any effect due to abnormal quantities of free sugar, it is advisable to determine the reducing sugar in the zinc hydroxide[8] filtrate prepared from 1 to 2 cc of serum. Results from sera which contain more than 125 mg of free sugar per 100 cc should be discarded.

The acids which are produced in normal sera can be accounted for entirely by the free sugar which is consumed. Growth of the organisms appears to stop when the sugar is used up; from 40 to 80 mg of lactic acid are produced. The average yield of lactic acid is 72 per cent.

Unlike normal sera, however, growth continues in positive (+++ or ++++) sera at an apparently undiminished rate after the free sugar is consumed, until a terminal acidity of about pH 5.5 is reached. *The quantity of lactic acid is always greater than can be obtained from the free sugar.* For example, a serum, which contained 104 mg of free sugar, yielded 233 mg of lactic acid. Approximately 75 mg of the acid were derived (by calculation) from the free sugar; 158 mg of lactic acid were therefore derived from some other source.

As has long been known, normal sera contain considerable quantities of protein-polysaccharides.[9-12] By using a standard technique[13] throughout (increase of reducing sugar after 6 hours of hydrolysis with acid), we have invariably obtained higher results in +++ and ++++ sera than in normal ones. None of the sera contain measurable quantities of glycogen. The polysaccharide content is not perceptibly decreased by the growth of the organisms in the normal serum, but large quantities may be rapidly removed in the serum in which precipitation is noted. The production of acids parallels the consumption of the hydrolyzable sugar. Our results therefore indicate that *the phenomenon is due to the presence of abnormal quantities of a polysaccharide which supports rapid growth and which is readily fermented by the pneumococcus.* It thus differs from the normally present polysaccharide, which is not apparently metabolized by the micro-organism, since growth stops in normal sera when the free sugar is consumed.

Besides the conditions mentioned by Rosenow and by Longcope, the phenomenon can be noted in sera from many other diseases. We have most often observed it in acute bacterial infections which are associated with a sustained high temperature. Negative results were obtained from the majority of sera from chronic osteomyelitis. Of sera which were obtained from 9 patients with tuberculous infections, 5 were negative. The polysaccharide appears also in the serum in some conditions in which there is no direct evidence of an infection. It is present in the majority of sera in acute nephritis, in about one half of the sera from hypertension in pregnancy and in about one half of the sera taken during parturition in human subjects.

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LISTERELLA FROM A PREMATURE BOVINE FETUS

PREMATURE birth of calves in Bang's disease free herds in Illinois has repeatedly caused concern on the part of cattle owners and veterinarians. Recently a seven months-old bovine fetus from a Bang's disease free herd was brought to the Laboratory of Animal Pathology and Hygiene for examination. Cultural examination and animal inoculation proved negative to *Brucella,* pyogenic organisms and mycoses. The results of microscopic examination for *Tritrichomonas foetus* were negative. However, a gram positive organism in apparently pure culture was isolated on liver agar plates from the stomach of the fetus. The cultural, pathogenic, tinctorial, serologic and biochemic characters of the organism are quite indistinguishable from those of the genus *Listerella.* There was no definite history of encephalitis in the herd in which the fetus originated. Unfortunately, no study could be made of the aborting cow since she was sold for slaughter immediately after aborting.

The organism is a hemolytic gram-positive rod. It is slightly motile in semisolid agar stabs and in hanging drop preparations. Acid, but no gas is produced in dextrose, maltose, levulose, rhamnose, and salicin. Slight acid is produced in lactose and very slight acid in inosite after ten days, while sucrose is not fermented. A rabbit inoculated subcutaneously with the stomach contents of the calf fetus died ten days later, and the organism was recovered from its heart blood. A rabbit and two chickens were inoculated intravenously and a guinea pig was inoculated intraperitoneally with a saline suspension of the organism. The rabbit died two days later, and the organism was recovered from the heart blood and brain. The guinea pig died six days after inoculation, and the micro-organism was recovered from both heart blood and brain. It has been recognized that ocular instillation of Listerella cultures may cause a transitory conjunctivitis in different species of animals, and Julianelle and Pons[1] suggest that the production of conjunctivitis in rabbits

[1] L. A. Julianelle and C. A. Pons, *Proc. Soc. Exp. Biol. and Med.*, 40: 362, 1939.

is of value in the identification of *Listerella*. To determine if the organism under investigation could cause conjunctivitis a drop of a heavy suspension of the bacteria was placed in the eye of a rabbit and a guinea pig. Two days later a severe conjunctivitis appeared in both animals. While the pathogenesis of this organism is thus established, its abortifacient properties, if any, are not established.

The results of agglutination tests are of particular interest. Julianelle and Pons[2] found two serological types of *Listerella* among the strains they studied. Type I was composed of two rabbit and two human strains, while Type II comprised one strain each from cattle, sheep, goats, and man. The strain herein reported, when set up against antisera of these two types kindly furnished by Dr. Julianelle, was partially agglutinated by the ruminant type antiserum in a titer of 1–25, while with the rodent type antiserum it was completely agglutinated at a titer of 1–1600. Apparently the serological and host relations of *Listerella* strains are more complex than heretofore believed.

Jones and Little[3] first mentioned the relation of *Listerella* to bovine encephalitis. Olafson, according to Udall,[4] also recognized the spontaneous disease in cattle and sheep in New York State, while more than a year ago encephalitis and encephalomyelitis in both cattle and sheep associated with *Listerella* were recognized in Illinois.[5] More recently Biester and Schwarte[6] reported spontaneous bovine listerellosis in Iowa. During the past few months two unreported outbreaks in cattle and one unreported outbreak in sheep have come to our attention, but so far as we know the presence of *Listerella* has not been reported heretofore in the tissues of a prematurely born calf. However, Burn[7] reported Listerella infection in a day-old infant and a prematurely born child. His findings and our own observation suggest the desirability of further study to determine the significance of *Listerella* in the premature bovine fetus. The possible extended role of this pathogen heretofore regarded as an encephalitic and/or encephalomyelitic factor in cattle is further suggested by an apparent artificially induced abortion in a healthy pregnant heifer. This heifer originated in a small Bang's disease-free herd, and proved negative to the agglutination test for Bang's disease immediately preceding exposure to *Listerella*. Ten days following intravenous inoculation of the *Listerella* culture isolated from the bovine fetus described herein, abortion occurred. From the aborted fetus, *Listerella* was regained in pure and abundant culture from the brain stem, cerebrum, heart blood, thymus gland and bone marrow.

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SOLUTE TRANSPORT IN PLANTS

THE problem of water and solute movement in plants periodically appears for reconsideration. Though work of Strasburger, Dixon, Ursprung, Renner and others, resulting in the cohesion theory of water movement, and its corollary, the upward transport of mineral nutrients in the transpiration stream, satisfied many, Curtis contends that salts ascend the stem in the phloem, and Priestley, Peirce and others question the cohesion mechanism as explaining the rise of water.

Work by Maskell and Mason[1] and Clements and Engard[2] clearly indicated upward transport of salts in the xylem. Even more convincing are results by Stout and Hoagland[3] and Bennett and Snell[4] with radioactive elements showing that salts absorbed by the roots ascend unringed as well as ringed stems in the xylem.

Though described years ago, certain details of the cohesion mechanism continue to elude clear interpretation. Micro-dissection studies conducted in connection with the translocation of herbicides in plants have thrown light on a number of obscure points. When transpirational water loss exceeds absorption by the roots, the water balance soon becomes negative, and hydrostatic pressure in the xylem lowers until, crossing the zero point, a state of tension is developed in the conducting tracts. When in this state of tension, liquid, contrary to popular opinion, displays tensile strength as would a solid. And the degree of tension may reach many atmospheres and the state persist for long periods.

In the tensile condition xylem sap is virtually a superheated liquid in a metastable state, and the stability of the system depends upon the fact that there are no unwet surfaces upon which the vapor phase may become initiated. As Dixon, Askenasy and others have shown, this situation may be demonstrated in a strictly physical system and depends not upon the form

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