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Modifications in Feather Pattern and Growth Rate Following Administration of Thiouracil in Brown Leghorn Fowl.*

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The administration of adequate doses of thiourea, thiouracil, and related compounds in various mammals, particularly the rat, is followed by marked hyperplasia and hypertrophy of the thyroid gland accompanied by signs and symptoms of hypothyroidism.^{1,2} In chicks fed sulfaguanidine² there was neither hypertrophy nor inhibition of the thyroid, but feeding of thiourea and thiouracil resulted in its hypertrophy.³

In the Brown Leghorn fowl hypothyroidism is manifested in the plumage by a decrease in barbulation and by the replacement of melanin with a red pigment resulting in a reddish, narrow, lacy feather.^{4,5} These changes are most evident on the breast, lateral and ventral areas where normally occurs a black, broad, webbed feather. The characteristic growth rates of the various feather areas are noticeably reduced.⁶ Since some of the manifestations of hypothyroidism in plumage are now well established, experiments were devised in an effort to determine whether this condition could be produced in the fowl by the administration of certain of these goitrogenic compounds. In the following report the reaction

to thiouracil in Brown Leghorn capons and cockerels is described, employing the plumage as an indicator.

Methods. Measured amounts of thiouracil were administered daily as a dry powder contained in a gelatin capsule which was placed on the back of the tongue and palpated down the esophagus. In most previous experiments employing these drugs, and in all using the chicken as a test animal, dosage was approximated since the drug was administered *ad libitum* by mixing it with food. In order to determine the period when effects on plumage first become evident, semi-weekly microscopic examinations of split, regenerating feather germ preparations were made. Feather growth rates were studied by measurements made on alternate days in capons and every sixth day in cockerels. Comparable areas were selected on back, saddle, and anterior and posterior breast feather tracts and 25 regenerating feathers per tract were measured in each bird.

Results. Daily administration of 0.4 g of thiouracil was begun in an adult capon 6 days after plucking. The first definite indication of an effect was noted after 26 days of medication when regenerating breast feather germs revealed a basal deposition of red pigment. Red pigment deposition continued and 48 days later when medication was discontinued (total 74 days) emerging breast feathers were red and showed a reduction in barbulation. Feather growth rates at this time were noticeably reduced in all areas. After emergence, breast feathers were red throughout and exhibited a fluffy or lacy condition instead of the characteristic black color and broad webbing (Fig. 1). Back and saddle feathers showed an increase in red pigment and some reduction in barbulation producing a feather which was narrower and somewhat more lacy than normal. By 18 to 19 days following cessa-

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¹ Astwood, E. B., Sullivan, J., Bissell, A., and Tyslowitz, R., *Endocrinol.*, 1943, **32**, 210.

² MacKenzie, C. G., and MacKenzie, J. B., *Endocrinol.*, 1943, **32**, 185.

³ Mixner, J. P., Reineke, E. P., and Turner, C. W., *Endocrinol.*, 1944, **34**, 168.

⁴ Greenwood, A. W., and Blyth, J. S. S., *Proc. Roy. Soc. Edinburgh*, 1929, **49**, 313.

⁵ Blivaiss, B. B., and Domm, L. V., *Anat. Rec.*, 1942, **84** (suppl.), 79.

⁶ Blivaiss, B. B., and Domm, L. V., *Anat. Rec.*, 1944, **89** (suppl.), 37.



FIG. 1.

Capon breast feathers. Right normal. It is black except for basal fluff and shows a solid web-like vane. Left from thiouracil-treated capon. The feather is red anteriorly and lacy in the normally webbed area due to reduction in barbulation. The basal fluff developed after medication was discontinued is similar in character to the normal.

tion of medication developing breast feather germs again showed deposition of black pigment and posterior breast feather measurements revealed accelerated growth.

In a second adult capon receiving 0.5 g of thiouracil daily, results were essentially similar to those described above.

The first indication of an effect was noticed on regenerating breast feather germs 24 days after medication began, at which time they showed a narrow, irregular band of red at the base. Medication was continued for 75 days, when emerging breast feathers were red and lacy and growth rates were below controls in all areas. Twenty days after medication ceased

developing breast feathers again showed black pigment and increased barbulation.

In a third experiment, four 5-months-old cockerels received daily medication of 0.3 g of thiouracil. Feather areas on the right side were depilated on the day treatments began. Beginning on the 25th day of treatment dosage was increased to 0.4 g and feather areas on left side were plucked. After 30 days total medication ingrowing feathers on right side, now several centimeters long in all depilated areas, showed no significant modification in color or form but did show a decline in growth rate as compared with controls. However, microscopic examination of split breast feather germs at this time revealed a basal deposition of red pigment. This process has continued producing red, lacy feathers in plucked areas similar to those developed in the treated capon. A period of 28 to 30 days medication was thus found necessary to produce these changes in the plumage of the cockerel. A single injection of 1.0 mg thyroxin brought about a deposition of melinin and increased barbulation in growing breast feathers.

Summary. Daily administration of 0.3 to 0.5 g of thiouracil in Brown Leghorn capons and cockerels brought about changes in plumage similar to those observed following thyroidectomy in this breed. Black pigments were replaced by red, barbulation was reduced, and growth rates retarded. Changes in feather color were first apparent 24 to 28 days following initiation of medication and in capons continued for approximately 18 to 20 days after medication ceased.

In a recent note⁷ Juhn reported similar modifications of breast feather pattern in the Brown Leghorn capon following thiouracil administration *ad libitum* by mixing with food. No record was made of observations on growth rate.

⁷ *Endocrinol.*, **35**, 278.