cilia; 4, the egg, in consequence of its size, so presses upon the ciliary surfaces of the tube that the cilia become effective in the downward passage of this body and thus supplement peristalsis.

4992

A General Test for Carbohydrates.

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A number of tests for carbohydrates depend upon interaction in the chromogenic system, phenol-aldehyde-acid. The Molisch, the Seliwanoff, the Bial, and the Tollen tests belong to this reaction system. The Molisch reagent employes the phenol, α-naphthol, the Seliwanoff reagent resorcin, the Bial reagent orcinol, and the Tollen reagent phloroglucin. The aldehyde in the reaction system is either the carbohydrate itself or the furfural obtained by the decomposition of carbohydrate by means of more or less concentrated acid. Either the reagent or the final reacting mixture contains hydrochloric or sulphuric acid. The aldehyde and the phenol react to form a compound of chromogenic power. The Seliwanoff, the Bial and the Tollen reagent serve to detect certain types of carbohydrates, while the Molisch reagent is universal in its ability to detect carbohydrates of any number of carbon atoms, aldehydic or ketonic in nature, with or without an open carbonyl group, free or in combination with other compounds.

We have developed a test for carbohydrates, which like the Molisch is of general application, by introducing thymol as the phenol in the system, phenol-aldehyde-acid. We have found that a 5% thymol in 95% alcohol serves as a useful, sensitive and practical reagent for carbohydrates. The thymol reagent has the advantage over the Molisch reagent, since the former is a colorless solution and does not deteriorate on long standing. We have kept the alcoholic thymol solutions in ordinary bottles exposed to window light for over a year without the development of any color.

To make the test we proceed as follows:* 3 or 4 drops of the 5%

* Molisch described a test for sugar in the urine based upon a reagent containing 15% thymol in alcohol. At this concentration 3 to 4 drops of the solution alone will yield a colored ring with concentrated sulphuric acid. The thymol used in our experiments was obtained from Merck and was of reagent quality.

thymol solution are added to the test solution. A volume of concentrated sulphuric acid is added equal to that of the sugar-containing solution. The acid is carefully poured down the side so as not to mix. A distinct and deeply colored ring appears at the junction of the light test solution and the heavy bottom layer of sulphuric acid. The usual color is a deep red or heavy pink red. Very often there is a purplish tinge mixed in with the usual color.

The reaction is positive with pentoses, hexoses, dihexoses, trihexoses, polysaccharides, glucosides, gums, glycoproteins, glycolipins, nucleic acid, which yields carbohydrate on hydrolysis.

Neither thymol or the Molisch reagent is specific for carbohydrates, since in the reaction system, phenol-aldehyde-acid, aldehydes themselves respond. Positive reactions have been obtained with formaldehyde, paraformaldehyde, acetaldehyde, paraldehyde, chloral hydrate, glyoxylic acid and furfural. Ketones may be substituted for aldehydes in the system.

Many straight chain carboxylic acids are aldehydogenic under the influence of a concentrated acid like sulphuric acid. These acids, therefore, give tests with the thymol reagent as well as with the Molisch reagent. Among the acids that give reactions may be mentioned lactic acid, maleic acid, tartaric acid, aspartic acid, citric acid and oxalic acid.

Neither the thymol nor the Molisch test can be used specifically for sugar in the urine, since certain aldehydes, ketones and organic acids likely to be present give positive reactions. Formic acid, lactic acid, oxalic acid, acetaldehyde, acetone, diacetic acid, and hydroxybutyric acid give color reactions with both reagents.

The sensitivity of both the thymol and the Molisch reagent is very great. With both reagents glucose yields the characteristic reaction in 0.001% solution, sucrose in 0.0001% solution, and raffinose in 0.00005% solution.