(0*k*0) absent when *k* is odd. The density of the crystals was determined by the flotation method to be 1·65 gm./c.c., so that there are four molecules of $C_6H_8O_6$ in the unit cell. Since C_2^2 has only twofold symmetry, a pair of molecules must be associated to form the asymmetric crystal-unit. (This does not necessarily imply polymerisation.)

On examination microscopically, the crystals are found to be tabular on (100), usually almost square, and exhibiting pronounced cleavage parallel to (010). The birefringence is very high and negative, the refractive indices being $\alpha = 1{\cdot}464$, $\beta = 1{\cdot}68$ (approx.), and $\gamma > 1{\cdot}70$, with α parallel to the *b*-axis. These results indicate that the molecules are nearly flat and lie in the (010) plane. The birefringence ($>0{\cdot}24$) is much higher than any so far observed among the carbohydrates or their derivatives, although that of γ-mannonolactone is about half this amount. This suggests that the hexuronic acid molecule has a ring structure with fewer groups projecting out of the plane of the ring than a normal carbohydrate, and contains double-bonds, possibly in carbonyl groups. The X-ray results are in agreement with these conclusions; the thickness of the molecule must be $\frac{1}{2}$ *b*, that is, 3·16 A., which is considerably less than that of any carbohydrate so far examined, indicating a flatter molecule, while the regular falling off of the intensities of the {020} reflections also requires a fairly flat molecule parallel to (010).

A very interesting feature of the X-ray results is that unless very long exposures are given, the photographs show no reflections from (*hk*0) planes for which *h* is odd. This indicates an almost perfect glide-plane of symmetry perpendicular to the *c*-axis, and therefore a pseudo-plane of symmetry in the molecule itself, at right angles to the plane of the ring. Since carbon and oxygen have nearly the same volumes and scattering powers, such an arrangement can occur without destroying the optical asymmetry of the molecule.

Optical examination and X-ray powder photographs show that the purified hexuronic acid is identical with the crystalline portion of the original substance obtained from Prof. Szent-Gyorgyi. (The amount of impurity in the latter is apparently quite small.)

A more detailed account of this work will be offered for publication in due course. I am indebted to Dr. E. L. Hirst for supplying the purified material and for numerous helpful discussions.

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Anaerobic Activation of Glycolysis in Tumour Tissue

ROSENTHAL[1] has shown that when the anaerobic conversion of fructose to lactic acid by the Jensen rat sarcoma is studied by Warburg's method, a spontaneous increase in the rate of acid production ($Q_M^{N_2}$), which he ascribes to the anaerobic formation of an activator, occurs about forty minutes after the manometric vessels are put into the thermostat at 38° C. We have been able to show that this spontaneous increase may also be demonstrated when glucose is the substrate, although here the pre-activation period is shorter; and we find that with both sugars the pre-activation period is abolished when sodium pyruvate is present in 10^{-3} *M* concentration.

Sodium pyruvate was stated by Mendel, Bauch, and Strelitz[2] to increase the anaerobic fermentation of glucose by normal body tissues. We find that when sodium pyruvate is added, by tipping from a side bulb, to Jensen rat sarcoma in fructose-containing Ringer solution during the period preceding the spontaneous increase of anaerobic fermentation, $Q_M^{N_2}$ rapidly rises and remains constant at approximately the value which would eventually have been reached by the spontaneous activation; whereas after this latter has occurred, addition of sodium pyruvate has no effect (Fig. 1 (i)). Further, the Mill Hill fowl tumour, although attacking fructose with about the same vigour as the Jensen sarcoma, does not show this spontaneous rise in lactic acid formation, and in this case sodium pyruvate shows no action.

A spontaneous increase of rate of lactic acid formation from glucose is not ordinarily observed with the Jensen rat sarcoma. We find, however, that if the tumour slices be suspended anaerobically at 38° C. for

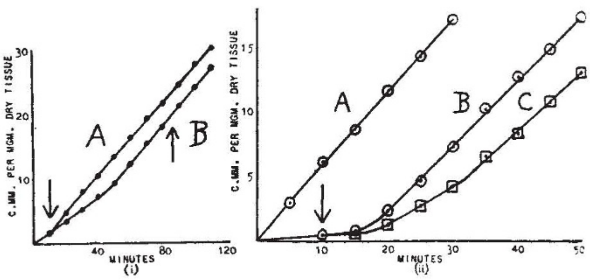

FIG. 1.—Lactic acid production by Jensen rat sarcoma, (i) in 0·2 per cent fructose solution; *A*, pyruvate added at 10 min.; *B*, pyruvate added at 85 min. (ii) *A*, glucose present from start; *B*, glucose and pyruvate added at 10 min.; *C*, glucose only added at 10 min.

20 minutes in sugar-free Ringer solution in the manometric vessels and glucose be then added from the side bulb, a preliminary de-activation results which allows a spontaneous re-activation to be observed. For after glucose addition, $Q_M^{N_2}$ does not immediately rise to its final value, but stays at a steady intermediate value for about 15 minutes and then rises rapidly to its steady final level. The presence of 10^{-3} *M* sodium pyruvate in the solution, or its addition together with the glucose, abolishes this preliminary period, $Q_M^{N_2}$ rising rapidly to the final value very soon after the glucose is added. Addition of 10^{-3} *M* pyruvate to the solution when glucose is present from the start causes no increase in the anaerobic lactic acid formation (Fig. 1 (ii)).

It thus seems that sodium pyruvate may replace the anaerobic activator in partially activated tissues, but has no effect when the activation is complete. The detailed results will be published in due course.

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[1] *Z. Krebsforschung*, **32**, 220; 1930.
[2] *Klin. Woch.*, **10**, 118; 1931.

Anomalous Adsorption on Active Charcoal

AT the recent discussion of the Faraday Society on the "Adsorption of Gases on Solids", Prof. A. J. Allmand and his co-workers[1] presented a summary of their investigations on the discontinuities they have found in adsorption isotherms for gaseous adsorptions.