

# THE EFFECT OF FEEDING THYROID ON THE PLUMAGE OF THE FOWL<sup>1</sup>

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The assumption of male plumage by the female fowl has frequently been observed and commented upon. When it occurs in nature it is usually found associated with a disturbance of the ovary (1),<sup>2</sup> and it may be produced experimentally as a sequel of ovariectomy (3). The writers are not aware that the spontaneous assumption of female plumage by the male fowl has been reported (leaving out of consideration those breeds, such as the Seabright Bantam, in which it is a normal inherited characteristic), though it is a process which occurs annually in many dimorphically colored birds, such as the scarlet tanager, bobolink, and indigo bunting. Goodale (4, 5) has succeeded, however, in inducing hen-feathering in males by a combination of castration and implantation of ovarian tissue. More recently, Torrey and Horning (6) have reported that when dried thyroid was fed to normal growing male chicks they developed female plumage instead of that natural to their sex. No change of plumage was effected, however, by feeding thyroid to normal females nor to castrated males or females. These results are of interest and seem important, even though a trial reported by Crew and Huxley (2) has failed to confirm them. It would seem that for the present the accumulation of additional evidence is more to be desired than extended discussion of the possible action of glandular secretions on the development and expression of secondary sexual characters.

A preliminary trial of the effects of feeding thyroid to adult males was made by the writers at the Wisconsin Agricultural Experiment Station in the late winter and early spring of 1923. Adult males were used for the test, partly because no chicks were available at the time and partly to see whether or not any effect would be

visible in the replaced feathers of the grown bird.

Ten Brown Leghorn cockerels nearly a year of age and one old male were used in the experiment. All had normal plumage of the breed with respect both to color and form of feathers. They were placed in individual coops (about the size of exhibition coops) in the poultry building, but were divided into four lots with respect to treatment, as follows:

In addition to the regular ration—

Lot 1, consisting of four birds, received every other day at first and later, daily, 400 mgm. of desiccated thyroids<sup>3</sup> containing 0.2 per cent iodine, or 0.8 mgm. iodine per dose. Torrey and Horning started with 50 mgm. of thyroids when their chicks were four weeks of age and increased the dose from time to time to 330 mgm. at the end of 15 weeks. They do not state the weights of their birds, but the writers have assumed that these weighed about 4 pounds when 19 weeks of age, and the dose for the birds in the present experiment, which averaged about 4.75 pounds, was calculated at approximately the same proportion in relation to weight. The material was easily administered in capsules.

Lot 2, two birds, each fed 1.05 mgm. KI, in capsules, the iodine content being equivalent to that in the thyroids. These were fed at the same intervals as the thyroids.

Lot 3, two birds, each given at the same periods by pipette 1 cc. of 0.08 per cent solution of iodine in 28.5 per cent alcohol.

Lot 4, three birds, controls, received no dosage.

The experiment was begun on February 9, all birds being given their doses on succeeding alternate days up to March 1; after that they were dosed daily until the experiment was con-

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<sup>2</sup> Reference is made by number (italic) to "Literature cited," p. 287.

<sup>3</sup> The writers desire to express their appreciation to Armour & Co., Chicago, for their kindness in furnishing the thyroids used in this experiment.

cluded on May 2. On February 20, a patch of feathers was pulled from the cape and wing bow of each bird and saved for future reference. (See Pl. 1.) On March 1, a patch from the saddle and one sickle feather were also pulled. All birds were weighed weekly and notes were kept on general health and on growth of new feathers. Such results as were obtained may be stated briefly.

There was considerable variability in the rate at which new feathers replaced those which were pulled, depending in part, apparently, on the state of health of the individual bird, but also, as will be noted later, on the medication. In the better-developed cases the new feathers were of full length by May 2, but in the others comparatively little replacement had occurred. In no case was the sickle replaced.

It will simplify matters to make the summary statement that in all lots except that receiving thyroids the new feathers were in all respects normal both as to shape and coloration. This is doubtless what was to be expected, since experiments on mammals have shown little effect caused by administering iodine, free or in inorganic combination, except in cases of iodine deficiency or of subnormal activity of the thyroid gland. There is no reason to suppose that either of these conditions existed in the present instance.

The new feathers on the thyroid-fed birds were, however, strikingly different from those which were pulled, as is indicated in the accompanying tabulation. There was considerable variation, as will be noted, and it can not be said that the replaced feathers were characteristically female. As relates to color, there was an evident action toward the reduction of red pigment, varying in degree in the different birds, but tending to be arranged in "stippling" when present. This was particularly true in the new cape feathers of bird No. 441, which were decidedly femalelike in appearance. In all cases the red was broken and much more irregular in distribution than in normal male feathers. The resemblance to female feathers was

much more striking in respect to shape and structure, the broad, rounded ends contrasting strongly with the pointed tips of the male plumage on these parts. Furthermore, the great reduction or absence of the zone of "free" barbs, that is, of barbs lacking barbules and hooks, so characteristic of the normal male feathers, was very evident, and constitutes another resemblance to female plumage.

Summing up, it may be said that the feeding of desiccated thyroids to male Brown Leghorn fowls in certain amounts profoundly modifies feathers grown while the material is being administered. The feathers produced under these conditions are not typically female in type, but they do show distinct female characteristics. There would seem to be in this case no question of altering the sex of the bird, nor in all probability of the sex hormones. Nor is it likely that the administered thyroid material acts through the mediation of the thyroid gland of the bird. It seems altogether more probable that the thyroid fed acts directly in influencing the metabolism of the developing feather germ. The very evident tendency to an increased melanism may indicate a higher oxidation of the pigment products; the explanation of the change in form must be less direct.

The feeding of iodine, free and in inorganic combination, gave no result comparable to that obtained from desiccated thyroids containing an equivalent amount of iodine.

One other apparent effect of the thyroid feeding deserves mention, namely, that the replacement of feathers on the birds receiving thyroids was noticeably more rapid than on the others. Since some of the birds were suffering from "colds" and were not in the best of health during the trial, however, it would not be safe to make too definite a pronouncement on this point. If the feeding of thyroid should prove to have a stimulating effect on feather development it might prove useful in inducing quick and uniform molting, a factor of considerable practical importance. It is proposed to test this further by later experiments.

#### EXPLANATORY LEGEND FOR PLATE 1

A, B, and C.—Normal feathers from saddle, cape, and wing bow, respectively, of bird No. 448. Cape and wing bow feathers pulled February 20; saddle, March 1.

D, E, and F.—New feathers grown by bird No. 448, replacing those pulled (D, wing bow; E, cape; F, saddle). The new feathers, which were pulled on May 2, appear normal in shape, structure, and coloration, apparently not having been affected by the free iodine in alcoholic solution administered to this subject.

G, H, and I.—New feathers (May 2) from saddle, cape, and wing bow, respectively, from bird No. 441. These feathers show modification of shape, structure, and coloration, approaching the female type in these respects. The stippling in the cape feather is closely similar to that which occurs in females. These modifications are attributed to the desiccated thyroids fed.

J and K.—New cape and saddle feathers from bird No. 444, following feeding of desiccated thyroids. The melanistic effect was especially pronounced in this bird.



## COMPARISON OF NEW FEATHERS IN THYROID - FED BIRDS WITH THOSE OF NORMAL BIRDS

	Cape	Wing Bow	Saddle
Normal birds.	Exposed portion generally red, base black; red may occupy whole distal half of feather or be reduced to a border. Distinctly pointed; with broad zone of free barbs.	Similar to cape but occasionally with black spot at tip. Same general shape, but shorter.	Varying from almost wholly red to red with black middle stripe. Long (some 12 cm.); narrowly attenuated distally; pointed. Wide zone of free barbs.
Bird No. 441..	Black, with <i>definite red stippling</i> near tip. Broadly rounded, without zone of free barbs.	Black with a considerable quantity of red more or less irregularly intermixed; tendency to stippling. Broadly rounded, without "free zone."	Black with considerable red irregularly distributed. Elongate (11 cm.) but broad, and rounded at tip; very little "free zone."
Bird No. 440..	Black; little if any red. Broadly rounded; without "free zone."	Black. Broadly rounded; without "free zone."	Dull black with some irregular red; tendency to stippling. Broad, rounded, without "free zone"; length 8 cm.
Bird No. 444..	Mostly black; a few feathers with a small amount of red on margin. Bluntly rounded; without "free zone."	Black with small amount of red, showing tendency to stippling. Bluntly rounded; no "free zone."	Black (no red). Elongate (11 cm.); with somewhat the taper of male saddle feathers but broader and rounded at tip; narrow "free zone" near tip.
Old male.....	Black or black with little red. Broadly rounded; without "free zone."	None available. (This bird pulled the new feathers he could reach as they grew.)	None available.

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