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A note on the reaction of protoplasm.

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A variety of considerations lead to the view that the pH of living matter is lower than that of its immediate extra-cellular medium. It is customarily stated, nevertheless, that protoplasm is "neutral or faintly alkaline" in reaction. If this were invariably so, difficulty would arise in understanding the behavior of nervous tissues of insects, for example, where the hemolymph may be acid.

Indirect estimations tend to show that the contents of echinoderm eggs (Vlès) are distinctly acid in reaction. Calculations of the inner pH of nerve have been made (Adams) from the standpoint of the Donnan equilibrium probably concerned in the production of the current of action; but these have involved the assumption that the pH of the fluid bathing the nerve is the same as that of the blood.

The direct determination of intra-cellular acidities is difficult because suitable indicators do not as a rule accumulate within the cell. In some instances, however, dibromthymolsulfonephthalein does serve as a non-toxic indicator of the pH of protoplasm. The staining is diffuse. The cells successfully used included those of *Paramoecium* and other ciliates, in a normal medium of pH 7.3; these gave tints of the indicator suggesting an inner pH distinctly on the acid side of neutrality, corresponding, in fact, to pH 6.7 or a little less. In the case of *Opalina,* the inner pH is lower, 6.2. The reaction of the indicator to alkalies ($NaOH$, NH_4OH) shows that it is not merely condensed on the external surface of the organism.

The nervous tissue of certain insects (larval dipterons) stains similarly. In certain other cases where absorption of the dye is visible, as in cells of the mesenteric epithelium of insects, the protoplasmic pH is also unequivocally on the acid side. This is consistent with information derived from the study of indicator pigments obtained from the cells of various marine animals. It seems possible that protoplasm is in general significantly acid in character, rather than alkaline or neutral.