XXIII. LAEVULOSE IN THE BLOOD OF THE HUMAN FOETUS.

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The presence of sugar in the foetal fluids of herbivora seems to have been first observed by Majewski [1858]. Noël Paton, Watson and Kerr [1907] pointed out that laevulose is the sugar of the amniotic and allantoic fluids of the cow, sheep, pig, cat, dog, rabbit, ferret and guinea-pig, and that it is also present in the blood and in the urine in the bladder of the foetus in the cow and sheep. Takata [1922] showed that laevulose is the sugar of the foetal fluids of the whale *Balaenoptera*.

Sugar is not generally present in the amniotic fluid of the human subject, but Labat and Favreau [1921] state that it is occasionally found in small quantities. It seemed desirable to ascertain if the blood sugar in the human foetus is in whole or in part of the nature of laevulose.

Thanks to the kindness of Dr Hewitt at the Royal Maternity Hospital, Glasgow, specimens of the mixed blood of several foetuses have been collected into alcohol from the placental end of umbilical cords at the time of birth.

Method.

The blood was received in an equal volume of rectified spirit and allowed to stand till the protein precipitate separated leaving a clear supernatant fluid. This was filtered off and the precipitate washed with spirit and then sucked dry. The precipitate was then intimately mixed with more rectified spirit in a mortar and filtered, washed, and sucked dry as before. The precipitate was treated once again in the same manner. The different filtrates and washings were now collected and the alcohol removed almost completely by concentrating under reduced pressure at 40°. The concentrated filtrate was acidified with two or three drops of acetic acid and a slight excess of 20 % normal lead acetate solution added. The precipitate was allowed to settle and the solution filtered, the precipitate being well washed. The excess of lead was now removed by adding a slight excess of dilute sulphuric acid, the requisite amount of alcohol being added to cause complete precipitation of the lead sulphate. The lead sulphate was allowed to settle and was filtered off and washed. The filtrate was then made just acid by neutralising any excess with sodium carbonate. It is important to keep the solution always just to the acid side of neutrality as even in faintly alkaline solution the

glucose tends to change to mannose and laevulose. The solution was now concentrated as far as possible (to about 30 cc.) by evaporation under reduced pressure at from 40° to 45°. The liquid thus obtained was examined for its sugar content by polarimeter and copper reducing value. To detect laevulose the Seliwanoff reaction was used.

Results.

1st Specimen, 26. vi. 22. 300 cc. Foetal blood:

Rotation	− 0·03°
Total sugar (by reduction)	0·09 %
Seliwanoff reaction positive.	

2nd Specimen, 10. v. 23. 300 cc. Foetal blood:

Rotation	+ 0·04°
Total sugar (by reduction)	0·075 %
Seliwanoff reaction positive.	

The fact that the Seliwanoff reaction was positive in the above cases as well as the abnormally low rotations indicates that *d*-glucose is not the only reducing sugar present in foetal blood. If we assume that *d*-glucose and laevulose are the sugars present, the rotations found compared with the rotations which would have been found had glucose been the only sugar indicate a proportion of *d*-glucose to laevulose of about 2 : 1.

In order to find if laevulose is present in the blood after birth, at least in ruminants, the blood of a kid just after birth was collected in alcohol at the Rowett Institute, Aberdeen, and examined.

3rd Specimen, 10. v. 23. 64 cc. Kid's blood:

Rotation	− 0·08°
Total sugar (by reduction)	0·14 %
Seliwanoff reaction positive.	

Evidently laevulose does not completely disappear at the time of birth.

For the determination of the rotations I am indebted to Professor T. S. Patterson. The green mercury line was used.

Summary.

1. Human foetal blood has been shown to give the Seliwanoff reaction indicating the presence of laevulose as well as glucose.

2. The persistence of laevulose in the blood of the kid after birth is demonstrated.

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