in 1 c.c. Bacillus enteritidis sporogenes: Not found in 10 c.c. of water.

22nd June.—Second-class swimming-bath in use at time of sampling. Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 300,000 per c.c. of water. Coliform or intestinal organisms: Present in 0.5 c.c. of water but not in 0.1 c.c. Bacillus enteritidis sporogenes: Not found in 10 c.c. of water.

28th June.—First-class swimming-bath. Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 219,000 per c.c. of water. Coliform or intestinal organisms: Present in 1 c.c. but not in 0.1 c.c. Bacillus enteritidis sporogenes: Not found in 10 c.c. of water.

28th June.—Second-class swimming-bath. Bacterial content: Number of organisms developing on gelatin incubated at 20° C. and counted in 48 hours = 63,000 per c.c. of water. Coliform or intestinal organisms: Present in 0.1 c.c. but not in 0.01 c.c. Bacillus enteritidis sporogenes: Not found in 10 c.c. of water.

In conclusion, I desire to thank Dr. Sutherland for enabling me to publish his interesting bacteriological report. Batley.

A CASE OF PERNICIOUS ANÆMIA TERMINATING IN ACUTE DIABETES.

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A MAN, aged 49 years, was first admitted to the London Hospital on June 7th, 1909, under the care of Dr. Robert Hutchison. He complained of lassitude and general weakness, with occasional vomiting and diarrhoea. He stated that about a year before (May 15th, 1908) he was one of a jury summoned to the inquest on a considerably decomposed body which had been washed ashore. The stench encountered on entering the mortuary affected him severely, inducing an attack of violent vomiting and diarrhoea, which continued through the rest of that day and night. To this the patient and his wife ascribed the onset of the present illness. Ill-health, with liability to vomiting and diarrhoea, had continued from that date, and had become worse during the last few months. The vomiting had no definite relation to food and occurred chiefly at night. In addition, he suffered from a "heaviness"

and "a feeling of wind" in the epigastrium. His appetite had been fair. His previous health had from boyhood been very good, except for an attack of gonorrhoea at the age of 19. There was no history of syphilis.

On admission the patient appeared to be well nourished, but the skin was pale and of a lemon tint, and the mucous membranes were very anæmic. There was neither oral sepsis nor stomatitis. There was no evidence of disease of the heart and lungs. Percussion showed the lower edge of the liver to be just below the costal margin, but neither liver nor spleen was palpable. The superficial glands were not enlarged. The knee-jerks were present, the pupils reacted to light and to accommodation, and no mental change was noticed. Slight "pitting" was obtained on pressure over one ankle. There was no pyrexia while he was in hospital. The urine was examined on this and three later occasions. It was acid and of specific gravity 1020–1026. Albumin and sugar were absent. On the day after admission a test meal was given. This consisted of a large cup of weak tea and two small slices of toast. An hour later a stomach tube was passed, but the gastric contents were so thick and lumpy that they came with difficulty through the tube. Free hydrochloric acid was absent and only 10 cubic centimetres of decinormal NaOH were required to neutralise 100 cubic centimetres of the filtered gastric contents. Three weeks later a further test meal showed absence not only of any acidity but also of pepsin. It had no action on albumin when incubated at 37° C. for one hour.

Examination of the blood on June 10th showed: Poikilocytosis present, rouleaux formation slight; erythrocytes, 1,350,000 per cubic millimetre; hæmoglobin, 30 per cent.; colour index, 1.1; leucocytes, 1900 per cubic millimetre. No nucleated red cells were found. On June 25th there was a slight increase of erythrocytes and hæmoglobin. Eight normoblasts and two megaloblasts were seen while counting 200 leucocytes. Polychromatophilia and granular degeneration were present.

A diagnosis of pernicious anæmia ("Addisonian") was made. The patient was confined to bed. The diet consisted of peptonised milk, milk puddings, bread-and-butter, and lightly cooked eggs; fish and meat were added later. A mixture containing 3 minims of liquor arsenici hydrochloricus with 15 minims of dilute hydrochloric acid was given three times a day. The amount of the acid solution of arsenic (1 per cent.) was gradually increased in this prescription until 13 minims were being taken. On discharge on July 13th (five weeks after admission) a blood report showed: Erythrocytes, 3,012,500 per cubic millimetre; hæmoglobin, 75 per cent.; colour index, 1.2. One normoblast and one megaloblast were seen in counting 200 leucocytes. His colour was good, his strength had returned, and there was entire absence of symptoms. A brother has written: "The change in him was most remarkable; he looked and felt a new man both in body and mind."

After discharge the mixture of arsenic and hydrochloric acid was taken at home, and each month the patient came up to be seen by Dr. Hutchison. He appeared and felt quite well. The last of these visits was on Nov. 13th, three weeks before readmission and four weeks before death. On that occasion he still considered himself quite well and looked so; he was shown to a large class as an example of the remarkable remissions which occur in pernicious anæmia.

The patient was readmitted on Dec 4th. He maintained that he had been perfectly well until ten days before, when, on looking into the mirror, he noticed that his gums were very pale. A day or two later there was general pallor and weakness and a rapid wasting began. In answer to particular questions, he said that thirst and some increase in the amount of urine had been present for only a few days before admission. The chief complaint, however, was of headache, nausea, epigastric discomfort, and great weakness and wasting. By a great effort he had journeyed several miles to the hospital, but was so exhausted that it was necessary to carry him in from a neighbouring station.

On readmission he was in a state of collapse and showed severe anæmia of the mucous membranes and the skin; the latter showed the lemon tint of pernicious anæmia. In addition the chest and back had a finely polished appearance. His weight was 8 stones 1 pound, being 11 pounds less than when discharged in July. The temperature was 98° F.; the pulse had a frequency of 100, was regular, of fair tension, but of small volume; the artery was not