# SUPERFICIAL PHENOTYPES [1]

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In *gallus domesticus* there are several criteria which permit the separate identity of adult females and males. Distinguishing characteristics which are evident as the adults reach sexual maturity include size, prominence of comb and wattles, and (in specific areas) shape and luster of feathers. Laying hens frequently have large combs and prominent wattles. Hence, if there is an accompanying alteration of feather structure, poultrymen are prone to comment, "I have a hen which turned into a rooster." In discussions with several groups of poultrymen, the author has heard responses of "Oh, yes, I had a hen that became a rooster too." It is the contention of the author that this does not normally happen.

There are several generally acknowledged instances when hens will assume a masculine appearance and look like roosters. The first involves intentional removal of the ovary when the female is a chick (1) and can be influenced by the breed which is treated (2). Another method of alteration is by the injection of hormones into chick embryos (3). A third alteration results from the so-called "spontaneous sex-reversals." It is with this last group that this report will be concerned.

## OBSERVATIONS

Hens from several of the common breeds and varieties of poultry, such as Barred Plymouth Rocks, White Plymouth Rocks and Rhode Island Reds, have relatively small combs when they are laying; the cocks have much larger combs. However, laying hens from two other common breeds, White Leghorns and New Hampshires, have combs which are frequently as large as, or larger than, the cocks' combs. At this station, several New Hampshire hens with masculine appearing heads have been observed. The birds appeared similar to the one reported as a male (4) in a recent popular article. Although two of the birds did not produce eggs, there were no testes found in any of those which were autopsied.

Most unusual of the hens which acquired masculine characteristics was White Leghorn hen No. 210. This hen was hatched in the spring of 1953 and laid eggs from September 1953 to March 1954.

[1]Approved for publication by the Director of the South Dakota Agricultural Experiment Station as paper 443 of the Journal Series.

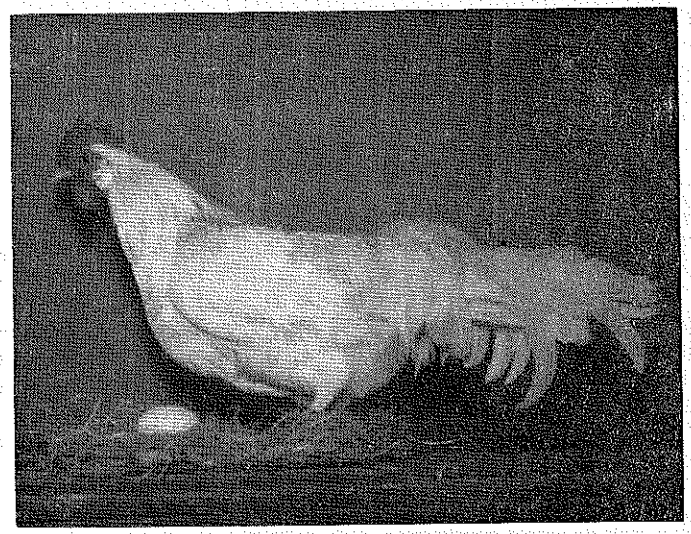

**Figure 1. White Leghorn No. 210 which, during its second year, grew male-type plumage and long spurs, but laid normal eggs.**

In the fall of 1954 it was observed that the hen possessed male-type plumage (Fig. 1). The main tail feathers were elongated and curved, the saddle feathers were long, pointed and glossy, the hackle feathers were pointed and glossy, and the spurs were long.

From October 1954 to April 1955 the bird was isolated in a wire cage and laid at the rate of 69%, which is a relatively high rate. She laid eggs which averaged 62 grams. Following artificial insemination with semen from a Barred Plymouth Rock cock, the eggs were incubated. High hatchability, of approximately 80%, resulted. The first chick was hatched on November 13, 1954; hatching continued through March 1955. Pullets from this mating began to lay early during their fifth month, which is comparatively normal.

At present two lines, selected for large and small body size, are being maintained from the original matings. From a total of approximately 200 birds, involving four generations, only one has appeared abnormal. That one was a son of No. 210 which, at eight months age, looked like a capon. When autopsied, the only observed internal abnormality was small testes which were approximately one-sixth the expected normal size.

## DISCUSSION

Forbes (5) summarized, in an historical fashion, the instances of spontaneous sex-reversal and the early stigma attached to the



transformation of hens into apparent roosters. In addition to the complete masculinity of feather appearance on a laying hen, there may result several intermediate types. Perhaps the phenotypic alignment could best be expressed as hen-poulard-capon-cock, with the two intermediate types having some characteristics which are common to the two extremes. There are two reports which describe the autopsy findings of sexual gynandromorphs which contained bisexual gonads (6).

Most of the chickens which are retained in flocks as adults are females. For commercial egg-laying flocks, only hens are used. In the breeding flocks, males are mated at the ratio of approximately one male to 15 females. Breeding flocks constitute a minor proportion of the total domestic chicken population. Throughout the United States the adult population would probably consist of 98%-99% hens and less than 2% roosters.

Therefore, two reasons are evident for the relatively numerous farm observations concerned with the phenotypic hen-to-rooster change, whereas the rooster-to-hen alteration is virtually unreported (6). The first reason is the preponderence of hens in the observed adult populations; the second is the gonadal asymmetry peculiar to hens.

A possible explanation, for the growth of male-type feathers and spurs on a hen which has previously appeared normal, concerns the production of sex homones. When a hen is laying, the ovary is large and there is an abundant secretion of estrogen, the female hormone. If the hen stops laying and molts, there is a regression of ovary and oviduct plus a reduction in estrogen secretion. It may be that there is inadequate female hormone to cause the replacement feathers to be of the female-type. As a result the hen could have poulard (or male-type) feathers. Then, as the hen completed the molt and the ovary enlarged, the hen could again lay eggs.

It is a natural reaction for poultrymen to remove hens which "look like roosters" from their laying flocks. Hence, ability of these transformed birds to fertilize eggs is rarely tested. Numerous autopsies of poulards at this station have clearly demonstrated that there are no genital ducts, which would permit passage of sperm to the cloaca on the right side of the operated birds; even if such sperm could be produced by the right pseudotestis. Therefore, it is extremely doubtful that the hens with the superficial "rooster" phenotypes would be either biologically or functionally of the male sex.

## SUMMARY

During the past five years several New Hampshire and White Leghorn hens have been observed to acquire male characteristics.

The most complete "sex-reversal" involved a White Leghorn which looked like a rooster but continued to lay eggs. The bird was artificially inseminated. Several generations of descendents have, for the most part, appeared normal. A possible explanation of the presence of male-type feathers and spurs on laying hens is offered in support of the authors contention that most of the popularly reported instances of "spontaneous sex-reversal" do not involve actual transformation of a hen into a rooster. These superficial phenotypes may be transitory.

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