altered by the addition of oxidants or reductants at a fixed pH, the membrane must contain a reversible oxidation-reduction system. By operating at a pH of 5.7 we were able to reverse the charge on the membrane by the addition of oxidants, and to regain the normal charge by subsequent reduction. *In summary,* the physiological flow of water from stroma to epithelium, *i. e.,* from blood capillaries to intra-ocular cavity, is the result of electro-endosmosis. The mechanism for this electro-endosmosis is a difference in oxidation-reduction potential across a charged membrane. It is postulated that the reversible oxidation-reduction system within the membrane acts as the electron conductor necessary to complete the electrical circuit.

8654 P

Differentiation of Pigment Cells in Tissue Cultures of Chick Neural Crest.

FRANCES DORRIS.* (Introduced by Ross G. Harrison.)

From the Osborn Zoological Laboratory, Yale University, and Hull Zoological Laboratory, The University of Chicago.

The experiments of DuShane[1, 2] have proved conclusively that the dermal melanophores of the amphibia originate in the neural crest, as suggested by Harrison,[3] and later by Weidenreich[4] and Holtfreter.[5] The differentiation of large numbers of typical pigment cells in tissue cultures of neural crest taken from embryos of pigmented fowls indicates the probability of a similar source of origin in the chick.

Embryos of various breeds have been used, ranging in stage between 6 and 10 somites. Thin strips of the rising folds anterior to the first somites were removed with fine scissors and explanted in a medium consisting of equal parts of plasma and embryonic extract. For controls, whole embryos minus the neural crest were cut into small pieces and explanted on a single slide; or specific areas, such as the eye, the brain floor with underlying endoderm,

*National Research Fellow in the Biological Sciences.

1 DuShane, G. P., *Anat. Rec.*, 1934, **60**, 62.

2 DuShane, G. P., *J. Exp. Zool.*, 1935, **72**, 1.

3 Harrison, R. G., *J. Exp. Zool.*, 1910, **9**, 787.

4 Weidenreich, F., *Z. f. Morphol. u. Anthropol.*, **2**, 59.

5 Holtfreter, J., *Roux' Arch.*, 1933, **127**, 619.

and the ectoderm and mesoderm lateral to the crest region, were explanted separately. Control cultures never contained more than one or 2 isolated pigment cells, and were for the most part totally negative.

The cells appear at the border of the explant during the first day *in vitro*. They are extremely variable in shape, ranging from bipolar to stellate forms, but are frequently found with long, thin, branching processes. They are filled with colorless, refractile granules, which gradually acquire pigment, developing from a pale yellow to deep brown or black, and reaching full intensity in many cells by the third day *in vitro*. The cells are actively amœboid, and show no tendency to form sheets or tissues, a trait which distinguishes them sharply from the pigmented epithelium of the eye, and from the nervous tissue and epithelium which frequently make up the remainder of such explants.

Pigmented cells of similar appearance and behavior were obtained from explants of limb buds of 3-day embryos of the Silky, a fowl having much pigment in the connective tissue, while Koller[6] found them in cultures of trunk mesenchyme from 3 and 4-day Black Leghorn embryos. Since no pigmented cells appear in cultures of mesenchyme taken from such embryos in early somite stages, it seems reasonable to assume that the cells found in the mesenchyme of later stages have wandered out from their source of origin in the neural crest.

The present experiments may throw some light on the genetic situation with regard to pigmentation in fowls. There are 2 types of whiteness in fowls,[7] a dominant white, in which the presence of the color factor is masked by a coexisting inhibitor; and a recessive white, lacking both color factor and inhibitor. Cultures of the neural crest of the Black Minorca and the Barred Plymouth Rock, both dominant blacks, invariably produced pigmented cells. Cultures of the Rhode Island Red, a non-melanotic breed, and of the White Plymouth Rock, a recessive white, show no trace of these cells, developing usually into nervous tissue, epithelium, and indifferent fibroblasts.

[6] Koller, P. C., *Arch. f. Exp. Zellforsch.*, 1929, **7-8**, 491.

[7] Sinnott, E. W., and Dunn, L. C., *Principles of Genetics*, 1932, **83**.