

secretion is active, while during pseudo-pregnancy the growth processes are very conspicuous, and little or no secretion occurs.

Summary. A condition resembling pseudo-pregnancy has been obtained in adult female rats, by the mechanical irritation of the nipple, produced by an actively suckling litter.

7277 P

Dependence of Continuous Bioelectric Currents upon Cell Oxidation.

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Lund has shown that bioelectric potentials are quantitatively linked with oxidations (frog skin, hydroids, etc.) and has advanced the theory that continuous bioelectric currents are established by redox systems in flux equilibrium within the cell.¹ The new findings

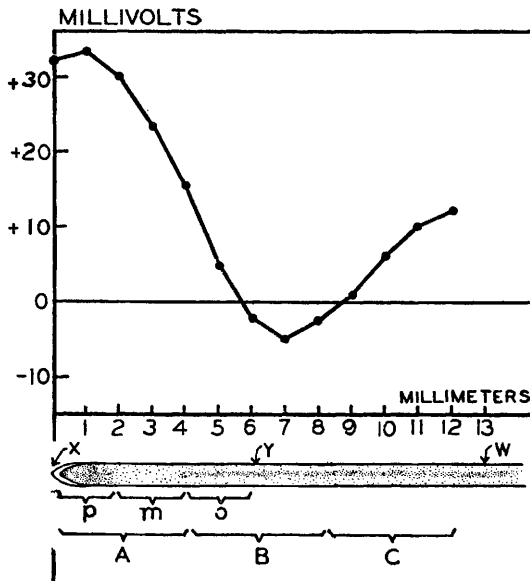


FIG. 1.

Typical curve of distribution of E. M. F. per unit length of root (*A. cepa*). Abscissa, position of positive electrode in millimeters from the tip. Root regions are drawn to scale. See text for further description.

¹ Lund, E. J., *Protoplasma*, 1931, **18**, 236.

have a significant bearing on (1) the nature of the electrochemical mechanism which generates a continuous output of electric energy in living cells, (2) the nature of the specific differences in the oxidative metabolism of young and old tissues, and (3) the rôle of electric energy in cell division, cell correlation, growth, and the absorption of water and solutes.

The curve in Figure 1 shows the typical distribution of E.M.F. per unit length of root in the onion (*Allium cepa*), in the uninjured unstimulated condition. The region of active cell division, p, maintains a high positive potential with respect to all other regions. Ordinarily, at a distance 5 to 12 millimeters from the extreme tip, there is a region of relatively low positivity followed by a region of increased positivity. Fluctuations in electric polarity, which are not due to any observable change in the environment, occur, and the distribution of E.M.F. varies from time to time.

The major facts which show that the magnitude and orientation of bioelectric currents in the onion root depend uniquely upon the concentration of oxygen and therefore upon the respiratory mechanism of the cell are as follows:

1. When electrodes using the native medium for contact, are placed at the positions X and Y then: (a) Removal of oxygen around the zone of active cell division, p, greatly decreases the E.M.F. of the root between X and Y. This decrease frequently inverts the electric polarity and in all experiments the potential remains at a relatively low level. Removal of oxygen around the zone of cell maturation and elongation, m, also produces a definite but less marked decrease in E.M.F. of the region X-Y. A similar small decrease in E.M.F. occurs when the region, o, in which permanent tissues are present, is deprived of oxygen. (b) Upon admission of pure oxygen around zone, p, after a period in its absence, an abrupt increase in E.M.F. occurs and the potential invariably exceeds its initial value. Reversible effects are also obtained when the regions, m, and o, in different roots are similarly exposed to oxygen after a period in its absence, but the rise in E.M.F. is less, and the conspicuously large increase over the initial value does not appear. (c) When all the different regions, p, m, and o, are simultaneously deprived of oxygen, a large decrease in the E.M.F. occurs, demonstrating the unequal effect of equal change in oxygen tension on the specific regions between X and Y. Measurements of E.M.F. per unit length show that in the absence of oxygen, the region of active cell division, p, becomes electronegative to the regions, m, and o, changing the characteristic pattern of correlation currents and

decreasing the total output of electric energy by the root, as measured. (d) The simultaneous addition of pure oxygen, after its absence, to all the regions, p, m, and o, produces a sharp drop in the total potential of the length X-Y, followed by a relatively enormous increase, frequently trebling the initial value. Distribution measurements show that in each root, the region, p, becomes highly electropositive to other regions, and the E.M.F.'s of the specific regions between contacts X and Y are each relatively greater in magnitude than in any previous period.

2. When electrodes are placed at the positions X and W, 13 millimeters above X, then: (a) A *drop* in the total E.M.F. of the length X-W is observed when oxygen is removed from the region indicated by the bracket A. On the other hand, a *rise* in the total E.M.F. is observed upon the removal of oxygen around the region designated by C. Variable results are obtained when oxygen is removed around the region B. The fact that the removal of oxygen around regions which exhibit oppositely oriented electric polarities produce opposite effects on the polarity of the whole furnishes confirmatory evidence of the principle of algebraic summation of cellular E.M.F.'s.

3. When electrode contacts are made at X and Y, and the region C, outside of the contacts, is exposed to absence and presence of oxygen, no change in the total E.M.F. of the length X-Y appears. Neither is a change in the total potential observed when the contacts are made at Y and W, and the region A is exposed to the same change in oxygen concentration.

7278 C

Glutamic Acid in Milk Anemia. Effect on Hemoglobin Regeneration in "Cystine Deficient" Animals.*†

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Certain investigators¹ have reported that glutamic acid supplements Fe in the treatment of milk anemia in rats, but this finding

* In cooperation with the Research Department of the Calco Chemical Co., Bound Brook, N. J.

† This paper was presented in part before the Society of American Biological Chemists, Philadelphia, Pa., 1932.

¹ Drabkin, D. L., and Miller, H. K., *J. Biol. Chem.*, 1931, **90**, 531.