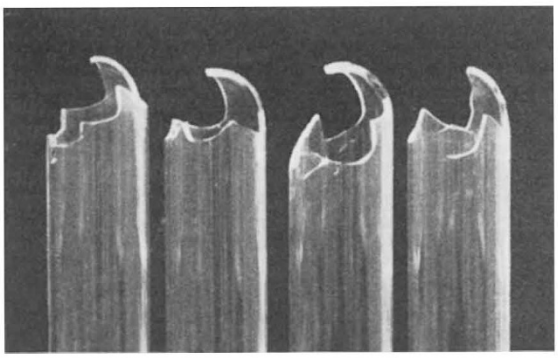
there is a feeling of surprise that such an effect should be produced by a relatively light action. It is significant also that during tapping a sharp click, resembling the impact of a column of mercury on the end of an evacuated tube, is sometimes heard. This is especially noticed when the paste is shaken down to one end and the tube then inverted and tapped with this end uppermost. This sound cannot be produced with water only in the tube, neither is it possible using reasonable force to burst such a tube containing water.

A singular feature is that in the cases we have noticed the type of fracture is always the same and, as will be observed from the accompanying photograph of four tubes collected in 1938, has a symmetrical character. The first three are Monax and the fourth, on the left, is of combustion quality hard glass. The similarity of fracture reflects the directional properties of the forces acting on the different occasions, and since the tubes are well annealed it is presumed that the axis of symmetry of the fractures is related to the plane in which the tube was moving when it burst. (A recent experience suggests that the two planes are at right angles.)



As a tentative explanation of the bursting, it is suggested that the main body of the paste sets into a piston-like cylinder which slides easily in the tube because it is violently sheared at the surfaces where it becomes fluid—a characteristic of thixotropic pastes. This piston slides downwards on impact and then, absorbing the energy of the blow, rapidly returns as a whole to the upper end. Since the pastes have very high yield values, the piston has considerable strength and is presumably rigid enough to prevent air 'blowing' through it. Thus effectively all the air is confined to the lower end, leaving a vacuum in the upper space, so that the piston on returning to this end impacts violently without the cushioning effect of the air film. Such an impact would be absorbed by the rubber bung, but the rigidity of the glass is such that bursting occurs when the closed end is uppermost.

It would be interesting to design an impact apparatus to test our suggestion as to the importance of the type of paste and to measure the forces involved, but at the moment we have no time to pursue the matter further.

G. W. COWDREY.
MERVYN L. SMITH.

John and E. Sturge, Ltd.,
Birmingham, 15.
Feb. 8.

Flavin Component of the Pyruvic Acid Oxidation System

EVIDENCE for the earlier suggested[1] participation of a flavin compound in pyruvic acid oxidation by *Bacterium Delbrückii* has been obtained by a procedure similar to that used by Warburg and Christian[2] to remove the prosthetic group (flavin-adenin dinucleotide) from amino-acid oxidase. Phosphate extracts derived from the lactic acid bacteria were repeatedly precipitated with 50 per cent ammonium sulphate at *p*H 3 at 1–2° C. By this treatment a protein fraction was obtained, which on addition of thiamin (vitamin B_1) pyrophosphate only[1], did not catalyse pyruvic acid oxidation, but did so on addition of thiamin pyrophosphate together with flavin-adenin dinucleotide, kindly supplied to me by Prof. O. Warburg.

In the following experiment, 1 ml. of protein solution, corresponding with 0·1 gm. of dried bacteria, was shaken with air for 30 minutes at 37° in the presence of 0·1 mol. pyruvate :

Thiamin pyrophosphate ..	—	15γ	15γ
Flavin-adenin dinucleotide ..	20γ	—	20γ
Oxygen used (ml.)	15	5	248

Riboflavin and the 'old' yellow enzyme were inactive.

In the light of our hypothesis that thiamin when acting as codehydrase is reduced reversibly[3], it is not surprising to find the insertion of a flavin compound between the assumed α-dihydrothiazole and oxygen. We know from the work of Warburg, of Karrer and of v. Euler that compounds of this type (for example, the dihydropyridines) are not autoxidizable, but do easily reduce flavin, which in turn is autoxidizable. Also, it seems significant that in the animal cell the same flavin-adenin dinucleotide has been found[4,5] to be the prosthetic group of diaphorase[6] (coenzyme factor[7]), the carrier between pyridine coferments and cytochrome.

This work was supported by the Ella Sachs Plotz Foundation.

FRITZ LIPMANN.

Biological Institute,
Carlsberg Foundation,
Copenhagen.
Feb. 9.

[1] Lipmann, *Enzymologia*, **4**, 65 (1937).
[2] Warburg and Christian, *Biochem. Z.*, **298**, 150 (1938).
[3] Lipmann and Perlmann, *J. Amer. Chem. Soc.*, **60**, 2574 (1938).
[4] Straub, NATURE, **143**, 77 (1939).
[5] Straub, Corran and Green, NATURE, **143**, 119 (1939).
[6] Adler, Euler and Hellström, *Sv. Vet. Akad. Ark. Kemi*, **12**, 1 (1937).
[7] Dewan and Green, *Biochem. J.*, **32**, 626 (1938).

Present Condition of a Twelve-Year Old Pure Strain of Carcinoma Cells *in vitro*

ON February 23, 1927, five small fragments of a mouse adenocarcinoma (Frankfurt strain of Ehrlich) were cultivated as hanging drop cultures[1]. With slight modifications, the culture medium used has remained practically the same throughout this period of twelve years. The medium used for cover-glass cultures consisted of one volume of a plasma mixture (equal parts of chick and rat plasma) and one volume of embryonic tissue juice of chick. For cultures in Carrel flasks, the solid medium was composed of equal parts of dilute chick and rat plasma coagulated by a drop of embryonic tissue juice ; the supernatant liquid phase, 0·5 c.c., consists of 20 per cent embryonic tissue juice (chick), 20 per cent rat serum and 60 per cent 'Tyrode' solution.