Pathological Findings

The laboratory investigations were as follows:

Blood Counts ...	Nov. 14, 1934	Nov. 19	Nov. 29	Dec. 6	Jan. 9, 1935
Red cells ...	3,330,000	3,230,000	4,230,000	4,270,000	4,140,000
Hb per cent. ...	60	56	61	76	77
C.I. ...	0.89	0.86	0.72	0.84	0.92
White cells...	24,000	19,000	14,000	10,000	6,500
Polymorphs per cent. ...	—	94.7	62	53.7	—
Large mononuclears per cent.	—	1.3	4	4.7	—
Small mononuclears per cent.	—	4	32.7	40.7	—
Eosinophils per cent. ...	—	—	1.3	0.3	—
Mast cells per cent. ...	—	—	—	0.6	—

No abnormal red or white cells seen.

Urine: trace albumin; a few leucocytes; culture sterile.
Blood culture on November 14th: sterile after eight days'

incubation. Blood agglutination on November 15th: negative for *B. typhosus*, *paratyphosus* A and B, and *Br. abortus*. Blood Wassermann reaction: November 16th, slightly positive; December 6th, strongly positive; January 9th, negative. Both guinea-pigs and mice were inoculated with citrated blood taken from the patient on November 18th, but no spirillum was recovered.

Although the causative organism was not recovered from the blood there appears no doubt that the illness is an example of *sodoku*. Features of special interest are the muscular swellings, which do not seem to have been previously recorded, and a definite conjunctivitis, which disappeared after the injections of N.A.B. The positive Wassermann reaction is a characteristic feature.

Our thanks are due to Dr. L. E. H. Whitby for performing the blood inoculation into the mouse, and to Dr. Eastes's laboratory for the other pathological investigations.

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AN UNUSUAL OUTBREAK OF
GASTRO-ENTERITIS

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The outbreak of gastro-enteritis here described appears to be worth recording for two reasons: in the first place because, notwithstanding the increase of our knowledge of the causes of food poisoning in recent years—particularly as regards the *Salmonella* group of organisms—there is still much to be learned about the subject; and, secondly, because I feel that it is very easy to attribute mild attacks of gastro-enteritis to "gastric influenza" or other unknown causes when a more careful investigation might disclose a food infection. The present outbreak would probably never have come to light were it not for the fact that two deaths following gastro-intestinal symptoms were reported to the coroner, and the resultant inquiries from private practitioners revealed other cases of a similar nature.

As far as could be estimated the period covered extended from about November 12th to December 9th, 1934. Some seventy cases in all came to notice in this district, and there were, no doubt, many more mild cases which did not consult a doctor. One heard of a few similar cases occurring in neighbouring districts, but inquiry of other medical officers of health failed to disclose any widespread epidemic. The majority of patients were the only members of the family to be affected, but in eight instances there was multiple infection in the same house. An interesting example of multiple infection (which unfortunately was not reported until two weeks later) occurred at a sports club where about one hundred members from various parts of London met for tea on a Saturday afternoon, and, of these, twenty were afterwards taken ill.

Nature of Illness

All classes of the population were affected indiscriminately, and there was no selectivity for age or sex. In the most marked cases there was a fairly sudden onset, with severe epigastric pains, vomiting, diarrhoea, and collapse. As a rule there was no increase of pulse rate, and the temperature was normal or subnormal, except in young children, where there was an occasional rise of one or two degrees. Some cases had vomiting only, and a

number complained of diarrhoea only. Even when the original illness was mild, convalescence was frequently associated with a feeling of profound depression and debility. It was possible to calculate the incubation period in the case of the group occurring in connexion with the sports club. They all partook of a common meal at tea-time, and in most cases symptoms began in twenty to twenty-four hours, with extremes of twelve to sixty hours. Bacteriological examination of the faeces was carried out in twelve cases without significant results. The two deaths which occurred during the time of the epidemic were both isolated cases, and were not of quite the same type as the others, but it was difficult to assign any other cause of death to them.

Fatal Cases

Case 1.—Male, aged 56. Previous health good. He complained of pains in arms and chest on morning of November 18th. At 12.30 a.m. on November 19th he was taken ill with acute epigastric pains, vomiting, and diarrhoea. He became very collapsed, and died at 5 p.m. on the next day. Post-mortem examination revealed a well-nourished man of good physique. The stomach and upper part of small intestine were distended. The stomach was sent to the analyst unopened and the interior was not seen. Small submucous haemorrhages were present in the small intestine. The large intestine was normal. All the other organs were normal.

Case 2.—Female (married), aged 44. Previous health good. On November 25th she complained of pain on the top of the head and epigastric discomfort. On November 29th she complained of nausea and was sick. There was slight diarrhoea and a general nervous tremor. There was no rise of pulse or temperature. She died suddenly and unexpectedly at 1.30 p.m. on the next day. Post-mortem examination revealed a woman of spare build. The interior of the stomach was intensely inflamed, and looked like raw beef. There was slight congestion of the lower end of the ileum, but there were no intestinal haemorrhages. There was very severe oedema of both lungs. The liver and kidneys showed severe parenchymatous degeneration, and the spleen was diffuent. The heart was normal.

A full bacteriological examination was carried out in both of these cases, but with the exception of a few colonies of *Staphylococcus aureus* from the spleen of Case 2, nothing significant was isolated. Analysis for inorganic poisons was also negative in both cases.

Epidemiological and Bacteriological Investigations

The private practitioners of the district were invited to co-operate in the discovery and investigation of cases, and an immediate and whole-hearted response resulted.

The possibility of gastric influenza was considered, but in view of the absence of general pains, respiratory symptoms, and pyrexia, it seemed most probable that an alimentary infection conveyed by food or drink was the cause. A detailed list of the food consumed as far as known was prepared in fifty cases. In the meantime Colonel Harold of the Metropolitan Water Board made a very thorough investigation of the local water supply, and assured me that an infection conveyed by water was most unlikely. It was also possible definitely to exclude milk as a source of infection. On analysis of the lists of food consumed it became apparent that there was no usual vehicle of food poisoning which was common to all, and if the source of the trouble was indeed food it must be one of the common widespread commodities.

The only foodstuff capable of harbouring bacteria which had been taken by everyone and could not be entirely excluded was butter, but there appeared to be no common source of supply except for the fact that 82 per cent. of the cases investigated were known to have consumed butter of an imported variety. In view of the large quantities of imported butter used, however, this is not necessarily significant. It was decided, however, to pursue the question further, especially in view of the fact that in two cases symptoms arose immediately after a change in the type of butter used. A specimen of the suspected butter was purchased on December 7th and consumed in normal quantities by a human volunteer. A mild diarrhoea with bright yellow stools followed. The specimen was then submitted for bacteriological examination and the following report was received.

"The cultures contain chromogenic staphylococci, also white staphylococci, and some short streptococci of the salivarius or faecalis type. The first-mentioned appears to be the important organism present, and it is the *Staphylococcus pyogenes aureus*."

The outbreak had now subsided, but further specimens of imported butter were obtained from different shops and were examined by Dr. Scott of the Ministry of Health with the following results:

No. 1.—Almost pure culture of cocci producing white and yellow colonies.

No. 2.—As No. 1, but with a few coli colonies and streptococci.

No. 3.—Indistinguishable from No. 1.

No. 4.—As No. 2.

No. 5.—A mixture of colon bacilli and *B. mycoides*. No coccal colonies.

One specimen was also submitted for chemical analysis with a negative result.

As is frequent in cases of suspected food poisoning, great difficulty was experienced in obtaining specimens of the actual food consumed, the more so as it was only possible to commence the investigations towards the end of the epidemic, and most of the inquiries related to convalescent cases.

Discussion

The epidemic differed from the ordinary type of food-poisoning outbreak in that it was spread over a period of a month, and it was difficult to find any definite connecting link between the cases. It is difficult, however, to accept any other aetiology than that of alimentary infection conveyed by food. The persistently negative bacteriological findings in the pathological specimens examined may be held almost certainly to exclude infection by the Salmonella or dysentery group of organisms. Attention is therefore directed to the part played by other organisms in gastro-enteritis.

Although I can find no record of an outbreak of gastro-enteritis caused by staphylococci in this country, the condition has been recognized in America, and several

instances have been reported in which the *Staphylococcus aureus* chiefly has been suspected. In 1914 Barber¹ attributed toxic symptoms arising from the consumption of milk to infection by *Staphylococcus albus*. In 1933 McBurney² reported an outbreak of gastro-enteritis due to the contamination of chocolate éclairs by *Staphylococcus aureus*, and collected six other reports from the literature, all of which referred to cases occurring in America or its possessions. In these examples the foods involved were: milk (2), cake (2), chicken gravy (1), and cheese (1). All these outbreaks were of an explosive nature, and symptoms began after a short incubation period of two to three hours. The symptoms usually consisted of nausea, salivation, abdominal pain, vomiting, extreme prostration, diarrhoea, and chilliness. He suggests it probable that a large number of outbreaks of food poisoning in which the aetiological factor has not been determined have been due to organisms of the staphylococcus group. Jordan³ used broth filtrates of staphylococci from various sources in feeding experiments with human volunteers, and produced a positive illness in a considerable proportion of his subjects. There is evidence that staphylococci with food-poisoning properties are sometimes present in cows' milk,⁴ and a well-authenticated outbreak has been recorded recently.⁵ A difficulty arises in correlating any particular strain of staphylococcus with the production of gastro-enteritis in that human volunteers have to be used in experimental work, and the illness produced is sometimes severe.

Although suspicion may fall on the *Staphylococcus aureus* as a possible cause of the outbreak under discussion, there is not sufficient evidence to come to any definite conclusion. It would appear from the foregoing that the *Staphylococcus aureus* is a potential cause of gastro-enteritis, and that butter is sometimes contaminated by that organism to a considerable degree. *Staphylococcus aureus* was isolated from the spleen in one of the fatal cases, but this finding is not necessarily significant.

Summary

An outbreak of gastro-enteritis is described which extended over a period of a month and affected upwards of seventy people, two of whom died. The cause of the outbreak was not definitely determined, but infection by the Salmonella and dysentery groups was almost certainly excluded. The symptoms consisted of severe epigastric pain, vomiting, diarrhoea, and collapse, with a normal or subnormal temperature. Attention is drawn to the *Staphylococcus aureus* as a proved cause of food poisoning, and to its presence in certain specimens of butter, the only food which came under suspicion. There is no evidence, however, regarding the toxigenic properties of these particular strains.

I should like to express my thanks to Colonel Harold of the Metropolitan Water Board, to Dr. Scott (who carried out most of the bacteriological examinations) and Dr. Maitland of the Ministry of Health, and to the private practitioners of the district for their valuable help.

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"Bringing Science into the Road Traffic Problem," by Colonel Mervyn O'Gorman, has been published as a pamphlet (with five appendices) by the British Science Guild. Copies—price 1s. 1d. each, including postage—are obtainable on application to the secretary of the Guild, 6, John Street, Adelphi, W.C.2.