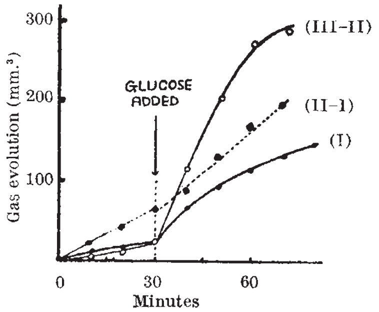
Hydrogen Evolution by *Trichomonas fœtus*

Trichomonas fœtus, a polyflagellated protozoon, is parasitic in the vagina of the cow and causes impaired reproduction. J. Andrews and T. von Brand[1] carried out some quantitative studies on glucose consumption by *T. fœtus* during cultivation, and then also found that a gas, which burned explosively when mixed with air, was produced by the organism when growing in serum broth with 0·1 per cent glucose. This fact suggested that it might be hydrogen.

Table 1. Composition of the Gas Evolved during Anaerobic Cultivation

Exp. No.	Gas evolved (ml.) per 50 ml. medium	Gas analysis (per cent) Carbon dioxide	Oxygen	Methane	Hydrogen	Nitrogen
1	10·0	0·00	1·77	1·89	83·73	12·61
3	9·4	0·00	6·00	0·30	73·65	20·04
7	11·9	1·96	5·57	2·05	78·65	11·77

We cultivated *T. fœtus* anaerobically in a 200-ml. injection syringe with a cock attached to its nozzle so as to catch any gas evolved. Cultivation was in a bacteria-free condition on a boiled beef extract containing 1 per cent peptone, 10 per cent bovine serum, 1 per cent glucose and 0·5 per cent sodium chloride at 37° C. for 48 hr. The gas evolved amounted to 9–11 ml. per 50 ml. culture medium. As shown in Table 1, it was demonstrated by micro gas analysis that the gas contained a large quantity of hydrogen and a small quantity of methane.



Relationship of the evolution of (I) hydrogen, (II–I) metabolic carbon dioxide, and (III–II) carbon dioxide by acid formation in the course of anaerobic glucose breakdown by *T. fœtus* suspension

By using the saline suspension of *T. fœtus*, we further investigated manometrically this hydrogen evolution under anaerobic conditions. In order to differentiate metabolic carbon dioxide from the hydrogen evolved and formation of acid, three flasks (Warburg manometers) were used, of which both flask I, containing 20 per cent potassium hydroxide in the centre well, and flask II, without potassium hydroxide, were filled with nitrogen as the gas phase, and flask III was kept in an anaerobic carbon dioxide–bicarbonate buffering state. We found a gas other than carbon dioxide in flask 1, and estimated the metabolic carbon dioxide evolution by subtracting the volume of gas evolved in flask I from that in flask II, and acid formation by the determination of bicarbonate remaining, as shown in the accompanying graph (in the presence and absence of glucose as substrate). Table 2 shows that this hydrogen evolution depends on the amount of glucose added and not on the peptone, and that it increases somewhat

Table 2. Effect of Substrates and *p*H on the Hydrogen Evolution

Substrates	Final concentration	*p*H	Relative amount of hydrogen evolved during 30 min.
Endogenous		7·0	100
Glucose	0·005 mol.	7·0	130
	0·01	7·0	234
	0·01	4·8	133
	0·01	8·5	264
	0·015	7·0	280
Peptone	1 per cent	7·0	99
Pyruvate	0·01 mol.	7·0	150
Formate	0·01	7·0	128

on the addition of pyruvate or formate. These facts suggest that the evolution of hydrogen is connected with the anaerobic carbohydrate metabolism accompanied with acid formation.

Further investigations showed that the main end-product of this acid formation is neither lactic nor pyruvic acid, but succinic acid. These results suggest that the anaerobic glucose breakdown differs considerably from the usual glycolytic process.

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[1] Andrews, J., and von Brand, T., *Amer. J. Hyg.*, 28, 138 (1938).

Helical Thickenings and Micellar Orientation in the Secondary Wall of Conifer Tracheids

The suggestion that the cytoplasmic surface possesses the capacity to govern the micellar orientation of the cell wall has been made both by Frey-Wyssling[1] and Preston[2], whereas the possible influence of forces arising from cell turgor and protoplasmic streaming have been discussed by Castle[3,]

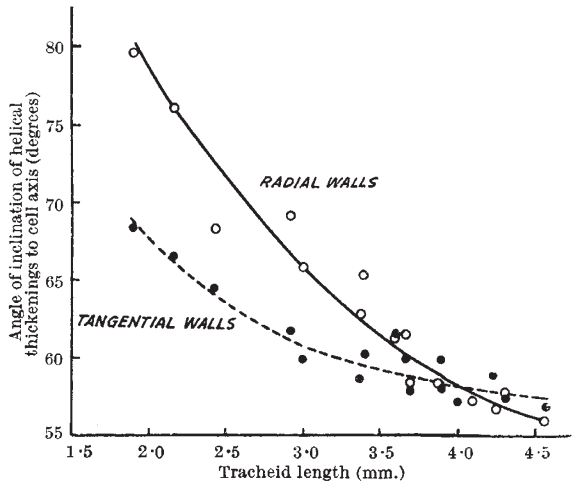

Fig. 1