

same whether measured under aerobic or anaerobic conditions. Rabbit cartilage was kept for a fortnight under aseptic anaerobic conditions in bicarbonate Ringer solution with glucose, and its glycolysis measured throughout. At the end of the experiment it had only fallen to 0.09 from an initial Q_0^N (c.mm. carbon dioxide per mgm. dry weight per hour in nitrogen) of 0.34.

There is no oxygen uptake that can be measured certainly by this method; if it exists, the Q_0 (c.mm. oxygen consumed per mgm. dry weight per hour) must be at most 0.01, and probably below 0.005. With methylene blue, however, an immediate large increase in oxygen uptake occurs, paralleled only by the similar behaviour described by Harrop and Barron² of non-nucleated mammalian red corpuscles. The Q_0 rises from an average of -0.003 (nine experiments) before, to an average, using the same slices, after addition of dye, of -0.065—a twenty-fold increase.

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¹ Krebs, *Tab. Biol. Period.*, 3, 209 (1933).

² Harrop and Barron, *J. Exp. Med.*, 48, 207 (1928).

Oxide Layer on a Polished Copper Surface

THE application of electron diffraction to the problem of the structure of polished metal surfaces has greatly extended the knowledge gained from microscopical methods. In general, in the course of polishing, the rings of the electron diffraction pattern become blurred until they run into two broad haloes. As these changes may be explained by assuming that the metal crystals become smaller and smaller as the polishing progresses, the above-mentioned results are strongly in favour of Beilby's supposition that the topmost layer of highly polished metal is amorphous¹.

There is, however, considerable difficulty in accounting for the fact that the haloes have been found to be practically the same for all metals. They correspond to the spacings 2.25 Å., and 1.28 Å. \pm 5 per cent respectively. This apparent uniformity could scarcely be expected. If we assume the polish layer to be composed of very small crystals, the radius of the haloes should depend on the lattice constants, while if the layer be completely amorphous it would be the atomic volume which should govern their size.

As the majority of the metals investigated are known to be easily oxidisable, it was decided to examine how far these difficulties might be due to the formation of an oxide film on the surface in the course of polishing. After having obtained results concordant with those of other authors for copper polished in the usual way with wet rouge, in air, I polished a specimen under the surface of benzene. This gave haloes of quite different size corresponding to spacings of 1.91 Å. and 1.16 Å. As polishing under pentane yielded the same result, it seemed likely that the pattern commonly attributed to polished copper is actually due to the oxide. To make sure, the specimen which had been polished under benzene was left in the air and the changes in the pattern were traced by taking pictures every few hours. It was possible to follow the gradual decay of the original haloes and gradual appearance of the pattern

corresponding to the spacings 2.24 Å. and 1.28 Å. The last pattern, which is the one obtained after polishing in air, is thus clearly due to an oxide.

Whereas in the pattern obtained in the absence of air the inner halo may be interpreted as the effect of degeneration of the (111) and (200) rings of copper, and the outer one of the (220), (311) and (222) rings, the haloes obtained in air occur exactly in places where one may expect maxima of intensity after blurring of the corresponding rings of cuprous oxide, the cube side of copper being 3.61 Å. and of Cu_2O 4.25 Å.

Many of the properties of a polished copper surface have recently been found to differ from those of a polycrystalline one¹. As usually no special precautions against oxidation are observed during polishing, an interesting question arises as to how far these differences are to be attributed to the change of the physical state of the surface, and how far to change of chemical composition.

The investigation is being extended to other metals, as it is known that many metals which have themselves different crystalline structures, such as iron and nickel, have face-centred cubic oxides with a cube-side differing from that of Cu_2O by only a few per cent. This fact may be partly responsible for the apparent uniformity of size of the haloes.

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¹For references see G. I. Finch and A. G. Quarrell, *NATURE*, 137, 516 (1936).

Electrolytes and a General Phenomenon in Tissue Cells

THE starting point of the present experiments was the assumption that the practically undiffusible particles of protoplasm are charged by the *per se* diffusible electrolytes with the formation of a double layer, and are maintained thereby in a dispersed state. If this be the case, then there must exist a certain equilibrium between the electrolytes, which build up the double layer on the particles of the protoplasm, and the electrolytes in the surrounding medium.

It must also be considered that this might concern thermodynamically a Donnan equilibrium—since the latter exists independently of the way in which the diffusible ions are adsorbed on the non-diffusible particles. In this case, if the salt ion contents of the outside liquid are diminished to nearly zero, then all the salt ions, as is well known, travel to the outside liquid.

If the above reasoning is valid, then it must be expected that if one makes the medium outside the tissue cells nearly free from electrolytes, the salt ions will travel to the outside liquid. Consequently a discharge, and a coagulation of the non-diffusible and discharged particles of protoplasm, would be expected.

It has been possible in the case of tissue cells cultivated in liquid media to make the liquid outside the cells nearly free from electrolytes and to produce thereby a discharge (most active Brownian movement in the protoplasm as a sign of a minimum of viscosity; obviously advancing aggregation of the particles of the protoplasm). The following results have been obtained: