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Skin Transplantation as a Means of Analyzing Factors in Production and Growth of Feathers.

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In most breeds of fowl there is a well marked sexual dimorphism in the color and structure of adult feathers. Experimental or pathological alteration of the endocrine balance has been shown[1] to produce striking reversals and modifications in these characters. Our problem has been to find a new method of attack which would yield further information on (a) the extent to which the output of a feather follicle is controlled by the endocrine relations which obtain at the time the feather is produced, and (b) the extent to which it is determined by characteristics which are inherent in the follicle itself. The procedure has been to transplant pieces of skin from one newly hatched chick to another and, some months later, to compare the feather production of the donor, the host and the skin originally transferred from the former to the latter.

The technique is simple. Young chicks were found to take the anesthetic (ether) very satisfactorily. They recover quickly and do not suffer from infections when moderate care is exercised. The grafts are easily held in place by interrupted silk sutures, which usually fall out spontaneously, but may occasionally remain and serve as good landmarks over a period of several months. The general results obtained thus far may be briefly summarized.

1. The percentage of *initial* "takes" is high, but many grafts after having become well established are subsequently lost. Such grafts often appear entirely successful at first, and produce normal pin feathers or even fully developed feathers. The cause of these failures has not been studied, but the distribution of cases with reference to sex and breed suggests varying degrees of incompatibility between donor and host. This type of experiment promises to be very favorable for the study of differences in tissue reactions and "individuality differentials."

2. In the wholly successful cases the grafted skin has remained normal throughout (the older specimens are now adult), increased to many times its original size and produced a full complement of feathers, regularly replacing those which were shed or pulled out. In some instances the grafted skin seemed to function more vigorously than that of the host.

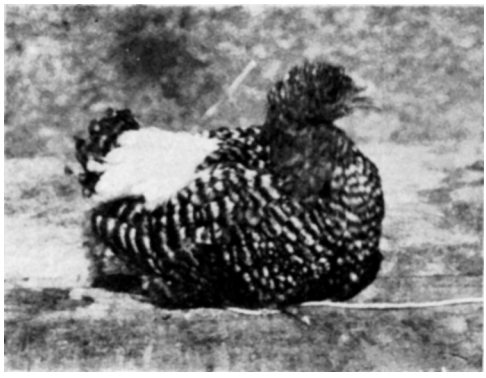

FIG. 1.
A Plymouth Rock chicken with graft from a White Leghorn.

3. The racial characteristics of feathers produced by grafted skin are those of the donor. Thus a bit of Rhode Island Red skin transplanted to a White Leghorn chick produces in due time feathers which are typically Rhode Island Red in color and texture. White Leghorn skin on a Plymouth Rock host produces feathers indistinguishable from those produced by normal White Leghorn fowls. Skin from a barred Plymouth Rock grafted on a Rhode Island Red produces typically barred black and white feathers. Yellow, black and penciled feathers have been produced by grafts from breeds of corresponding colors. Several months after the transplantation of the skin, follicles still continued to produce successive feathers typical of the breed to which the donor belonged. It may, therefore, be inferred that the white of the Leghorn or the barring of the Plymouth

Rock is due to factors inherent in the follicles themselves, rather than to special endocrine or general metabolic peculiarities of the breed. (Two cases with a few mosaic, black and white feathers in Rhode Island Red grafts on White Leghorn hosts are as yet unexplained. Since both of the donors died young, the purity of their own plumage cannot be vouched for.)

4. In regard to sex characteristics, on the other hand, feathers produced on the graft follow the host rather than the donor. For example, skin from a Rhode Island Red male grafted on a White Leghorn female produces feathers similar to those of a Rhode Island Red hen. Stated briefly: Feathers produced by grafts follow the breed of the donor, but the sex of the host.

5. The rate of feathering, or age of appearance of pin-feathers, which varies with different breeds, is largely influenced by the donor. Rhode Island Red skin grafted on a Leghorn develops pin-feathers more slowly than does the skin of the more precocious host, while Leghorn skin on a Rhode Island Red or Plymouth Rock produces pin-feathers earlier than the host.

[1] Especially Cole, Crew, Domm, Goodale, Morgan, Pezard, Riddle, Torrey and Horning. There is a good summary of the literature in the paper by L. V. Domm, *J. Exp. Zool.*, 1927, xlviii, 15-173; and also in the paper by Frank R. Lillie, *ibid.*, 175-196.

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A Formula Expressing a General Relationship Between Blood Pressure and Body Weight.

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The question of a relationship between body weight and blood pressure may be studied from the findings in large numbers of individuals of various sizes essentially normal, particularly as regards the cardiovascular system and nutritional status. Children afford the best material for such a study. In them a large range of body size is available, and arterial disease is so rare that in group studies it can safely be disregarded as a disturbing factor. Satisfactory tables of normal weight or height are at hand for the exclusion of nutritionally unsuitable cases. By utilizing group averages the effects of temporary or accidental variations in pressure, of observational error, and of individual variations in body structure or composition can all be minimized.