

part of the tuberculosis problem appear more difficult than it really is. We would repeat what we have before said, that we value very highly the adoption of measures directed to provision of an increased supply of clean, pure milk, which would, *pari passu*, lessen the chances of contamination with tubercle bacilli, and again insist on regarding bacilli-discharging cattle as the paramount danger, and their removal from our cowsheds the only means by which this menace to human health can be radically affected. It may be useful in its way to discover under what conditions the transmission of the disease from animals to man takes place, and the circumstances favourable or unfavourable to such transmission, but no amount of enquiry as to conditions favouring or disfavouring transmission can alter the view of the desirability of arresting the production of bovine tubercle bacilli at its sources. Such an enquiry may bring out facts bearing on the suppression of bovine tuberculosis which will facilitate the process, but the measures suggested for diminishing the supply and distribution of the essential element which are practicable, and have already been partially adopted with a high degree of success, must be included in any recommendations made as the outcome of any well-directed enquiry. Indeed, in the first interim report of the present Royal Commission we are told that the information gained up to the time of issue warranted, on the part of the authorities and the public, no relaxation of the efforts in carrying out the measures in operation prior to Koch's momentous statement. If tubercle bacilli from bovine sources are so virulent for man as the second interim report leads us to infer, delay in compelling the withdrawal of the danger by measures which are practical means a continued massacre of the innocents, and complicity on the part of those who are responsible. It is no excuse to tell us that local authorities may acquire powers, for the fact that they do not is in itself proof of the necessity for compulsion and uniformity of action.

CHEMICAL ANALYSES OF WATER IN ALLEGED CASES OF SEWAGE POISONING OF CATTLE.

By WILLIAM ROBB, F.R.C.V.S., Glasgow.

It is not my intention to review the following analyses as an expert in chemistry, but rather to put on record the findings of experts, followed up by a short history of the outbreak. Some of these cases I have personal knowledge of, and in the others I am indebted to the local veterinary surgeon for the information.

While no one can honestly say that he would prefer that cattle should drink of polluted water in preference to pure water, it is common knowledge that cattle do drink of polluted water with impunity. It does seem strange that cattle can drink with impunity water polluted by their own excreta or that of their owner's household, while water which to taste and smell seems infinitely purer acts as a rank poison, provided it is polluted by a neighbour.

What the particular element or elements are in the polluted streams that act as a poison varies in the different cases according to the knowledge possessed by the expert giving evidence.

The simplest way of explaining the illness, and the one adopted by some, is to assume that the cattle were healthy prior to the pollution, that the stream was polluted, and that the cattle turned ill after drinking of water which could not be pure after the polluting matter had been added to it.

Of course, this takes some further explaining when it can be shown that the pollution has been going on perhaps for years prior to the outbreak and that in most cases no cattle farther down the stream suffered, and still more when it can be proven that others have drank even nearer the source of pollution.

MAYBOLE CASE.

Sample drawn 24th June 1905 :—

	<i>Grs. per gall.</i>
Mineral matter	21'22
Organic matter	1'63
Nitrates	'35
Free ammonia	'071
Albuminoid ammonia	'017
Total ammonia	'088

The cows on this farm were turned out to grass early in May, and nothing was heard of illness in the herd until late in the autumn, when the cattle were reported to be aborting. The farm was visited by the officials of Maybole, accompanied by their veterinary surgeon, Mr D. Weir, M.R.C.V.S., and no complaint was made as to the condition of the cattle except that some had aborted. Some seven or eight which had aborted were isolated in a second byre and attended to by the farm manager only, except in one case, when a veterinary surgeon was called in to remove the placental membranes. This cow afterwards developed "blood-poisoning" (septic metritis, possibly), but, according to some opinions, this was quite to be expected after cattle have drunk of polluted water. These aborting cows were washed out daily with some preparation supplied by the owner, and were kept in this byre until all discharge had ceased, when they were removed to a third byre.

The bull that was in use at the time of the outbreak was sold, and two fresh bulls were bought, one being used on the aborting cows and the other being reserved for the rest of the herd. When the case came on for trial it was stated that there had been a general wreckage of the herd in flesh and milk supply. It was admitted that the Burgh of Maybole had been tipping kitchen refuse into the loch supplying the stream from which these cattle drank, but that this was not new; in fact, it had been going on for a very long time. On the other hand, a neighbour's cattle had a drinking place a few yards higher up, and did not suffer from drinking the alleged polluted water. In spite of the evidence that no complaint of illness was made either during the summer or at the time of the officials' visit in the autumn, and of the further fact (to me a most damning one) that no veterinary surgeon ever saw these cattle at any time during the summer, when they were wasting and giving milk of a variety of colours and quite unfit for use, the Sheriff decided in the fullest manner in favour of the owner.

FALKIRK CASE.

Analysis of stream above source of pollution :—

	<i>Grs. per gall.</i>
Mineral matter	27.42
Organic matter	1.80
Nitrates	None
Free ammonia077
Albuminoid ammonia016
Total ammonia093

At drinking place :—

	<i>Grs. per gall.</i>
Mineral matter	21.90
Organic matter	8.65
Nitrates	None
Free ammonia	1.68
Albuminoid ammonia51
Total ammonia	2.19

In this case the polluting matter consisted of the condensed steam from evaporating vats and liquid matter from a fish guano factory.

The cattle were turned out early in May, and in the month of June three cows had been seized with a loss of power of their limbs, diarrhœa, a uterine discharge, loss of flesh, and stoppage of milk. By the beginning of July one more had shown the same symptoms, one had aborted, and another was thought to be threatened with abortion but went her full time.

These four cows specially mentioned never came back into condition, and one was left for some months with a staggering gait. The owner alleged that the rest of his herd had suffered in body and in milk secretion, but this was not held as fully proven. He also alleged that his horses had suffered after being turned out to grass for a night or two in the fields watered by the polluted streams; but, as his veterinary surgeon, who was in attendance on the cattle at that time, had not seen them, the Sheriff did not admit that part of his claim.

There were no more serious cases after July, and, although the farmer put on a man to carry water to the cattle, it is difficult to believe that these animals did not drink of the still polluted stream. There is no question but that it was a most ill-smelling discharge that was poured into this stream, and if the illness of these four cows was produced by putrefactive bacteria and their toxins I am at a loss to understand why the rest of the herd escaped very serious illness. In the human being one knows the dire and immediate results in a family attacked with ptomaine poisoning.

Some witnesses in this case stated that they believed the albuminoid ammonia to be the cause of the illness, but I think this can be simply brushed aside, as albuminoid ammonia does not exist as such in the water, but is produced by the chemist in his analysis, and, further, the dosage of ammonia is fractional.

The Sheriff again decided in favour of the farmer, but in a very modified degree.

NETHERBURN CASE.

I am not personally aware of the facts in this case, but I have, through the courtesy of Mr R. Millar, M.R.C.V.S., Strathaven, received some of the data in connection with it.

Analyses—Three Samples.

	(1)	(2)	(3)
	<i>Grs.</i>	<i>Grs.</i>	<i>Grs.</i>
	<i>per gall.</i>	<i>per gall.</i>	<i>per gall.</i>
Mineral matter . . .	18·65	24·37	22·37
Organic matter . . .	2·90	·35	·83
Nitrates	·24	None	·09
Free ammonia	·315	·024	·057
Albuminoid ammonia .	·091	·013	·021
Total ammonia . . .	·406	·037	·078

In this case twenty-eight cows, during the winter of 1905, were allowed out for a short time each day to drink, and Analysis No. 1 is that of the water taken from the stream at their drinking place. Analysis No. 2 is that of water from a ditch that has been used for some years as water for the boilers and for making the cows' food. No. 3 is that of a sample drawn 100 yards farther down than No. 1.

On 7th November 1905 the first cow turned ill with diarrhœa, and it died on 20th November. On 1st December another turned ill, and it died on 7th December. No other deaths occurred till April 1906, when two more died from diarrhœa. Other seven had been attacked with diarrhœa, but had recovered from the acute symptoms, although still out of condition. In May two other cows were also attended to, suffering from the same ailment.

The chief symptoms were violent and persistent diarrhœa, loss of appetite, cessation of rumination, temperature 102·5° to 103·5°, pulse 60 to 70, no tympany, but tenderness over loins and abdomen. No abortion had taken place so far.

In the summer of 1906 the cows were grazed in a field some half mile away from the farm, where the water was believed to be purer, and no cases occurred after that, with one exception. This was a cow due to calve in autumn that was put into a field near the original drinking place. She calved in August, and immediately after was attacked with diarrhœa, from which she recovered.

The cattle went on fairly well, although not giving the proper amount of milk, until February of this year (1907), when abortion broke out in the herd. My informant thinks it was confined to those animals that had suffered from diarrhœa and recovered.

Briefly, out of twenty-eight cows in the herd fourteen of them were affected, four of them dying. The ten that recovered were left in an emaciated condition, and aborted the following season.

It must be admitted that in this case the stream was badly polluted with human excreta. The sewage of some thirty-four houses was run into this small stream a short distance above the original drinking place of these cattle. Whether this was something new, or whether the cattle had never drank of that stream before, seems to be worthy of further investigation. I am attempting to get these

facts, also as to whether or not any cattle farther down the stream were affected. At the present moment I am told it is not known that any other herds were affected.

Since writing the above I have learned that the pollution had been going on since 1901, but it was getting worse through time, as a great many new houses had been built in the village. It does seem strange that, while the cattle were out all day during the summer of 1905, there was no illness until November, and, as has been mentioned, they only got out once daily at that time, whereas in summer they drank freely of the same polluted stream.

This case was also decided in favour of the farmer.

IRISH CASE.

Analyses.

	<i>No. 1.</i>	<i>No. 2.</i>
Total solids	24·5	33·0
Volatile solids	8·5	4·0
Chlorine	2·35	2·5
Free ammonia	·17	·20
Albuminoid ammonia	·68	·42

In all the analyses up to this one the results are given in grains per gallon, but in this the free and albuminoid ammonia are estimated at parts per million, and the other substances at grains per gallon.

No. 1 sample was drawn above the alleged source of pollution, and No. 2 was drawn at the drinking place.

The pollution in this case was alleged to be due to the effluent from a creamery, and it was said to give rise to symptoms "peculiar and characteristic."

The story of the outbreak runs from 1899 to 1905. In 1899 it was undiagnosed, but believed to be a toxic poisoning. In 1900 it was believed to be due to creamery effluent, and, while unnamed, it is a diseased condition known to some local practitioners as peculiar to cattle drinking of water polluted by creameries.

In June 1907 the case came into court, but was settled by the defendants paying £100 and costs. When one compares the amount of money received in this case, after an illness extending over years, with the handsome allowances given in the others, it seems quite inadequate.

The symptoms, as far as I have been able to gather, are as follows: Out of some twenty cows, there seems to have been always a portion of them ill from some "acute form of low fever," diarrhoea or dysentery, and rise in temperature. Some showed traces of pneumonia, and others an affection of the skin. This affection of the skin was a sort of rash, something like scarlatina. It was a disease something like typhoid in the human being, but there was no perforation of the bowel; and to those acquainted with this special disease the affection ran a definite course. The milk supply, besides being decreased in quantity, was materially affected in quality.

In 1905 a *post-mortem* examination was made on a cow which died, and it was found that the animal had suffered from muco-enteritis; the second and fourth stomachs were in the same condition; the

intestinal glands were enlarged, and more or less decomposed ; and there was also enlargement of the liver.

There were other farms intervening between the source of pollution and the drinking place of the cattle on this farm, but there does not seem to be any record of illness on these farms.

While not personally acquainted with the neighbourhood, I understand that this farm was about a mile and a half below the creamery, and that the stream also received sewage from the town. If these facts are correct, it does seem strange that other cattle should escape, and that creamery effluent should be considered more harmful than town sewage.

Total Ammonia in Analyses.

	<i>Grs. per gall.</i>
Maybole Case	·088
Falkirk Case (drinking place)	2·19
" " (above pollution)	·093
Netherburn Case	·406
	<i>Parts per million.</i>
Irish Case	·62
" (above drinking place)	·85

To those who believe that chemical analysis is quite satisfactory, and that there is any ratio between the ammonia present and the clinical symptoms, the above table should prove interesting.

In the Maybole Case ·088 grains per gallon caused general wreckage and abortion, while in the Falkirk Case the normal condition of the burn prior to pollution showed ·093 grains per gallon, and of this the cattle drank without any bad effects.

I am attempting to get the analyses of streams of which the cattle have drunk for years without causing illness, and if I am successful I think they would prove an interesting sequel to this article.

The following is typical, in my opinion, and I can vouch for its accuracy. A farmer's cattle drank of water containing farm and house sewage, and showing total ammonia to the extent of 2·19 grain per gallon, same as in the Falkirk Case, and remained healthy. On being put into another field, the waters of which ran past two cottages (neighbours), they turned ill. The analyses of these streams are respectively, total ammonia ·015 and ·021.

ECHINOCOCCOSIS IN THE DOMESTICATED ANIMALS.¹

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SINCE the publication of the classic works of Professors Neumann and Railliet, echinococcosis has been the subject of a large number of investigations which have yielded important biological and pathological results. I therefore thought it would prove interesting to enumerate, in a general review of the subject, the most recent

¹ Translated from the "Revue Vétérinaire," Nos. 10 and 11, 1907.