we are aware, listerellosis in sheep and cattle showing an encephalitic and/or an encephalomyelitic syndrome has not been reported in central United States. However, Doyle[9] described an idiopathic encephalitis of sheep in Indiana accompanied by gross and microscopic changes in the brain analogous to ovine Listerella infection encountered in Illinois during the winter of 1937–38.

In this paper reference is made to two outbreaks of ovine and one outbreak of bovine encephalitis and/or encephalomyelitis associated with Listerella. The first outbreak coming to the attention of the Illinois Agricultural Experiment Station occurred in a group of 250 feeder lambs that had been purchased at a central market. Lambs of this type for fattening generally originate in western grazing states, but the origin and history of the animals comprising this shipment were not determined. Approximately six weeks following arrival of the lambs on a farm in DeWitt County, Ill., symptoms of illness developed. The symptoms consisted of depression, weakness, incoordination, fever, walking in circles, pushing against objects with the head, anorexia and progressive paralysis, terminating in coma and death. Approximately 30 lambs died or became moribund and were destroyed and a few mildly affected lambs apparently made a complete recovery. An ophthalmia of transitory nature was noted in some of the mildly affected lambs. The same lesion was also observed at autopsy of fatally affected lambs.

Five of the typically affected lambs from this flock came to autopsy. Each yielded Listerella-like organisms from the brain stem on liver agar plates and/or in tubes of meat mash media incubated at 37.5° C. Bacteriologically sterile brain tissue filtrates (Berkefeld N) proved negative to demonstrable virus upon intracerebral inoculation of rabbits, guinea pigs and chickens.

The second outbreak occurred in a flock of 100 breeding ewes in DeWitt County, but so far as determined, had no connection with the first outbreak. A small number of the breeding ewes in this flock displayed symptoms involving the central nervous system with a mortality of six ewes. One of the clinically affected animals was submitted for observation and autopsy. An organism possessing characters of the genus Listerella was iolated from the brain stem.

A third outbreak showing an encephalitic and/or encephalomyelitic syndrome was observed in a group of 60 yearling feeder steers in Piatt County, Ill. The principal symptoms were glassy, dazed expression of eyes, partial paralysis of mandible, elevation of the head and salivation. Affected animals became prostrate and remained comatose for three to four days before death. Listerella-like organisms were isolated from the brain stem of two fatally affected steers.

Postmortem examination of naturally affected lambs and ewes in two outbreaks did not reveal any marked gross pathologic changes in the internal organs. In some of the lambs the cervical and visceral lymph nodes were enlarged and slightly edematous. There was an increased amount of slightly cloudy cerebrospinal fluid with slight congestion of the meninges. In one case gross lesions suggestive of a localized meningitis were noted. The blood picture of five of the natural ovine cases did not show any significant deviation from the normal.

An examination of stained sections from the brain of naturally affected lambs and cattle showed polymorphonuclear and mononuclear foci in the stem and in the white matter of the cerebrum and cerebellum, together with perivascular cuffing with mononuclear cells and a mononuclear meningitis.

The pathogenic properties of Listerella strain isolated from one outbreak in sheep have been established by artificial exposure of healthy lambs, calves, chickens, guinea pigs, rabbits and rats, while cultural and biochemic properties of the strains from the three outbreaks described herein conform to the genus Listerella. It appears that three natural outbreaks (two in sheep and one in cattle) in Illinois, accompanied by symptoms of encephalitis and/or encephalomyelitis, were associated with Listerella infection.[10]

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THE EFFECT OF NUCLEOPHOSPHATASE ON "NATIVE" AND DEPOLYMERIZED THYMONUCLEIC ACID

IT has been definitely established that desoxyribonucleic acids differ in their molecular weight, depending upon their method of preparation. The substance prepared by E. Hammarsten[1] seems to be the un-

[9] L. P. Doyle, *Jour. A. V. M. A.*, 81: 118, 1932.

[10] After dictating the above report on the occurrence of Listerellosis in cattle and sheep in Illinois, attention was called to an article on "Listerella Infection in Fowls in East Anglia" by Dr. J. Stuart Paterson, Institute of Animal Pathology, Cambridge University, published in *Veterinary Record* 49: 49, 1937, with reference to spontaneous Listerella in four separate groups of fowls, as follows:

a. Two adult fowls were involved, and in both cases death occurred suddenly.

b. One hundred and twenty out of 200 Leghorn pullets died during a period of three months. In addition to the presence of organisms of the Listerella group, *B. pullorum* was recovered from some of the pullets and there was also a heavy infestation of tapeworms (*Davainea proglottina*).

c. Four hundred pullets and 24 stock cockerels comprised the affected unit. The losses were 190 pullets and one cockerel. In several of the pullets from which Listerella were recovered, lesions of fowl paralysis (neurolymphomatosis) were also present.

d. Eight out of 24 young poultry died.

[1] E. Hammarsten, *Biochem. Zeits.*, 144: 383, 1924.

changed acid as it occurs in the cells of the thymus gland and of fish sperm (in combination with histone in the former and with protamine in the latter); according to investigations with various methods[2] (filtration and ultracentrifugation) its molecular weight is approximately 1,000,000. It may therefore be referred to as the "native" desoxyribonucleic acid.

Thus far the molecular weight has been determined definitely for the "native" nucleic acid only. Complete depolymerization of the acid to a single tetranucleotide has not yet been accomplished by chemical means.

On the other hand, by a specific enzyme obtained for the pancreas gland, Feulgen[3] succeeded in transforming the "native" nucleic acid to a tetranucleotide which differs from the "native" nucleic acid in certain physical properties and which is referred to in the literature as "b" nucleic acid.

In collaboration with Dr. E. G. Pickels,[4] we compared the behavior of "native" and "b" nucleic acid in the ultracentrifugal field with the result that the "b" form did not sediment at all, whereas the "a" form (prepared according to Neumann) settled down in a cleared boundary indicating particles of molecular weights between 200,000 and 1,000,000. These results represent the exact proof for Feulgen's assumption, that the enzymic transformation from "native" nucleic acid into the "b" form is a depolymerization.

Even though the molecular weight of "b" nucleic acid has not yet been determined, still it is not improbable that it represents a single tetranucleotide, for the reason that its behavior towards nucleophosphatase[5] is entirely different from the nucleic acids of higher molecular weight. We now find that the so-called "b" nucleic acid is the only one entirely dephosphorylated by the phosphatase, whereas the "native" desoxyribonucleic acid is not affected by this nuclease at all. Only when contaminated with the depolymerase does phosphatase affect nucleic acids of the high molecular weight.

This find, then, is of significance not only because it brings out an additional step in the process of biological catabolism of nucleic acids, but also because it furnishes a means of testing the purity of "native" nucleic acid, on one hand, and of testing the purity of a nucleophosphatase by means of the native nucleic acid, on the other.

It will be of significance also in connection with other questions bearing on the structure of nucleoproteins.

The method of preparation of nucleophosphatase free from depolymerase will be given in detail elsewhere.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE RECORDER FOR PHYSIOLOGICAL VOLUME CHANGES

As a sensitive recorder of small changes in volume, the bellows recorder devised by Brodie in 1902[1] has no equal. Its usefulness is limited, however, by the fact that it is tedious to build satisfactorily, especially since the membranes used in its construction are perishable and must be replaced frequently.

We have used in this laboratory for the past year a volume recorder which retains the principle of the Brodie apparatus, yet which can be made air-tight without difficulty, and in which the perishable membrane can be replaced in a few moments. The apparatus has found so many uses in both the student and the research laboratories that it seems to merit a brief description.

The construction of the recorder is shown in the accompanying sketch. The membrane *a* is a light, inelastic balloon, made by tying a commercially prepared sheep's cecum to the lead tube *b*. The sheep's

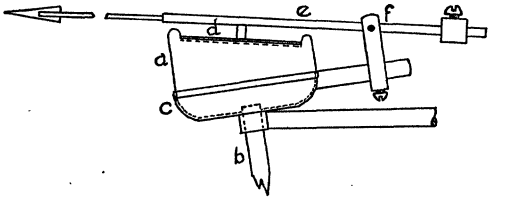

FIG. 1

cecum is sold as a contraceptive sheath. It is softened by soaking in 50 per cent. glycerol solution for a few minutes before tying. The lead tube passes through the center of a metal base, *c*, made concave to conform to the shape of the balloon. The lead tube is of rubber,

[2] R. Signer, T. Caspersson and E. Hammarsten, *Nature*, 146: 122, 1938; W. T. Astbury and F. Bell, *Nature*, 146: 747, 1938.

[3] R. Feulgen, *Zeits. physiol. Chem.*, 237: 261, 1935.

[4] We wish to acknowledge our appreciation to Dr. Pickels for his kind cooperation in this work.

[5] Nucleophosphatase probably consists of two components, one splitting the tetranucleotides into mononucleotides, and one dephosphorylating the latter. In the interest of shortness, we use in this note the term nucleophosphatase for this whole enzyme system.

[1] T. G. Brodie, *Jour. Physiol.*, 27: 473, 1902.