Genetic Pigment Mosaics in the Pigeon.

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Plumage pigment of wild-type *Columba livia* is black, but domestic varieties exhibit also such hereditary conditions as "brown" or "chocolate" (recessive, sex-linked), "ash-red" (dominant, sex-linked, allele of brown), "almond" (dominant, sex-linked, closely linked with "brown"), "faded" (dominant, sex-linked, allele of "almond"), "dilute" (recessive, sex-linked), "recessive red" (not sex-linked), "grizzle" (dominant, not sex-linked), and others.

Occasionally striking patchwork or mosaic combinations ("chimeras") of the above color types are found. These afford some opportunity for analysis of pigment physiology. Successive molts produce little alteration in such specimens, and adjacent feathers growing at the same time may differ completely, so that horomonal control does not seem involved. On the other hand, feathers at the edge of such patches may change color at molting, indicating that melanoblasts rather than tissue cells govern the pigmentation and are capable of some migration. There is a perfect analogy here with grafted (experimental) color mosaics. Genetic evidence, from pedigrees and progeny tests, indicates that a number of such specimens may actually be a sort of natural graft, as a result of autonomous tissue formation by supernumerary sperms in embryogenesis. Other cases may have more conventional origins, such as chromosome aberrations, or somatic gene mutation.

Another type of mosaic effect, more commonly observable, is referred to as "flecking" or variegation. This occurs usually in pigeons of the "ash-red," "almond," "faded," and "grizzle" color types. For example, flecks in an ash-red male are black if he is heterozygous for black, but brown if he is heterozygous for brown; flecks in a male almond heterozygous for brown are black, brown, and faded (side by side). Genetic control is very evident. The flecks vary in size from almost microscopic to entire feathers or even small patches of feathers. When large, they usually show a lengthwise orientation in the feather.

Flecks appear to be local somatic "mutations" of the dominant gene involved, so that a recessive allele appears. The effects are apparently much the same as in the "position effect mottling," extensively studied in *Drosophila*. Apparently the "mutations" may occur at any time in the life of a pigment cell, and in the case of extremely small flecks may occur after the final mitosis. Since there is sharp distinction in pigmentation of the flecks, it seems probable that the melanoblast is diploid; mutation in a polyploid cell would probably result in graded changes.

Both chimeric and variegated mosaic effects are known among other domestic birds, and other animals.

Specimens were displayed at the meetings.

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Discussion by J. P. TRINKAUS, Osborn Zoological Laboratory, Yale University, New Haven, Conn.

Role of Epidermis and Hormones in the Differentiation of Melanoblasts.

The melanin pigments of feathers are deposited in the epidermal cells of the differentiating feather by branched pigment cells called *melanophores*. In the undifferentiated condition, prior to the synthesis of pigment granules, they are referred to as *melanoblasts*. In the Brown Leghorn fowl, grafting experiments have demonstrated that the melanoblasts are embryonic-type cells, in feather germs of the adult as well as of the embryo, with a dual potency; they may form either black or red melanophores [Trinkaus, *J. Exp. Zool.*, 109:135-170 (1948)]. The differentiation of melanoblasts, within the limits set by their genic constitution, is markedly influenced by the tract-specific epidermis of each feather germ, and by estrogenic and thyroid hormone [Trinkaus, *J. Exp. Zool.*, 113, in press (1950)]. The nature of the resulting pigment pattern in each feather is, therefore, a consequence of the complex interaction of a number of tissue and humoral factors [cf. review by Rawles, *Physiol. Rev.*, 28:383-408 (1948), for studies on pigment patterns in other fowl, and in amphibians and mammals].

This analysis suggests, of course, that more attention might be directed to the possible role of tissue and humoral factors, in other studies on the differentiation of normal and atypical pigment cells. It would be of interest, for example, to determine whether the pigment mosaics in pigeon feathers, described by Dr. Hollander, are due to modifications of the melanoblasts, or of the epidermis (or of both). By grafting melanoblasts from the pigmented area of a regenerating mosaic feather to the wing bud of an embryo, the melanoblasts would differentiate in the presence of different epidermis. The nature of the resulting pigment pattern in the host wing feathers should give a critical answer to the question.