8141 C

Testicular Hormones and Sebright Plumage.*

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There are recognizable in the fowl 3 intergrading types of plumage, usually designated as hen-feathering, cock-feathering, and capon-feathering. The capon type, which does not occur normally in nature is, in effect, an exaggeration of the male form. It appears following the complete removal of testes or ovaries. Hen-feathering occurs in the presence of an adequate amount of functional ovarian tissue (native or grafted) in any individual, so far as known, without regard to breed or sex. It may also be induced by the injection of certain hormones, such as thyroxin, and occurs normally in males of certain breeds, notably Sebrights.

Attempts to interpret these phenomena have led to 2 not wholly concordant views. One group of investigators[1] has postulated differences in testicular hormones, pointing out that the degree of cock-feathering varies in different races, but that in all races the male is less elaborately feathered than the corresponding capon. Others have questioned the differential effect of testicular hormones on plumage. Roxas[2] found that exchange of testes between hen-feathered and cock-feathered males had no effect on the plumage of either. Gallagher, Domm and Koch[3] have recently reported that purified testicular hormone, while having no effect on capons of cock-feathered strains, readily induces hen-feathering in Sebright capons. They interpret these findings as indicating merely somatic differences in response to the same hormone. Results following skin transplantation,[4] while for the most part supporting this contention, afford some indication of racial differences in the hormones themselves. The question is obviously still open, and calls for a more nearly quantitative analysis. The following experiments only partially meet this need.

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1 Benoit, J., *Arch. Zool. Exper.*, 1932, **73**, 1; Pezard, Sand et Caridroit, *Arch. de Biol.*, 1926, **36**, 541; Morgan, T. H., *Carnegie Inst. Washington Pub.*, **258**.

2 Roxas, H., *J. Exp. Zool.*, 1926, **46**, 63.

3 Gallagher, T. F., Domm, L. V., and Koch, Fred C., *J. Biol. Chem.*, 1933, **100**, xlvii.

4 Danforth, C. H., *Biol. Gen.*, 1930, **6**, 99.

Three 5½-months-old cockerels of Sebright type, full brothers, and very similar in appearance, were used for a gonadectomy test. In *A* the testes were left undisturbed, in *B* both were removed, and in *C* one was removed. *A* and *C* remained hen-feathered and normal as to comb and reactions; *B* became a typical capon with abundant plumage. After a year the greater part of the remaining testis was removed from *C*, following which his comb diminished and he became capon-like in behavior and plumage. A few months later, however, his comb returned to normal, he became masculine in behavior and acquired a fairly good type of cock-feathering. *C* remained in appearance a cock-feathered male till he was killed some 3 years later. All 3 birds were autopsied at about 5 years of age. *A* had normal testes, *B* no testicular tissue, and *C* a small nodule. In plumage they were, respectively, hen-feathered, capon-feathered and cock-feathered. *A* and *C* had normal combs and had been cocky in bearing, *B* was a typical capon. This would seem to indicate that the type of plumage produced by a Sebright soma may be directly associated with the amount of functional Sebright testicular tissue; that in this case there is a purely quantitative relation between testicular output and type of plumage.

Another capon of Sebright type was grafted on the breast with bits of testis from a cock-feathered strain. After a few months his comb increased appreciably and he acquired a plumage that was definitely more that of a cock than that of a capon. With minor fluctuations, he continued in this condition for two years, at the end of which time he was given injections of a potent extract of beef testis on two successive days. Feathers developing at the time of these injections showed characteristic diamond shaped "feminized" areas, which is quite in agreement with the findings of Gallagher, Domm and Koch. This bird had a graft of female skin (bearing at the time feathers of male type) which responded to the testicular hormone even more definitely than did the skin of the host. In this case it would seem that derivatives from testes of bulls and of cock-feathered male fowls may be made to augment each other in the production of hen-feathering in a Sebright. Finally, after the effects of this treatment had worn off, the same bird was given daily injections of 200 rat units of gonadotropic hormone[5] over a period of 17 days, at the end of which time testicular material weighing about a gram and showing all stages of spermatogenesis was removed from the breast. Feathers developed during the period of

[5] I am greatly indebted to Dr. H. H. Cole for a very generous supply of gonadotropic hormone.

gonadotropic injections were influenced in the same direction, and to about the same degree as those influenced by beef testes. They fell short of being fully of the hen type. Following removal of the grafted testis new feathers were of the capon type, similar to those developed before testicular grafting or injection. Following a second testicular graft, feathers completely of the hen type were produced by both grafted and host skin.

These observations are essentially in accord with the findings (but not necessarily with the conclusions) of most students of this subject. It appears to the present writer that there are probably both somatic and endocrine variables, that the testicular secretion of hen-feathered and cock-feathered male are not precisely equivalent, at least quantitatively, and that thresholds of response are not so distinct as has sometimes been supposed. Further, the rather similar manifestations following injection of mammalian testicular extract and excessive stimulation of an avian testicular graft does not afford evidence of sufficient delicacy to warrant the conclusion that the bull and cock produce identical testicular hormones.

8142 C

Two Gonadotropic Substances in Mare Serum.*

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The finding by Cole and Hart[1] that there is no relationship between the activity of mare serum when administered alone and its activity when combined with pituitary synergist,† led them to believe that there are two gonadotropic substances in mare serum. More convincing evidence is now at hand. We have been able to make potent pregnancy serum completely ineffective when given alone without destroying its synergistic properties. This has been

* The chemical work described here was carried out in the Department of Biochemistry of the University of California under the supervision of Dr. D. M. Greenberg.

1 Cole, H. H., and Hart, G. H., PROC. SOC. EXP. BIOL. AND MED., 1934, **32**, 370.

† This pituitary synergist was prepared after the method of Evans *et al.*[2] and probably is an impure preparation of the follicle-stimulating hormone of Fevold and Hisaw.

2 Evans, H. M., Simpson, M. E., and Austin, P. R., *J. Exp. Med.*, 1933, **58**, 545.