

ing abdominal operations and that it is the diaphragmatic component that is primarily affected.

Inasmuch as post-operative pulmonary complications usually occur in the lower lobes and most commonly follow operations on the abdomen, it is probably more than a coincidence that abdominal operations result in decreased diaphragmatic excursions with the attendant diminution of ventilation of the lower lobes of the lungs.

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Fermentation of "Levan" by Pneumococci.

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The studies of Hiss¹ show that inulin is fermented by the pneumococcus organism and that this fermentation can be used as a method of differential diagnosis between the *Pneumococcus* group and the *Streptococcus*. Bergey² mentions a *Streptococcus inulinaceus* Orla-Jensen, which also ferments inulin. A differentiation between these two organisms can be made by using other sugars. Among fungi, the presence of an inulase appears to be widespread, and inulin decomposition has been observed both among higher and lower types. Bourguelot³ found inulase in *Aspergillus niger*; Grüss⁴ in *Ustilago maydis*; Dean⁵ in *Aspergillus niger* and a *Penicillium*; Frou⁶ in *Morchella*; Wehmer⁷ in a species of *Mucor*; Hanzawa⁸ in *Rhizopus dele-mar*; and Castellani and Taylor⁹ in *Monilia macedoniensis*.

In view of the work of Harrison, Tarr and Hibbert¹⁰ and of Hibbert, Tipson and Brauns¹¹ on the constitution of levan and its relation to inulin, it seemed of interest to investigate the fermenta-

¹ Hiss, P. H., *J. Exp. Med.*, 1905, **7**, 547.

² Bergey's Manual of Determinative Bacteriology, 1930.

³ Bourguelot, E., *Comptes rend.*, 1893, **116**, 1143.

⁴ Grüss, J., *Berichte d. deutsch. botan. Gesellsch.*, 1902, **20**, 213.

⁵ Dean, A. L., *Botanical Gazette*, 1903, **35**, 24.

⁶ Frou, Cr., *Comptes rend.*, 1905, **140**, 1187.

⁷ Wehmer, C., *Lafar's Handbuch der techn. Mykologie*, 1905, **4**, 527.

⁸ Hanzawa, J., *Mykolog. Zentrbl.*, 1912, **1**, 76.

⁹ Castellani, A., and Taylor, F. E., *Biochem. J.*, 1922, **16**, 655.

¹⁰ Harrison, F. C., Tarr, H. L. A., and Hibbert, H., *Can. J. Research*, 1930, **3**, 449.

¹¹ Hibbert, H., Tipson, R. S., and Brauns, F., *Can. J. Research*, 1931, **4**, 221.

tion reactions of levan obtained from *B. mesentericus* and from *B. subtilis* as well as of dextrans obtained from two different strains of *Leuconostoc mesenteroides*.*

The method used was as follows: Sugar-free bouillon plus 10% normal horse-serum and 1% Andrades' indicator. The carbohydrate was added after filtration through a Berkefeld candle in order to make a final concentration of 1%. A control of the horse-serum, sugar-free broth, without carbohydrate, and each of the sugar media was seeded from an 18-hour blood-agar, slant culture of virulent "S" pneumococcus Types I and II, and also from an "R" pneumococcus of the same type. The cultures were incubated at 37°C. and reactivity observed after periods of 24 hours and 4 days respectively. Readings were checked against the control, which latter exhibited no reactivity as denoted by its inability to produce a color change in the medium. The results are shown in Table I.

TABLE I.
Fermentation Tests with Pneumococci and the Levan, Dextran and Inulin Polysaccharides.

		Pn I (37)	Pn II (1599)	Pn I "R" (379)	Pn II "R" 1599 I ₉	Pn II "R" (R.I.)
Levan	24 hr.	±	±	—	—	—
<i>B. mesentericus</i>	4 days	+	+	+	+	+
Levan	24 hr.	—	—	—	—	—
<i>B. subtilis</i>	4 days	+	+	±	±	±
Dextran	24 hr.	—	—	—	—	—
(<i>Leuconostoc Mesen-</i> <i>teroides A</i> ³)	4 days	—	—	—	—	—
Dextran	24 hr.	—	—	—	—	—
(<i>Leuconostoc Mesen-</i> <i>teroides A</i> ⁶)	4 days	—	—	—	—	—
Inulin	24 hr.	++	—	++	—	—
	4 days	++	++	++	±	+
Control	24 hr.	—	—	—	—	—
	4 days	—	—	—	—	—

— No acid production; ± very slight acid; + distinctly acid, and ++ strongly acid.

The results show that levan but not dextran undergoes fermentation, although this change is less pronounced than with inulin. This difference may possibly be explained as due either to a diminished action of the "inulase" of the pneumococci on levan or to the lower activity of an enzyme capable of fermenting levan. The acidity in both cases seems to be mainly due to lactic acid obtained from the fructose, the latter formed by hydrolysis of the levan.

* We wish to thank Prof. Hibbert for his generosity in supplying these polysaccharides and correcting the manuscript.

Haworth¹² showed that inulin is a polymerized anhydro-fructo furanose, the linkages being at positions 1 and 2 of the fructose chain, while levan is formed by linkages at positions 2 and 6, as shown by Hibbert and co-workers. The structure of dextrans is unknown but is being actively investigated by the latter authors.

In view of the present results, is it to be assumed that pneumococci possess 2 different enzymes, one specific for inulin and another for levan, or that the same enzyme is capable of splitting both of these polysaccharides, which while polymerized fructo-furanoses yet differ markedly in structure? It seems possible, in the light of the suggestive and interesting researches of Quastel,¹³ who assumes the possibility of one cell possessing at least 56 "hydrogen transportases" (Thunberg's terminology), that different enzymes are actually present.

Much further work is needed to settle this fundamental point regarding enzymic behavior of microorganisms on various chemical substances. The various enzymes apparently exert a very specific and selective action with respect to the chemical structure.

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Seasonal Changes in Frog's Muscles and Their Bearing on the Clasping Reflex.

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Sommerkamp¹ showed that different striated muscles reacted differently to contracture producing substances such as acetyl choline, nicotine, etc., and explained his results by the assumption that certain muscle fibers (tonus fibers) reacting specifically to contracture producing substances are unequally distributed in different muscles. It is apparent that these investigations have great importance in the study of tonus. Therefore experiments were carried out in which the isometric tension of the flexors of the forelimb was determined in male and female frogs (*Rana esculenta*). Acetyl choline (1:10,000), KSCN (0.113M) and veratrin (1:1,000,000) were used during and after breeding season. The results are sum-

¹² Haworth, W. N., and Learner, A., *J. Chem. Soc.*, 1928, 619.

¹³ Quastel, J. H., *Trans. Faraday Soc.*, 1930, **26**, 115.

¹ Sommerkamp, H., *Archiv. Exp. Path. und Pharmacol.*, 1927, **128**, 99.