

lambs is that when infective material is present in the abomasum the casein from an abnormally large quantity of milk ingested renders the acidity of the abomasal secretion inert, thus favouring proliferation of *C. welchii* type D in this rich pabulum. Toxin is formed initially in this site, but is activated by the trypsin in the small intestine from which it is absorbed with rapidly fatal effects.

Roberts used for his *in vivo* experiments an artificially-prepared milk which simulated the composition of the ewe's product. It was decided to attempt to induce entero-toxæmia in lambs using Roberts' technique, but to substitute ewe's milk for "adjusted milk." In the first experiment, 1,450 millilitres of ewe's milk to which the centrifuged bacteria from a twenty-four-hour *C. welchii* type D culture (a strain recently isolated from Canterbury) were suspended, were administered by stomach tube to a twenty-three-day-old twin lamb weighing 21 lb. Apart from the general discomfort occasioned by the very large quantity of milk, the animal showed little ill effects until the next day, when a transient diarrhoea was observed. The lamb was kept under close observation for a week without any further ill effects being exhibited. As the milk had been aerated during the stripping process from the ewe and as the dissolved oxygen had not been expelled by boiling, it was thought that the failure to induce entero-toxæmia in this lamb may be attributed to the failure to provide sufficient anaerobiosis for growth of the suspended bacteria, it being assumed that less oxygen would have been present if the lamb had suckled naturally.

In the next experiment it was decided to administer the "adjusted milk" of Roberts to one lamb and ewe's milk, from which the dissolved oxygen had been expelled, to another of similar age and weight. It was thought that possibly the "adjusted milk" may provide a suitable pabulum for bacterial growth or induce a digestive disturbance, thus initiating *C. welchii* proliferation, but that this condition may not be induced by ewe's milk.

A female twin thirty-six days old, weighing 22½ lb., was given two litres of "adjusted milk" plus suspended *C. welchii* type D bacteria per stomach tube. The animal was collapsed after five hours and then followed the familiar train of symptoms. Six and a half hours after the administration the animal was purging severely, and it died a quarter of an hour later. The autopsy findings were identical with a natural case of entero-toxæmia. It was established that proliferation of the welch organisms had occurred in the forestomachs and the abomasum and *C. welchii* type D toxin was present in these sites.

The lamb which received the ewe's milk (which had been previously boiled and rapidly cooled to expel the dissolved oxygen) plus the suspended bacteria was a female twin thirty-seven days old and weighed 26 lb. This lamb died within six hours after receiving the milk, and the findings were identical with those of the previously recorded case. These cases confirmed Roberts' experiments and provide a reliable method of artificially inducing entero-toxæmia in a suckling lamb.

It was proposed to extend the work to attempt to induce entero-toxæmia in lambs under conditions simulating those which may pertain in the field. Owing to the lateness in the season, difficulties were encountered in obtaining lambs of suitable age. As a basis for future work it was decided to isolate a ten-weeks-old lamb from its mother for twenty-four hours and then return the lamb after drenching with a large quantity of *C. welchii* spores (obtained from the ileal contents of an experimentally induced case of entero-toxæmia) suspended in 100 millilitres of milk. It was thought that the large quantity of milk ingested by the hungry lamb would provide a suitable pabulum for proliferation of the organisms in the abomasum with consequent death from entero-toxæmia. The animal remained normal, and it is possible that the lamb was a little too old and the mother's milk secretion was on the decline.

It is proposed to extend the scope of the work next season, when more conclusive results may be obtained as to the conditions predisposing to entero-toxæmia in lambs, hoggets, and older sheep under conditions simulating those observed in the field.

*Enzootic Icterus*.—Mr. Buddle, who has been interested in the anaerobic flora of the alimentary tract of sheep, reports as follows on *Enzootic icterus* :—

"In view of the high percentages of copper which have been demonstrated in the livers of sheep dying from *Enzootic icterus* and the great similarity between the symptoms and lesions of this disease and chronic-copper poisoning it was decided to determine the effect of administering 100 millilitres of a 1-per-cent. solution of copper sulphate daily to four fully-grown crossbred sheep.

"It was suggested at one time that the condition was a *C. welchii* type A entero-toxæmia, but, while it has been demonstrated at Wallaceville during the past season that in a number of cases a proliferation of *Clostridium-welchii*-like organisms in the alimentary tract has occurred, no appreciable toxin has been demonstrable in the ileal contents using mice as the test animals. It is possible that this proliferation of a hæmolytic *C. welchii* organism may occur in the terminal stages of chronic-copper poisoning when digestive processes are in abeyance and conditions have been induced in the alimentary tract which would favour its growth and would contribute in some degree to the rapidly fatal course once symptoms are exhibited. A case of *Enzootic icterus* has been examined at Wallaceville which was associated with severe hæmonchosis, the severe anæmia related to this condition most probably accentuating the effects of a possible chronic-copper poisoning, the doses of copper apparently being insufficient for a medicinal effect on the parasitic infestation.

"It was decided, therefore, to determine the bacterial flora of the abomasum and small intestines of these four sheep at death and to test the ileal contents biologically for *C. welchii* toxin. After thirty days' administration two sheep were drenched with *C. welchii* type A culture (recently isolated from a natural case of *Enzootic icterus*), but the conditions in the bowel were not such as to favour their growth or toxin production to such a degree to precipitate the animals' deaths.